PRINT FORM SUBMIT

GROSSMONT-CUYAMACA
COMMUNITY COLLEGE DISTRICT

Education Master Plan
Information Submission Form

The Grossmont-Cuyamaca Community College District is starting a year-long process to develop an Educational Master Plan that will serve as the blueprint for our future. The Educational Master Plan is a long-range, comprehensive document intended to guide institutional and program development at both the college and district levels. The priorities established in the Educational Master Plan will serve to guide College and District decisions about growth, development and resources allocation.

As the first step in this planning process, everyone in the GCCCD community (faculty, staff, students and community members) are invited to identify and submit information sources to be reviewed for the trend analysis in one of six areas – society, technology, economy, environment, politics, and education. We are not asking you to do research, only to identify information you already have or that you encounter during the search period (March 21- April 25) and bring it to our attention for review.

Please answer the following questions for each document you submit:

(Feel free to submit as many of these forms as you would like)

1) What is the name of the document? The Outlook for Learning - Views on the Future

2) Author: Herman-Miller

3) Source: White paper - research

4) Which of the following areas does this document best address? (Please select only one)

- ○ Society
- ○ Technology
- ○ Economy
- ○ Environment
- ○ Politics and Legal Issues
- ● Education
- ○ Other

5) Relevance: Forecast for higher education circa 2009

6) Page/Section: All

7) **Attach Document/Place URL Here:**

Download the free Adobe Reader X: http://www.adobe.com/accessibility/products/reader/

To attach a document: **Reader 9: Use "Tools"-"Comments and Markups"-"Attach a File as a Comment"**
Reader X: Use "Comment" (upper right), then select the paper clip icon under "Annotations"

Questions email: lynne.davidson@gcccd.edu Research, Planning and Institutional Effectiveness

The Outlook for Learning—Views on the Future. Opinions vary on how higher education deals with change. Faced with diminishing resources, advancing technology and increasing enrollments, colleges and universities continually attempt to find a balance between innovation and tradition to remain relevant and current in a rapidly evolving world.

In 2005, Herman Miller convened a series of Leadership Roundtables in an attempt to predict what trends would affect education in the year 2015. Representatives from research universities, state colleges, community colleges, private institutions and architectural and design firms participated in exercises designed to brainstorm the future. Their collective thoughts, contained in an original list of 12 predictions, were published concurrently in a white paper, "The Future of Learning—Scenarios 2015," a document that developed case studies of four fictional institutions that had taken a unique and visionary approach to dealing with contemporary challenges.

In the interim, the world economy has gone into a tailspin, and as of this writing there is no end in sight to the recessionary forces that have impacted global economies. To keep its literature current, Herman Miller convened a new panel of experts in the spring of 2009 to review the predictions of the 2005 panel. There was general agreement that many of the "predictions" developed by the original panels had already become realities, and that the original wording developed by roundtable participants needed a more nuanced and contemporary interpretation to recognize how the current financial environment had impacted the original discussions.

This paper contains the revised version of the 12 original predictions and the thoughts of the latest roundtable. There was general agreement that for each original challenge, opportunities were present for those colleges and universities willing to change to accommodate the current financial situation.

1. Globalization will influence and shape all aspects of teaching and learning.

Thomas Friedman, in his best-selling book *The World is Flat: A Brief History of the Twenty-First Century*, offers this observation on the growth of the Internet:

"Never before in the history of the planet have so many people—on their own—had the ability to find so much information about so many things and about so many other people."

With the playing field leveled, or "flattened," due to technology, Friedman identified young people in China, India, and Eastern Europe as providing increased competition to their counterparts in the United States, suggesting that a native educational system that can rapidly respond to competitive challenges is needed.

Other nations are now attracting American students for graduate work in increasing numbers.

The presence of international students in the U.S., slowed after 9/11, is beginning to grow again. However, other nations are now attracting American students for graduate work in increasing numbers. Global higher education mobility is now a rapidly growing phenomenon, with over 2.9 million students seeking an education outside their home country, a 57 percent increase since 1999. The emergence of global rankings of educational institutions, the liberalization of the higher education sector through the General Agreement on Trade and Services (GATS) treaty, increased competition in science and technology, and the creation of a European Higher Education Area through the Bologna process, an effort to make academic degree and quality assurance standards more compatible throughout Europe. All these efforts indicate that the movement of students and scholars across national borders will increase.

There are still many unresolved issues. Global integration of higher-education practices, such as how to credential across borders and how to make institutional boundaries more "permeable," still remain. The U.S. system is being influenced by the European practices, such as three-year bachelor's degree programs. The current weakness in the dollar makes study abroad more expensive. As nations such as China and India develop their own university systems, there will be a decline in foreign student enrollments in the U.S.

Some may quibble with Friedman that the topography of the world hasn't changed, but with the advent of the Internet, it certainly has made the world seem smaller.

2. The wide range of ability, preparedness, background, opportunity, and motivation of higher education students will require more varied and holistic approaches to inclusive learning.

There is a growing tension in higher education, perhaps felt more in some segments than in others. Colleges and universities seek and recruit an increasingly diverse student body, yet there is internal resistance to dealing with the learning issues that come with the diverse abilities, aptitudes, and skills that the current generation of students possesses.

> There are concerns whether the core mission of the institution should include developmental or remedial coursework.

How well are today's students prepared to deal with college-level learning? Private liberal arts colleges and research-based universities are particularly challenged by the diverse abilities and lack of preparation found in many students, while community colleges absorb an increasing workload in these areas. There are concerns voiced by faculty in all sectors as to whether the core mission of the institution should include developmental or remedial coursework. Another issue is the increasing realization that our adult population has literacy issues, including technology competency, problem-solving abilities, critical thinking, and communication competency that must be addressed to maintain a competitive workforce in an information age.

Taking an ostrich-like approach is a not a viable response to this challenge. Teaching methods and pedagogies, institutional resources and commitment, and the traditional ways of engaging students—all must be re-examined to meet the contemporary needs of America's students and workers.

3. The demand for more experiential, outside-the-classroom learning opportunities will require faculty to respond thoughtfully and proactively.

The newest generation of college students has a preferred mode of activity and interaction not always in sync with an educational system that is centuries old. Writer and educational consultant Marc Prensky, who coined the word "NetGen," says today's students are not interested in large lecture halls, preferring informal small group discussion, often conducted through text messaging or e-mail, as a means of gaining understanding of curriculum content. They choose search engines to find information, The preference for more experiential learning is part of the increasing demand for programs that develop practical, job-enhancing skills.

frowning on library-centered research methods or the local course management system (CMS). The social nature of the NetGeners, as well as their desire for experiential learning, sends a message to educators that interaction is an important technique for colleges to embed in the curriculum.

The importance of interaction is not new; learning studies have consistently demonstrated that students learn more when they interact—with material, with each other, and with faculty. The increasing preference of students for more experiential learning is part of the increasing demand for programs that develop practical, job-enhancing skills. As long as there is a significant gap in student and faculty perceptions regarding the role of each in determining the degree and amount of experiential opportunities to be pursued, there will be the potential for alienation, discomfort, and disagreement.

Colleges need to work with employers to provide faculty with industry "externships" that will update and refresh their knowledge of on-the-job requirements. Involving industry in more meaningful ways to provide input, assistance in curriculum development, internships, apprenticeships, co-op experiences, service learning and program advisory committees can help faculty understand the need for involvement and active engagement in the teaching and learning process.

4. Colleges and universities will be expected to deliver more education in less space—to increase their "learning per square foot."

There are two aspects to this statement—the expectation that higher education, in the face of unparalleled fiscal challenges, will be asked to do more with less, and that colleges need to become more efficient in response to calls for greater accountability.

It is doubtful that the planners who designed our current classrooms had technology, innovation, and change in mind when facilities were on the drawing board long ago. It's more likely that durability, usability, and cost effectiveness were the driving principles. Too often, questions on multiple pedagogical approaches in a given space, its functionality and flexibility, access to technology, and the human needs of the room, such as lighting, temperature, acoustics, adaptability, and comfort, were lost in the rush to come in on time and under budget.

We have seen that technology has significantly affected our world, and its presence is strongly felt in education, where its growing popularity has increased pressure on an outmoded infrastructure not designed to support the demands of bandwidth, wireless capabilities, and increased power usage. While virtual learning has an increasing role to play in the future, there is no reason to eliminate the place-bound campuses and locations in which government and private educational institutions have invested over centuries. But the likelihood of massive new capital construction funding or extensive renovations is small, given current circumstances. A balanced, blended approach may be the answer.

To be fully accountable, colleges must find ways to respond to critics by demonstrating that deep and meaningful learning takes place in their facilities. Stronger metrics that accurately assess learning are needed to assuage concerns about the accountability of higher education in tough economic times. It's time to transform the twentieth-century classroom into the twenty-first-century learning environment.

5. Advancements in technology will drive ongoing changes in all aspects of college and university life and offer new opportunities to enhance and broaden learning experiences.

Today's students bring with them not only a desire for experiential and collaborative learning; they also possess technological competence not seen in previous generations. Older faculty, trained in another era without the benefits of today's technology, may tend to teach as they were taught, resisting a change in their pedagogy or grudgingly increasing their technological competence.

Professional development programs tend to support further expertise in a field rather than provide training and support on how to master current technology to enhance teaching and learning. Administrations are challenged to find the right balance in budget allocations between instructional and administrative computing.

Called upon to support the entire spectrum of college operations—instructional computing, intranet services, student records, payroll, purchasing, admissions, business transactions, financial aid, library and student health centers—IT departments are increasingly challenged to be all things to all people. Any perceived preference for one department over another engenders an us-versus-them mentality that hinders effective collaboration and implementation of services.

There is no service or activity that will not be affected by advancing technology.

There is no service or activity conducted in higher education that will not be increasingly affected by advancing technology. The time to take an institutional, comprehensive, and holistic review of this rapidly growing tool is now.

6. Interdisciplinary learning will become increasingly common and popular.

One often-heard criticism of higher education is that its structure resembles a group of silos—separate colleges, divisions, or departments that rarely interact. Creative, innovative teachers who want to explore the multidimensional aspects of their subject matter are still held hostage by the Carnegie unit, the need to break down content into 50-minute classes and three-credit courses. Occasionally, creative initiatives such as the learning communities movement and interdisciplinary studies programs are successful, but they are in the minority.

How can a college change its way of doing business to deal with the new generation of students who seek a more collaborative, interactive, and experiential education? Again, technology may be the lever that accelerates change.

Here is one possible scenario. The Internet introduces the student to a vast array of data, information, and knowledge. The physical limitations of the collection in a

Freed from the classroom, faculty can collaborate with colleagues throughout the college to design programs of study.

brick–and-mortar library are gradually replaced by limitless opportunities for primary source research by the student, which increasingly becomes self-directed. In time, the role of the faculty evolves from the traditional model—lecture, assign, and evaluate—to one of helping a student identify a course of directed research and study in a set of appropriate disciplines, critiquing progress, and learning with the student throughout the research process.

Ultimately, the faculty-student relationship is changed, and the curriculum becomes a co-designed course of study in which the student contracts for a learning experience with mutually agreed upon outcomes, while the faculty member monitors, assesses, and certifies student progress.

Freed from the classroom, faculty can now collaborate with colleagues throughout the college to design programs of study, which may be called interdisciplinary, co-disciplinary, trans-disciplinary, or whatever term seems appropriate. The important thing is that the curriculum—like life itself—is challenging, rich, and diverse.

7. Students will take much greater control of their own learning as proactive producers and managers of their own learning solutions, materials, and portfolios.

In recent years, there has been an often-contentious discussion on the concept of the student as consumer or customer. Naturally there has been resistance to this concept. There are concerns that such an approach lowers quality, dilutes the authority and role of the teacher, and places the college in a passive, reactionary role. This resistance is natural, as the underlying assumptions of a college education have remained remarkably constant over generations: teachers are experts who disperse their knowledge in a structured setting, and students are evaluated on how much of the dispersed information they have stored.

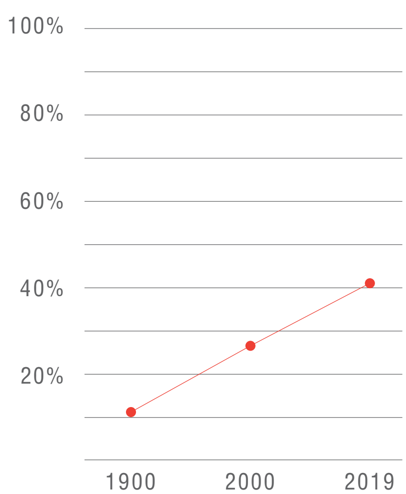
But times are rapidly changing. Interest in online learning is surging for a variety of reasons, including flexibility in scheduling, family and time constraints, cost of transportation, dissatisfaction with traditional academic scheduling, and economic pressures. More asynchronous interactions with learning institutions provide needed flexibility in a student's life. As noted earlier, colleges and universities are now facing unparalleled competition. The growth of home schooling and charter schools indicates a growing dissatisfaction with the educational establishment.

If students are becoming more proactive regarding their educational choices, then teachers must rethink their approach to the classroom and laboratory, acting as directors and not dictators of student learning. The Internet offers the student a vast array of data, information, and knowledge, providing limitless opportunities for primary source research, which is increasingly becoming self-directed.

As certification of skills and competencies grows in value as coin of the realm in the business world, more individualized programs of study will emerge, supported by the

As certification of skills and competencies grows in value in the business world, more individualized programs of study will emerge.

Percent of the population age 50 or over



technology infrastructure. Ultimately, the faculty-student relationship could become a co-designed course of study in which the student contracts for a learning experience with mutually agreed upon outcomes, and the faculty member monitors, assesses, and certifies student progress.

Just as our society has moved from a manufacturing to a service economy, so will higher education eventually be seen as a service oriented institution, rather than a manufacturer of knowledge. And ultimately, if a student sees himself or herself as a customer—paying the bills and having high expectations of receiving educational value for the money—the student will go, or log on, to the institution that fulfills an immediate learning need.

8. The average age of students will continue to rise; the mix of cultures, ages, and learning styles will become increasingly varied and rich.

The student body is getting older. Nationally, 39 percent of students enrolled in all degree-granting institutions are above age 25, including 18 percent who are over 35. For many colleges, evening and weekend classes look more like adult education centers rather than the traditionally youthful college environment.

Community colleges enroll 44 percent of all undergraduates in the country—almost 12 million in early 2009. The average age of the student body in two-year colleges is close to 30. Full-time students are in the minority. Women make up almost 60 percent and minorities make up 36 percent of all enrollments. Given its low cost of tuition and local appeal, this sector of higher education will continue to grow and become more diverse.

There is another demographic issue that education needs to address. As we grow as a nation, we also age. The fundamental age distribution of our population is changing at a brisk pace. In 1900, only 13 percent of the population was age 50 or over. In 2000, it was over 27 percent. And in ten years, it will be almost 40 percent.

Let's look at some AARP statistics as they pertain to the workforce. In recent years, the highest growth rate in the U.S. workforce was among workers aged 55-64. By 2015, nearly one in five workers will be 55 or older. Many will want to continue working, yet will need retraining to acquire new skills. America's colleges and universities are best qualified to provide this training. Teaching groups of students of varying ages, backgrounds, and abilities will be a major challenge to colleges in the future.

9. Competition for students and resources will force colleges and universities to sharpen their brands and identities and distinguish themselves in new ways.

The current economic malaise has created many challenges for higher education. Publicly funded institutions face cuts at the state and federal level. Endowments decline in value as fluctuations in the stock market diminish investments. According to

Colleges and universities need to understand their stakeholders and constituents and align their brands accordingly.

FinAid, a leading financial aid website, tuition tends to increase on average about 8 percent per year. This tuition inflation rate means that the cost of college doubles every nine years. For a baby born today, tuition will triple by the time the child matriculates in college.

To attract qualified, motivated students, colleges and universities must find ways to attract the best and brightest. In this regard, they are no different than corporations who seek to attract the most talented workers. A positive image translates into sales for corporations and enrollments for higher education.

Many aspects of the educational experience have direct branding implications: student recruiting and admissions, alumni giving, community relations, faculty engagement, staff culture, quality of academics, and the entire student experience. The brand image of an institution is created by and reflects many institutional dynamics.

Just as business leaders have increasingly focused on branding as the marketing means to shape identity and appeal for their product, colleges and universities need to understand the needs, expectations, and perceptions of their stakeholders and constituents (students, faculty, alumni, employers, government) and align their brands accordingly.

10. Colleges and universities will become increasingly important parts of regional economic development, both in creating growth and taking advantage of it.

The days of "town versus gown" are long past. Even private liberal arts colleges recognize the need to relate to, and be a part of, the community in which they are located. While the relationship between campus and community can still be ambivalent due to local issues, the two entities are becoming increasingly interdependent. This is primarily due to the growing demands of economic development and the role colleges and universities play in the training and retraining of America's workforce.

No country can achieve sustainable economic development without substantial investment in human capital. If America wishes to retain its leadership in an increasingly competitive world, it must equip its citizens with the skills and abilities to succeed in a knowledge-based economy. Investing in an educational system that develops and trains our human capital will produce future increases in productivity and profitability. The relationship between economic development and education is symbiotic.

Forward thinking educational institutions will engage business, labor, economic development, and workforce organizations in their region in developing holistic approaches to strengthening training programs through collaborative educational career pathway programs, student internship programs, and cutting-edge curricula.

Colleges and universities need to be more proactive in participating in local and regional economic and workforce development issues. They can position themselves as centers that bring together and strengthen various regional endeavors. They are the logical conveners of initiatives that strengthen the local economy. Connecting strongly with governmental economic development organizations will increase local support at a time when higher education is challenged with an uncertain economic future.

11. The structures of educational institutions and the types of employment relationships between them and faculty will continue to multiply; inequities among faculty will cause tensions.

The American Faculty: The Restructuring of Academic Work and Careers (Schuster and Finkelstein) has provoked considerable discussion within the academy with its pessimistic view of the future of the professoriate. The author's data-driven research predicts a big increase in the use of part-time faculty with lower wages and no benefits, a decline in full-time and tenure track appointments, a shift from the arts to the professions, increasing workloads, wages falling behind inflation, and large applicant pools for fewer positions. The culmination of these trends may lead to a stressful, fractious working environment.

There's another cloud on the campus horizon—faculty are aging. Data from the National Center for Educational Statistics shows that in 1987, the age structure among most faculties could be described as uniform, with 25 percent of the full-time instructional staff less than 40 years old, 50 percent between the ages of 40 and 54, and 25 percent being 55 or older. However, the professoriate aged rapidly during the next decade, so that by 1998, only 18 percent of faculty was less than age 40 while over 31 percent were aged 55 years or older. More recent statistics confirm the gradual aging of the faculty.

Senior faculty, seeing retirement savings and investments shrink, are now much less inclined to retire.

Senior faculty, seeing retirement savings and investments shrink due to the economy, are now much less inclined to retire. Continued employment of faculty beyond normal retirement age diminishes prospects for promotion among eligible younger faculty, reduces the number of new hires with the potential to bring revitalized energy to academic departments, and increases labor costs. On the other hand, delayed retirement might help institutions respond to increased numbers of students while maintaining a veteran instructional resource and keepers of institutional memory.

In the current economic climate, academic leaders should re-examine personnel policies and engage in strategic planning, not just to fill positions when they become open, but to select a new generation of faculty who can deal with a technologically sophisticated, diverse, and growing student body.

12. Accountability and assessment tools will continue to become commonplace in defining institutional effectiveness.

Historically, quality in higher education has been defined as adherence to self-defined standards, with accrediting agencies overseeing academic enterprises. While other countries regulate higher education through a government ministry, the United States has opted for a system of voluntary self-regulation. Over time, criticism about the relatively static rate of change in higher education, low completion rates, and poor workforce preparation has increased.

The Spellings Commission is the latest group charged with recommending a national strategy for reforming postsecondary education, with a primary focus on how well colleges and universities are preparing students for the 21st-century workplace. A significant motivation behind the Spellings Commission's formation was the fear that the United States higher education system was deteriorating and failing to prepare the workforce for the rigors and competitiveness of a global marketplace. Not unexpectedly, the Commission's report was met with sustained and vocal criticism from the education establishment.

The greatest concern was focused on a Commission proposal that would create a public database, where statistics and other information about colleges and universities could be viewed by anyone in order to provide necessary accountability. The database could eventually contain items such as the "learning outcomes of students." The Commission argued that colleges might have a more vested interest in the success of their students if this information were made public to prospective students and their parents. The critics argued that it was too much work to measure and improve performance, and such a movement would compromise the "integrity of the academy."

It is better to be proactive in assessment than to be reactive to external mandates.

There is a dangerous link between funding challenges referenced earlier and increased calls for accountability, a quid pro quo that legislatures and governmental agencies could use to leverage unwilling colleges into cooperation. Publicly funded institutions need to be accountable to their principal stakeholder—the public. Should colleges continue to resist implementing solid assessment systems and accountability measures, they risk exacerbating an already tentative relationship with their benefactors. It is better to be proactive in assessment than to be reactive to external mandates.

Looking to the Future

Each of these twelve statements provides both a challenge and an opportunity for colleges and universities. Scanning the horizon for future trends that could impact the educational enterprise is a wise expenditure of institutional time and energy, assuring a strong, resilient, and vibrant academy for generations to come.

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2) Author: William J. Flynn

3) Source: League of Innovations Meeting - February 2011

4) Which of the following areas does this document best address? (Please select only one)

- ○ Society
- ○ Technology
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- ○ Politics and Legal Issues
- ◉ Education
- ○ Other

5) Relevance: Forecast for higher education

6) Page/Section: All

7) **Attach Document/Place URL Here:**

Download the free Adobe Reader X: http://www.adobe.com/accessibility/products/reader/

To attach a document: **Reader 9: Use "Tools"-"Comments and Markups"-"Attach a File as a Comment"**
Reader X: Use "Comment" (upper right), then select the paper clip icon under "Annotations"

Questions email: lynne.davidson@gcccd.edu Research, Planning and Institutional Effectiveness

Forecast 2020 - The Future of Learning

12 Macro Trends That Will Impact Your College

William J. Flynn

Managing Director Emeritus

National Council for Continuing Education & Training (NCCET)

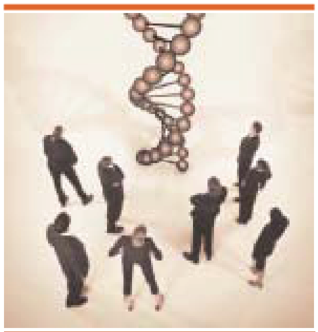
History of the Project

The Learning Foresight Group in 2005

What Influences, Conditions and/or Drivers Will Influence Higher Education in 2015?

- **Pedagogy**
- **Assessment**
- **Recruitment and Retention**
- **Technology**
- **Student and Faculty Expectations**
- **Funding**
- **Life Long Learning**
- **World and Domestic Competition**
- **Innovation and Experimentation**
- **Branding**

The Learning Foresight Group



Reviewed and synthesized responses to questions

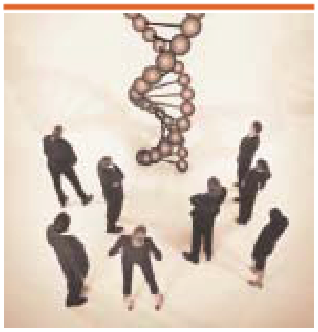
Visioning exercises to identify future trends

Stanford, U of Michigan. U of Phoenix, State Colleges, Community College, Private Liberal Arts, Architects, Facility Managers

"The Certainties"

The Future of Learning

The Learning Foresight Group in 2009



- **Reviewed and discussed original predictions**
- **Discussed current status of each and impact on education**
- **Deleted fully completed predictions**
- **Added some new trends**

The Future of Learning

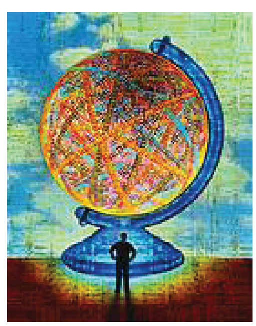
Today’s Session

- **Identify the Twelve Trends**
- **Give examples of the trend in action**
- **Ask your contribution on what your college is doing to deal with the trends**
- **We encourage your participation and discussion**

Major Trends in the Pipeline

1

Globalization will influence and shape all aspects of teaching and learning



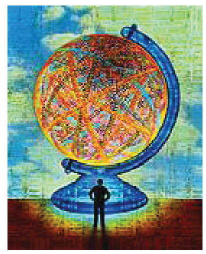
Global Education Mobility

- 2.9 million students educated outside their home country
- 57% increase since 1999
- Bologna process creates European Higher Education Area

Student Activities

- **ACE Survey of 500 high school seniors who intended to enroll at four-year colleges or universities:**
  - ***Over 80 percent of students - very or somewhat important that colleges and universities offer opportunities to interact with students from other countries.***
  - ***73% - it is important that their college offer courses on international topics.***
  - ***Over 70 percent - it is important that their college offer study abroad programs.***
  - ***Almost nine in ten students said they were interested in gaining exposure to another culture.***
  - ***Just over 60 percent said they were interested in international education to acquire career-related experiences.***

The Global Corporate College is a national consortium of colleges with a business model of serving corporations with multiple sites throughout the U.S. and the world



Question

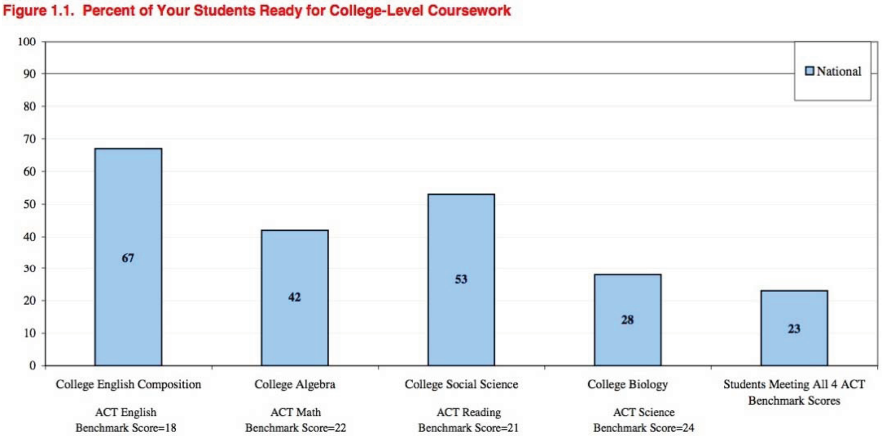
How has your institution been impacted by international events or forces?

2

The wide range of ability, preparedness, background, opportunity, and motivation of higher education students will require more varied and holistic approaches to inclusive learning

ACT Scores: Graduating Class of 2009 1,480,469 student

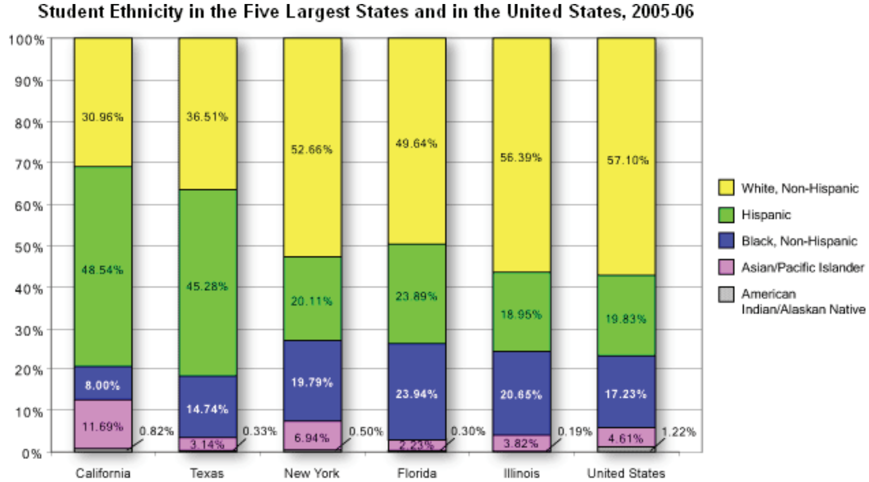
Figure 1.1. Percent of Your Students Ready for College-Level Coursework



11.7 Million Community College Students

- **44% of all undergraduates in the U.S.**
- **Minorities - 36%**
- **Women - 58%**
- **Part Time - 60%**
- **First Generation - 39%**
- **Freshmen Needing Remedial Work - 42%**

Student Ethnicity in the Five Largest States and in the United States, 2005-06



Data: National Center for Education Statistics (NCES).

Note: NCES collects data in these five ethnic group categories only. Percentages are based on the total number of students identified as being in one of these categories and do not include California students in the state's "multiple or no response" category.

Question

How does your institution deal with such far ranging diversity?

ability, preparedness, background, opportunity, motivation

3

The demand for more experiential, outside-the-classroom learning opportunities will require faculty to respond thoughtfully and proactively.

***Campus Compact* is a national coalition of more than 1,100 college and university presidents - representing some 6 million students - dedicated to promoting community service, civic engagement, and service-learning in higher education**

Learn and Serve America

- **Sectors:**
  - K - 12
  - Community Based
  - Research Capacity
  - Tribal and US territories
- **26 million hours**
- **1.47 million participants**
- **Disadvantaged Youth Served - 486,000**
- **35 states have adopted SL**

Each year, over 20,000 students at the University of Central Florida participate in experiential learning courses including Cooperative Education (Co-op), internships, and Service-Learning.

VILLANOVA UNIVERSITY SCHOOL OF LAW

- **Client Counseling**
- **Clinics**
- **Externships**
- **Inn of Court**
- **Pro Bono**
- **Trial Advocacy Competition**

Question

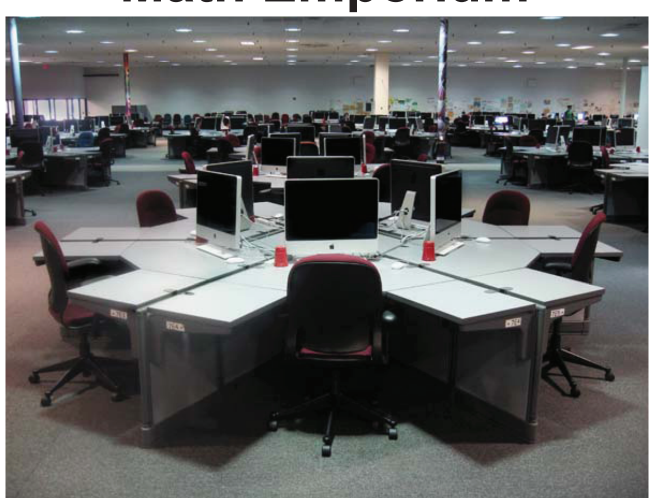
How has your faculty responded to requests for experiential learning opportunities?

4

Colleges and universities will be expected to deliver more education in less space - to increase their "learning per square foot"

"At Maricopa, as hybrid pedagogy evolves, significantly less space per student need be devoted to classrooms, while well-planned "mixed-use" space for informal, active and collaborative learning should be developed or added to."

Virginia Tech Math Emporium



William H. Whyte

- 1956 - The Organization Man
- 1980 - The Social Life of Small Urban Spaces
- Pioneer studies of pedestrian behaviors
- The whole campus is a classroom, a complex, interwoven system for learning
- Often the spaces not designed for learning are actually more conducive to learning

Social Learning Concepts

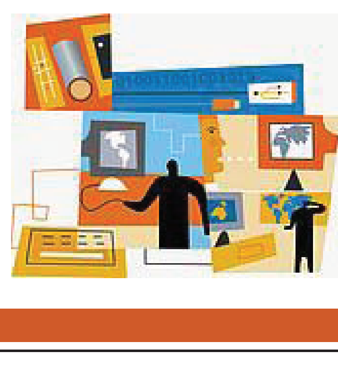
- Buildings are determined to be "efficient" by planners on the basis of assignable space, such as classrooms or offices
- Often it is the unassigned space, the circulation space, where the most learning per square foot happens
- This space needs to be thought through as carefully as the classroom space itself
- Should a building tell you how to behave or how to think?

Question

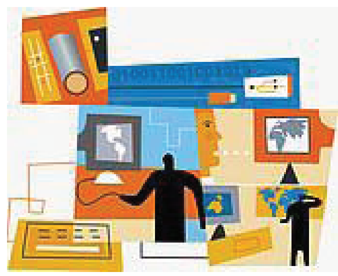
Have You Designed or Renovated Your Buildings to Maximize Learning Spaces?

5

Advancements in technology will drive ongoing changes in all aspects of college and university life and offer new opportunities to enhance and broaden learning experiences.

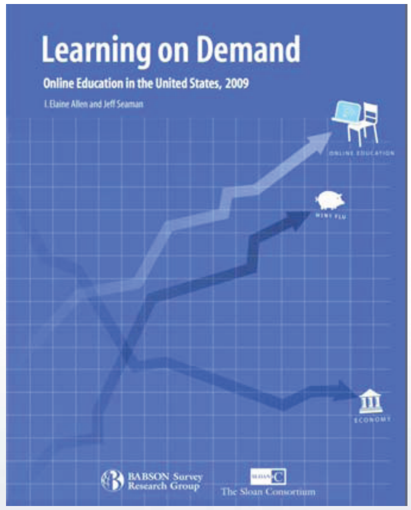


Cell phones can now receive colleges' course updates, quizzes, bus schedules, and safety alerts



myTC3

- "On The GO"
  - Grades
  - Class Schedule and Cancellations
  - Account Balance
  - Financial Aid Status
  - Live Chat
  - Bookstore Orders
  - Registration



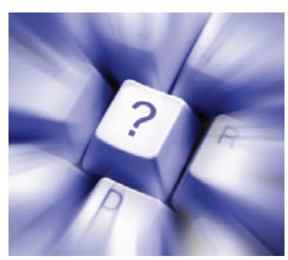
- Over 3.6 million students were taking at least one online course during the fall 2008 term
- This is a 17% increase over the previous year
- Overall growth in higher education in the same period - 1.2%
- 25.3% of all U.S. higher education students were taking at least one online course in fall 2008

Take Your Pick

- Course Management Systems
- Learning Management Systems
- ePortfolio tools
- How many exhibitors here?

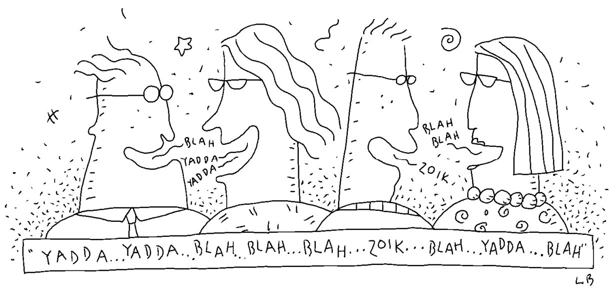
Question

How has your institution used technology to substantially improve learning?

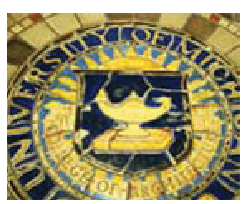


6

Inter-disciplinary learning will become increasingly common and popular.



The University of Michigan now offers 35 interdepartmental graduate programs, ranging from Bioinformatics to Macromolecular Science and Engineering



20% of Stanford's Research is Done by Multidisciplinary or Interdisciplinary Units

University of Alabama at Birmingham

- **"The Anatomy of Desire"**
  - *Art, Finance, Psychology*
- **"Bottom-up. Top-down"**
  - *English, Physics, Anthropology*
- **"It's About Time"**
  - *Music, Economics, Math, Psychology*
- **"In Search of Human Nature"**
  - *Linguistics, Theology, Biochemistry, English*

Question

What has your school done in interdisciplinary courses?

What are the impediments to truly integrated interdisciplinary learning?

7

Students will take much greater control of their own learning, as proactive producers and managers of their learning solutions, materials, and portfolios.

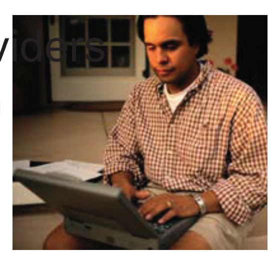
The New Student

- Intuitively use technology and navigate the Internet with ease
- Constantly connected and always "on"
- They have fast response times, often preferring speed to accuracy
- Highly social and prefer to work in teams
- Prefer engagement and experiential learning
- Prefer to learn by doing
- Don't relate to lecture mode

Diana and James Oblinger: *Educating the Net Generation*

How Will Faculty Relate To The New Student Who . . .

- Prefers Self-directed Initiatives
- Is Able To Do Primary Source Research
- Displays An Assertive Learning Style
- Has Selective Loyalty to Providers
- Wants Career Path Selection
- Has A Customer Orientation

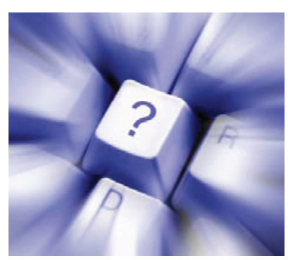


Minnesota offers a free electronic portfolio to every student - and citizen - in the state to help them meet their educational and career goals

eFolioMinnesota™ Empowering Individuals

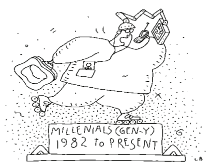
Question

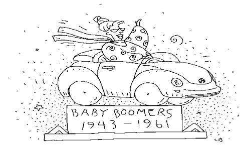
How Are You Helping Students to Be Proactive in their Learning?

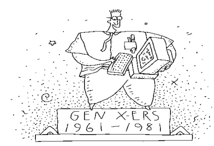


8

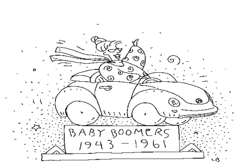
The average age of students will continue to rise; the mix of cultures, ages, and learning styles will become increasingly varied and rich







The National Center for Educational Statistics statistics - undergraduate enrollment for persons age 25 and over rose by 34 percent from 1980 to 1990 while enrollment of students under age 25 increased by only 3 percent



Kid Stuff?

- Average age at Harvard and Notre Dame is 27.
- University of Phoenix: 35 - 37
- 38% of all undergraduates are 25 or over
- Boomers in need of an educational overhaul
- 10%+ unemployment fills classrooms
- UT Dallas range: 17 to 89

Classroom Diversity

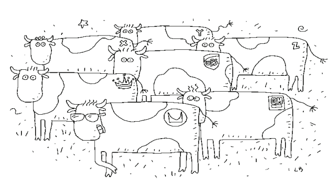
- Millenials
  - Text messaging and Blogging
- Gen Xers
  - CD's and PC's
- Boomers
  - TV and Record Players

QUESTION

What is Your College Doing to Deal With The Mix of Cultures, Ages, and Learning Styles?

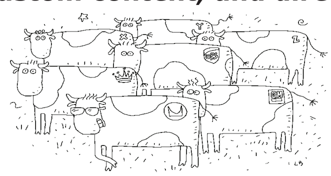
9

Competition for students and resources will force colleges and universities to sharpen their brands and identities, and to distinguish themselves in new ways



Branding

"Your school will be highlighted as a featured school when it appears on a student's College Search results list at collegeboard.com, for only $2,500, annually. A photo is displayed beside your school's name, increasing the likelihood that students will click through to information about your campus. Once they click through, they'll discover information above and beyond the usual college information they are accustomed to viewing, including campus photos, custom content, and direct links to your website."



"Every phrase we use to describe Albright, every photograph we choose, every time we use our logo, we are creating an image of Albright. These verbal and visual elements introduce Albright to those who do not yet know us and create their first impression of our College. Our *brand image,* therefore, is both drawn from and enriched by the actual *experience* of Albright. Everyone who speaks publicly about Albright, publishes print or electronic information about us or represents us to the media plays a part in creating and maintaining our image. Everyone who touches student lives contributes to our brand."

Albright College
Brand Handbook

http://www.albright.edu/cr/albright-guidelines-1.pdf

COLUMBIA UNIVERSITY
IN THE CITY OF NEW YORK

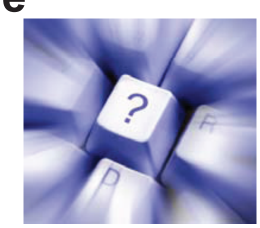
What Do You Think?

- Miami of Ohio University
  - “For Love and Honor”
- Bowling Green State
  - “Changing the world by degrees”
- University of Alaska, Fairbanks
  - “Latitude with Attitude”
- Notre Dame
  - “Nowhere but Notre Dame”
- Harvard University
  - “Ask what you can do”

Questions

Does your college have a “brand phrase?

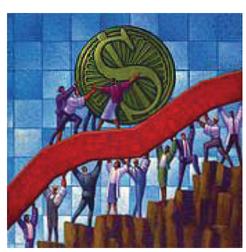
What distinguishes your institution from comparable colleges?



Why should a student choose your school?

10

College and universities will become increasingly important parts of regional economic development, both in creating growth and taking advantage of it



Ivy Tech's Marion campus (Indiana)

- *Partnership of college, city, and county and state*
- *Trains and retrains local workers*
- *Community-centered campus*
- *Interactive learning spaces*
- *Community gathering spaces*

IVY TECH COMMUNITY COLLEGE
EAST CENTRAL INDIANA
MUNCIE | MARION | ANDERSON

Community Colleges and Workforce Development

- **95% of businesses and organizations that use them recommend community college workforce education and training programs**
- **65% of new healthcare workers get their training at community colleges**
- **80% of first responders have been trained by community colleges**

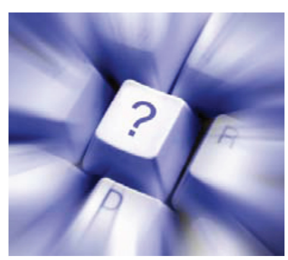
Oregon Has Combined Community Colleges and Workforce Development into One Agency

COMMUNITY COLLEGES AND WORKFORCE DEVELOPMENT
WORKSOURCE OREGON

Question

How committed is your institution to workforce and economic development in your region?

Examples?



11

The structures of educational institutions and the types of employment relationships between them and faculty will continue to multiply; inequities among faculty will cause tensions

The American Faculty: The Restructuring of Academic Work and Careers

Jack H. Schuster and Martin Finkelstein

Johns Hopkins Press

The American Faculty: The Restructuring of Academic Work and Careers

- **Big increase in PT Faculty**
- **Decrease in tenure track FT Faculty positions**
- **Shift from the Arts to professions**
- **FT workload increasing**
- **Wages falling behind inflation**
- **Huge applicant pools**

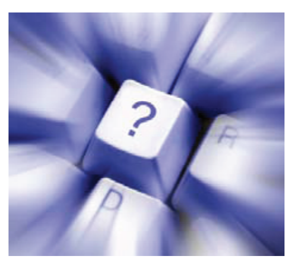
Anne Arundel Community employs 40 hour per week, non-tenure track "trainers" to fulfill its workforce development commitment to local business and industry

Aging Professoriate

- In 1987
  - 25% - less than 40
  - 50% between 40 and 54
  - 25% - 55 and older
- In 1997
  - 18% <less than 40
  - 52% between 40 and 54
  - 31% - 55 and older

Questions

- Is the current fiscal crisis going to change any retirement plans?
- Can an aging faculty respond to a rapidly changing educational environment and student mix?
- Does the prospect of a growing proportion of faculty aged 70 and over create a new set of problems for colleges?



12

Accountability and assessment tools will continue to become commonplace in defining institutional effectiveness

North Central Association Higher Learning Commission

Criteria and Core Components

- 1. How are your stated student learning outcomes appropriate to your mission, programs, and degrees?
- 2. What evidence do you have that students achieve your stated learning outcomes
- 3. In what ways do you analyze and use evidence of student learning?
- 4. How do you ensure shared responsibility for assessment of student learning?
- 5. How do you evaluate and improve the effectiveness of your efforts to assess and improve student learning?

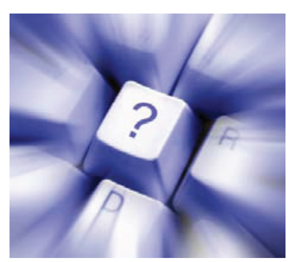
The American Association of State Colleges and Universities & the National Association of State Universities and Land-Grant Colleges

Joint "Voluntary System of Accountability" - 332 institutions and growing

www.voluntarysystem.org/

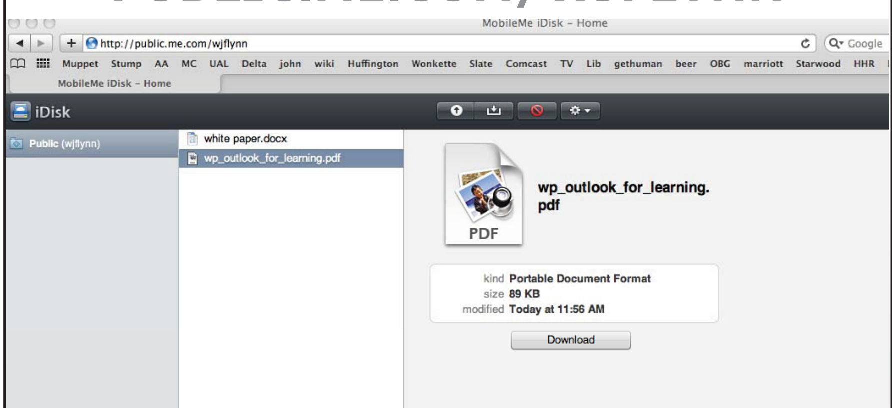
Question

What Accountability Measures Has Your College Implemented?



Recommendations for a new trend

PUBLIC.ME.COM/WJFLYNN



Discussion

Thank You!

nccet@comcast.net

Educational Master Plan

Information Submission Form

1) Title: STEM Advances at a Two-Year College, But Gap Still Looms Nationwide

2) Author: Adam, Michelle

3) Source: The Hispanic Outlook in Higher Education (Jan. 3, 2011)

4) Taxonomy Area:

- ☐ Society
- ☐ Technology
- ☐ Economy
- ☐ Environment
- ☐ Politics and Legal Issues
- ☑ Education
- ☐ Other: __________

5) Relevance: STEM programs

6) Page / Section: __________

7) Link to document: __________

or

8) Attach Document Here: ☐

Magazine

STEM Advances at a Two-Year College, But Gap Still Looms Nationwide

Article from: **The Hispanic Outlook in Higher Education** Article date: **January 3, 2011** Author: **Adam, Michelle**

Last October, when the University of Alabama-Birmingham hosted a National Science Foundation (NSF) workshop on improving student numbers in STEM fields (science, technology, engineering and mathematics), Anthony S. Tricoli was invited to attend as keynote speaker. As president of a two-year-institution, Georgia Perimeter College (GPC), he spoke to the importance of two-year colleges preparing more students for STEM fields.

"They invited a two-year-college president as keynote speaker," said Tricoli. "It shows that we recognize that two-year colleges are important players in preparing STEM graduates."

When Tricoli presented his speech, "Community Colleges: Radically Inclusive Partners in STEM," he pointed out the importance of partnerships between two-year and four-year colleges and universities in addressing a STEM student shortage that our nation has experienced for several decades. His insistence on improving the numbers of graduates in science, technology, engineering and math was a familiar theme, but his emphasis on improving two-year and four-year college collaborations to do so was unique.

"Two-year colleges educate half of our students. We are now a big player in the STEM field and are strengthening our curriculum in these areas every day," said Tricoli. "It is important for us to do this because it is important to our country."

During the past few presidential administrations, strong efforts have been made to increase student graduation in STEM fields in order to maintain our country's competitiveness. This call for more scientists, engineers, mathematicians and technology experts has been in direct response to our diminished strength in these fields.

According to the National Science Foundation, most other countries have surpassed the U.S. in STEM field education, and especially in natural sciences and engineering. In 1975, Japan was the only country with a higher ratio than the United States in natural science and engineering degrees per hundred 20- to 24year-olds. All that has changed. This reality was revealed in a NSF 2009 report, which stated that, "By 1990, a few of these locations 1 23 countries and economies with dala available and studied) had surpassed the U.S. ratio, and by 2005, nearly all had done so."

To address this discrepancy. President George W. Bush spoke to our decreased competitiveness in his 2006 State of the Union address. He established the American Competitiveness Initiative and called for an increase in federal funding for research and development projects and for U.S. higher education graduates in STEM fields. In November 2009, President Obama launched the "Educate to Innovate" Campaign for Excellence in Science, Technology, Engineering and Math Education. He announced a series of partnerships and financial support involving leading companies, foundations, nonprofits, and science and engineering societies to motivate and inspire young students to pursue STEM field careers.

These presidential efforts reflect an ongoing, larger nationwide push to improve our graduate numbers in STEM fields. For example, the National Science Foundation has numerous programs in STEM education, as well as the National Research Council. In addition, the United States National Academies, the National Aeronautics and Space Administration, numerous states and multiple nonprofit organizations have all played a role in increasing these STEM numbers.

Many schools, from elementan t0 me highest ranks of higher education, have also been working with federal agencies, states and organizations to do their part in advancing STEM education. Back in Atlanta, at (iPC, Tricoli has also focused on improving student interest in these fields, given that his school and so many other two-year-colleges have become key players in establishing the groundwork for students' success in higher education.

Since embarking on his presidency in 2006, Tricoli has been working to improve programs, especially those in STEM fields, and widening the education pipeline between his school and dozens of others in Georgia and beyond. As president of the third-largest institution within a 35-coUege and university system of Georgia, with 25,549 students, he has focused intently on addressing the particular needs of students who might pursue careers and education beyond its walls.

"GPC is unique in that it has completed 38 transfer agreements (TAG) allowing students to automatically transfer from their current program at GPC into a four-year college or university," said Tricoli. "These four-year institutions represent a broad range, including in-state and out-of-state, private and public, large and small. The diversity of TAG Agreements allows flexibility for student needs, allowing students to select the institution that best meets their needs for success."

Facilitating success for students when and if they choose to transfer to a four-year college is the first step toward ensuring that those interested in STEM-related fields continue their education beyond two years.

The other important step that GPC has taken has been to develop curriculum and programs that inspire and educate students in STEM-related fields during their first years of college.

Since 2004, GPC has initiated several programs and activities designed to increase the numbers of STEM majors at this institution and continuing in the same fields at four-year colleges and universities. For example, the school's MESA program, launched in 2004 and based on the California MESA program in community colleges, provides math, engineering and science academic enrichment to GPCs STEM students.

The MESA program, established nationally in the 1970s, began with students as young as elementary age and as old as college level, At GPC and other two-year colleges, the program is designed to ensure that these students successfully transfer to four-year institutions with career plans that involve math-based majors such as physics, engineering, computer science, chemistry or geology. MESA also provides students with social-networking and career-preparation opportunities, which are especially important given that students live off campus and balance schoolwork with jobs. In addition, this program offers students career fairs, transfer fairs, stipends, scholarships and visits to potential transfer institutions.

During this past academic year, the school's MESA program served approximately 75 active students. Of them, 66 are expected to transfer into a STEM-related field at a four-year college/university by the end of the summer.

Beyond the MESA program, GPC, in partnership with the University of Georgia and five other institutions, received a Louis Stokes Alliance for Minority Participation (LSAMP) grant from the National Science Foundation in 2005. Its purpose has been to increase the number of underrepresented minorities earning bachelor's degrees as well as graduate degrees in STEM disciplines.

Of the five institutions participating in the Peach State 15??? Alliance, Georgia Perimeter College is the only two-year institution. As Georgia's largest, GPC is the main feeder school for students transferring into most of the four-year colleges and universities in the state.

Today the LSAMP Alliance provides a support system that includes tutoring, mentoring and enrichment opportunities in the form of workshops, seminars, field trips and other activities. Students can also take part in summer research and internships and receive monetary support in the form of stipends during fall and spring semesters (provided they maintain the required GPA and fulfill other criteria, which include participation in various workshops and seminars and five hours of service).

"The opportunity for students to get to know one another and work together is also an important benefit. Networking with faculty and fellow LSAMP scholars at the four-year institutions helps make transfer easier for the students." said Tricoli. "A professional conference is also held each fall. Last year, there were over 350 Alliance students and faculty in attendance at the fall conference. Students who have participated in research during the year or during the past summer present their findings either orally or as poster presentations."

For the first three years of LSAMP, during the summers of 2006, 2007 and 2008, GPC also sponsored a Summer Bridge for high school graduates. Students enrolled in the Bridge program in the summer before matriculating at GPC or one of the Peach State LSAMP institutions. Here students received daily sessions in math to help prepare them for the college math placement tests, in addition to classes in computer science, engineering and the various science disciplines.

The purpose of these sessions was to help pique student interest in the STEM fields and help them decide on a major. Students took field trips related to their coursework and visited the other Alliance institutions.

"Last summer, GPC also held a Transfer Summer Bridge experience for current GPC LSAMP scholars as they prepared to transfer to a four-year institution. The students were involved in small research projects and took field trips to each of the four-year Alliance institutions," said Tricoli. "The Transfer Summer Bridge will be held again during the summer of 2010."

In addition to enhanced curriculum provided by these programs, GPC also offers students a plethora of courses in biology, chemistry, computer science, engineering, geology, mathematics and physics (all STEM-related subjects). But despite these courses and national programs, GPC and many other two-year and four-year colleges and ?12

schools are going to have to push even harder to truly change student numbers in STEM fields.

"The state of science, technology, engineering and mathematics education in our country is reaching a critical stage. According to the Bureau of Labor Statistics, jobs requiring science, engineering or technical training will increase by more than 24 percent by 2014 to 6.3 million," said Tricoli. "Meanwhile, it is anticipated that our schools will need 200,000 or more new teachers in science and math over the next decade due to retirements, according to estimates by such groups as the Business-Higher Education Forum in Washington. Furthermore, in order to improve the U.S. economy, science and technology are and will continue to be drivers of economic growth and national security, and yet students' interest in these critical areas is either flat or declining."

These concerns hold true in GPCs home state and nationwide. "To illustrate the problem here in Georgia, only nine chemistry teachers and three physics teachers graduated from University System of Georgia institutions in 2006. yet we were predicting the need for 415 new chemistry teachers and 210 new physics teachers by 2010. Increasing the numbers of STEM majors and STEM students pursuing teaching careers is an important goal of both GPC and the University System of Georgia."

The challenge of addressing STEM shortfalls nationwide is one that a school like GPC or other two-year colleges can't face alone. And that's exactly why Tricoli is determined to do his part in building bridges and collaboration with schools throughout the country.

"Bridge programs are becoming more common. Educators around the country are recognizing thai, in order to increase the number of students graduating in STEM fields, it is vitally important to implement efforts Io assure that those students successfully transition to the fouryear institution. 1 expect this trend to continue to grow," said Tricoli.

"In Georgia, the University System, with its 35 institutions, has implemented multiple STEM initiatives that not only focus on specific STEM fields but also on producing quality teachers of STEM. So in Georgia, we are working very hard on this. My colleagues across the country tell me they are doing the same at their institutions."

As Tricoli aims to "transform education for our students as quickly as 1 can," he looks back at when he was a youngster and how the world of science and technology looked different back then.

"When I was growing up, we'd look at an item, and if it was made in Japan, we didn't buy it. Now a number of people won't buy Americanmade cars," he said. "In order for the U.S. to be competitive again, we need to train students in STEM fields. It has always been a race for science and math, and now it's just a race to compete in an area where we were leading."

For Tricoli, that means change and "improving the way our students learn and are educated." "But I'm a change agent, and my goal is to give this school and its students a platform to be successful."

[Sidebar]

At GPC and other two-year colleges, the program is designed to ensure that these students successfully transfer to four-year instutions with career plans that involve math-based majors such as physics, engineering, computer science, chemistry or geology.

Educational Master Plan

Information Submission Form

1) Title: Crossing State Lines

2) Author: Botman, Selma

3) Source: The New England Journal of Higher Ed (October 1, 2009)

4) Taxonomy Area:

- ☐ Society
- ☐ Technology
- ☐ Economy
- ☐ Environment
- ☐ Politics and Legal Issues
- ☑ Education
- ☐ Other: ____________________

5) Relevance: Transfer

6) Page / Section: ____________________

7) Link to document: ____________________

or

8) Attach Document Here: [ ]

Magazine

Crossing State Lines

Article from: **The New England Journal of Higher Education** Article date: **October 1, 2009** Author: **Botman, Selma**

New models for cooperation in the 21st century

American higher education is the envy of the world, and it also is the world's most democratized system.

But originally, colleges and universities were created for affluent students ages 18 to 22. They were socially, racially and ethnically homogenous. These young people attended full time, and they matriculated and graduated from the same institution in four years.

We all know that this is no longer the case. In fact, this world has long passed. Today, our universities are filled with students of all ages, social classes, races, ethnicities, genders, sexual orientations and abilities. They are mobile and technologically sophisticated, and not surprisingly, they often live very complicated lives.

Yet we maintain the same higher education infrastructure that came into being in 1857 when U.S. Sen. Justin Smith Morrill of Vermont submitted the Land Grant Act to Congress. Signed into law in 1862 by Abraham Lincoln, this law enabled the creation of the land-grant university system that led to the establishment of the great public research universities that serve each individual state.

Our challenge in the 21st century is to figure out how to break out of that outdated box, to create partnerships and articulation agreements with educational institutions not only within but also across states. We must think of new ways to reach students. One approach that works, and is being employed at colleges and universities throughout the United States, is the early college program that provides college courses and credits for qualified high school students, building the K-16 pipeline. Another strategy is to work more closely with community colleges. When I was executive vice chancellor and university provost of the City University of New York (CUNY), we developed 2+2 programs designed to provide community college students in that system clear pathways into its four-year colleges. This work was important not only because it translated into natural transitions for students between the two- and four-year institutions, but also because it brought faculty together to discuss curricula and pathways the community college to more study. Similarly, it drew together academic support who would act as to the students.

We need to start thinking of ways extend models like these across lines in our region. That is the only way to enable the success of today's student, who attends multiple on the path toward The National System for Statistics (NSES) found as of 2001, 59% of first-time degree recipients had more than one institution. More recent data from NSES confirms trend, offering a compelling for prompt efforts to the needs of such students. response to growing awareness today's college students are multi-institutional, the Western Interstate Commission on Education (WICHE) has funding from the Lumina for research into articulaand transfer between two- and institutions. This 20-monthLumina-funded WICHE project, entitled Best Practices in State Transfer and Articulation Systems, will review policies and practices of all 50 states.

How might we apply these insights into student mobility across institutions in New England? Students could be admitted to specific degree programs that span universities across New England and that guarantee smooth transitions between those institutions, dependent on a student completing a prescribed set of courses. This coursework would include agreedupon classes in the major discipline, a set of general education courses and acceptable électives. Students would have to pass all courses and maintain an approved grade average in their major. Faculty at the participating universities would co-design the curricula and agree to accept all courses from their partner institutions in the major as well as general education coursework. This substantive cross-institutional collaboration would ensure that the approved curricula and designated courses would be accepted seamlessly to fulfill the requirements of the given major. The chief academic officers of each institution would oversee this process, reporting back to their presidents.

At CUNY, 2+2 programs brought together faculties in such areas as criminal justice and business as well as in general education areas to ensure that specific courses corresponded in their rigor and learning outcomes. Overseen by the chief academic officers of collaborating CUNY institutions, these efforts provided revealing insights into the many ways in which differing institutional cultures and disciplinary expectations inadvertently placed obstacles in the way of student transfer and degree attainment. The 2+2 approach moves beyond the conventional articulation agreement since students are co-enrolled in both the community college and baccalaureate programs, and they earn direct admission into the bachelor's program upon the successful completion of their associate degree. They carry their credits from their community college coursework and they have demonstrated to faculty that they have met expectations about their learning and academic performance.

New England's challenge - and an arena in which it can play a nationally important leadership role - is in truly placing the student at the center of our work, not only within universities or within university systems but across the whole region. We can do that by enabling our faculties and disciplines across our institutions to collaborate creatively in service of the intellectual substance of their programs as well as the academic aspirations of our students. That is how we can best ensure the success of our students.

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Educational Master Plan

Information Submission Form

1) Title: Global Education Challenges and Opportunities

2) Author: James M. Dennis

3) Source: www.universitybusiness.com (feb 2011)

4) Taxonomy Area:

- [ ] Society
- [ ] Technology
- [ ] Economy
- [ ] Environment
- [ ] Politics and Legal Issues
- [x] Education
- [ ] Other: __________

5) Relevance: Ed. trends

6) Page / Section: 49

7) Link to document: __________

<u>or</u>

8) Attach Document Here: [ ]

Global Education Challenges and Opportunities

Students are not isolated from world events

By James M. Dennis

GLOBAL EDUCATION HAS been a focus in American higher education for several years. Recently, we have seen an increase in conferences, speeches, and papers encouraging us to think globally and prepare our students for a world where success may be dictated by one's ability to navigate varying cultures, languages, and practices.

Students need to learn that they are interconnected globally.

There are, of course, many interpretations and definitions of what constitutes a "global education." Some would have us believe that by hosting students from other countries on our home campuses we are providing a global education. Others believe that sending students abroad achieves the goal. Several institutions operate campuses abroad to enhance their global objectives.

Although all of these are valid strategies, global education requires more. It requires that we develop a global mindset and understand that what happens in other parts of the world affects all of us. Our students need to learn that they are interconnected and cannot isolate themselves from world events.

Students today need to have the opportunity to develop competencies that will prepare them to live in a complex world that's socially, politically, and economically interdependent. They need to understand the challenges they will face as they move into positions of leadership and acquire skills that will allow them to navigate a highly networked world.

Employers tell us that today's graduates lack the knowledge and skills needed to achieve success. The recent AAC&U report entitled "College Learning for the New Global Century" revealed the following:

It is not enough for us to offer short-term learning experiences through study abroad.

- Fully 63 percent of employers believe that too many recent college graduates do not have the skills they need to succeed in the global economy.
- Only 18 percent of employers rate college graduates as "very well prepared" in the area of global knowledge. More than 45 percent rate them as "not well prepared" at all in this area.

In an era of diminishing resources and demands for accelerated learning, how do we position our institutions to meet the needs of today's students and the global demands of today's marketplace?

To meet these challenges, we must strive to:

1. Ensure that our students understand and appreciate the opportunities that our global future holds.

2. Develop institutional strategies that encourage faculty and students to prepare for a rapidly changing world.

3. Provide resources that encourage students to engage in international learning experiences and faculty to construct classes with a global emphasis.

True global learning cannot be isolated in our curricula.

Our challenge is to incorporate our local institutional values within a broader framework to prepare students for the global challenges and opportunities ahead. Not only should we provide study abroad opportunities, but we should also promote the development of international global content in ALL classes and research. True global learning must be integrated throughout the curricula.

To partially address the demands of global education, the faculty of **McKendree University** (Ill.) are launching a new interdisciplinary major in Global Studies. Students will study "the world as an interacting human community, including the movements of goods, the migration of people, the spread of technologies, and the unifying of cultures," explains faculty member Brian Frederking. "The faculty agree that "the greatest issues faced by humanity—climate change, economic stability, disease, terrorism, hunger, poverty, war and conflict, etc.—require a global solution. The Global Studies program focuses on these processes and problems."

The program will also explore "how the world works now that technology and global communication are instantaneous," Frederking continues. "Career ▶

James M. Dennis has been president of McKendree University in Lebanon, Illinois, since 1994. He serves on the Board of Directors of the Council of Independent Colleges, www.cic.edu.

opportunities for a student in the major include international organizations, international business, economic development, international law, human rights, humanitarian groups, health, the environment, mass communication and a wide variety of government agencies."

We must affirm a global learning emphasis.

It is not enough for us to offer short-term learning experiences through study abroad or foreign exchange programs, as these typically affect but a few students. Rather, to ensure that we are truly preparing our students for the dynamic world they will inherit, we must do the following:

1. We must develop among students a comprehensive understanding of and appreciation for the many international opportunities that exist now and will exist in the future.
2. We must provide opportunities for our students to develop knowledge and skills through cross-cultural experiences, and we must connect these experiences in a deliberate way.
3. We must value global experiences and understand how our students can benefit from them.
4. We must encourage and support faculty who are striving to include global learning in their classes.
5. We must commit ourselves to shaping our institutional culture to support and affirm a global learning emphasis.
6. We must determine how best to establish educational outcomes and learning assessment tools to measure our success.
7. We must develop co-curricular opportunities to complement our global academic initiatives.

Developing a comprehensive global education program is a daunting process. It must be a university-wide initiative that evolves through deliberate planning. Such an effort requires strong and effective leadership. At McKendree, we believe that global education, in all its forms, will ensure the success of our students in a rapidly changing world. U

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GROSSMONT-CUYAMACA
COMMUNITY COLLEGE DISTRICT

Education Master Plan
Information Submission Form

The GCCCD is starting a year-long process to develop an Educational Master Plan that will serve as the blueprint for our future. The Educational Master Plan is a long-range, comprehensive document intended to guide institutional and program development at both the college and district levels. The priorities established in the Educational Master Plan will serve to guide College and District decisions about growth, development and resource allocation.

As the first step in this planning process, everyone in the GCCCD community (faculty, staff, students and community members) are invited to identify and submit information sources to be reviewed for the trend analysis in one of six taxonomy areas - society, technology, economy, environment, politics, and education. We are not asking you to do new research - only to identify information you already have or that you encounter during the search period (March 21 - April 25) and bring it to the attention of the Scan Teams for review.

Please feel free to submit as many of these forms as you would like. Please answer the following questions for each submission:

1) What is the document we should review? : UCSD policy limits community college students Raising GPA requirement to 3

2) Author: By Pat Flynn

3) Source: San Diego Union Tribune

4) Which of the following taxonomy areas does it fit into? (Please select only one):

- ☐ Society
- ☐ Technology
- ☐ Economy
- ☐ Environment
- ☐ Politics and Legal Issues
- ☒ Education
- ☐ Other:

5) Relevance: The raising of GPA requirement will make it more challenging for our students to TAG into a UC university.

6) Page / Section: entire article

7) **Add Attachment/Hyperlink Here**: http://www.signonsandiego.com/news/2011/mar/18/ucsds-new-transfer-standard-roils

To attach a document: ***Reader 9:*****Tools-Comments and Markups-Attach A File As A Comment**
Reader X: Comment (upper right), select paper clip icon under Annotations

Questions: lynne.davidson@gcccd.edu *Research, Planning and Institutional Effectiveness*

Educational Master Plan

Information Submission Form

1) Title: Where do Rural HS Students Go to Find Information About Their Futures

2) Author: Dana Griffin, Bryan Hutchins, Judith Meece

3) Source: Journal of Counseling and Development : JCD; Spring 2011; 89, 2

4) Taxonomy Area:

- [ ] Society
- [ ] Technology
- [ ] Economy
- [ ] Environment
- [ ] Politics and Legal Issues
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Where Do Rural High School Students Go to Find Information About Their Futures?

Dana Griffin, Bryan C. Hutchins, and Judith L. Meece

Using data from a national study of rural high school youth, the authors examined where students go to receive information about their futures and which sources are most helpful. Results indicated that students in rural and low-income schools were more likely to report going to teachers and found teachers to be most helpful compared with students in small town and higher income schools. Patterns of differentiation were also found on the basis of gender, ethnicity, and grade level.

Although more than a quarter of America's public school students receive their education in rural school settings, little empirical research has examined the counseling development and exploration activities of rural youth (Gandara, Gutierrez, & O'Hara, 2001; Hardré, Sullivan, & Crowson, 2009; Provasnik et al., 2007; Sutton & Pearson, 2002). These youth face a number of challenges that can limit their career exploration and development activities. Compared with students from metropolitan areas, rural students, especially in low-income communities, have limited access to career counseling, college preparatory courses, career academies, and school-to-work programs (Provasnik et al., 2007). Additionally, poverty rates are higher for youth, particularly ethnic minorities, in rural than in urban areas (Ley, Nelson, & Beltyukova, 1996; Lichter & Johnson, 2007; Nadel & Sagawa, 2002). Numerous studies document the negative impact of low family socioeconomic status on rural youth's future educational and vocational attainment (Conger, Conger, & Elder, 1997; Duncan, 2001; Haller & Virkler, 1993; Hansen & McIntire, 1989; Rojewski, 1999). Furthermore, rural communities have experienced significant changes in terms of demographic, social, and economic trends over the past decades (Johnson & Strange, 2007). Previous occupations for rural youth in the service, labor, extraction, and agriculture sectors, which have been the mainstay of rural communities for generations, are disappearing (Albrecht, Albrecht, & Albrecht, 2000; Crockett, Shanahan, & Jackson-Newsom, 2000; Elder & Conger, 2000; Friedman & Lichter, 1998; Gibbs, Kusmin, & Cromartie, 2005).

Despite these challenges, parental expectations for their children mirror those in more urban locales. Approximately 20% of rural parents expect their children to obtain 2 or more years of college, and more than one third (37%) expect their children to complete a bachelor's degree (Provasnik et al., 2007). Research indicates that parental expectations and support play an important role in the development in children's college and vocational aspirations (Bryan, Moore-Thomas, Day-Vines, Holcomb-McCoy, & Mitchell, 2009; Griffith, 1996; Simons-Morton & Crump, 2003). However, college completion rates for adults tend to be lower in rural than in urban areas (Provasnik et al., 2007; Whitener & McGranahan, 2003). Parents who have not attended college may lack important information that is needed to help children prepare for college (Saenz, Hurtado, Barrera, Wolf, & Yeung, 2007). Under these conditions, school- or community-based college and career counseling programs may play a particularly influential role in the career development of rural youth.

Given current demographic and economic trends in rural communities, research is needed to examine where rural students go for information and what resources they perceive to be most helpful in informing their future aspirations (Gibbons, Borders, Wiles, Stephan, & Davis, 2006). Therefore, the purpose of this study is to examine the sources of information rural youth explore as they make career decisions and the sources they find most helpful in this career exploration activity. The study draws on a national sample of more than 8,000 rural youth (14 to 18 years old) from geographically and socioeconomically diverse small town and rural communities. A majority of these youth aspired to attend or to complete 2- or 4-year postsecondary institutions, and a majority also aspired to adulthood jobs and careers that require a college education or postgraduate degree (Meece & Farmer, 2009). We next discuss the career and academic aspirations of students.

Career and Academic Aspirations

Career and academic aspirations can be defined as the educational and vocational dreams students have about their future

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or a combination of an individual's ambitions (the ability to look ahead and invest in the future) and his or her inspirations (the ability to invest the required time, energy, and effort; Quaglia & Perry, 1995; Sirin, Diemer, Jackson, Gonsalves, & Howell, 2004). Much of the effective school literature ignores the issue of student aspirations when talking about effective schools, child motivation, and student expectation (Quaglia, 1989). Aspirations must be considered an important part of a student's motivation to succeed, because the motivations students develop in school can influence their future goals and expectations (Bandura, Barbaranelli, Caprara, & Pastorelli, 2001; Eccles, Wigfield, & Schiefele, 1998; Lent, Brown, & Hackett, 1994; Schneider & Stevenson, 1999).

Research also indicates that youth's career and academic aspirations are influenced by a variety of factors, including race and the educational level of parents (Sirin et al., 2004). Additionally, research suggests that the educational aspirations of students can be influenced by the educational aspirations that school counselors, parents, close relatives, teachers, and peers have for them (McDonough, 2005; Trusty, 2002). Furthermore, high school counselors may be particularly influential in the college enrollment plans of low-income students and students of color. However, for urban schools serving large concentrations of students of color or low-income students, some evidence suggests that school counselors may be unable to provide adequate guidance or resources for college planning (Corwin, Venegas, Oliverez, & Colyar, 2004). Little current research has examined the role of school counselors in preparing youth for their futures in rural schools.

Nevertheless, research conducted in the 1980s and early 1990s suggested that, when compared with urban students, rural students have lower educational and career aspirations (Cobb, McIntire, & Pratt, 1989; Haller & Virkler, 1993; Kannapel & DeYoung, 1999; Quaglia, 1989; Rojewski, 1999). Quaglia and Perry (1995) identified five contributing factors to the lower aspirations of rural youth: (a) high poverty rates in rural areas, (b) the relationship of socioeconomic status and educational outcomes, (c) the educational level of parents (Pollard & O'Hare, 1990), (d) less access to knowledge of occupations, and (e) lower occupational aspirations because of employment opportunities in the youth's local community (Brown, 2007; Haller & Virkler, 1993).

Guiding Conceptual Framework of the Study

Social cognitive career theory (SCCT; Lent et al., 1994) was used as the conceptual framework to guide this study. Based on Bandura's social cognitive theory, SCCT addresses the intersection of culture, gender, genetic endowment, social context, life events, and career-related choices, as well as the connection of self-efficacy, personal goals, and outcome expectations that may influence career choice (Savickas & Lent, 1994). Lent et al. (1994) theorized that individual predisposed biological attributes (e.g., gender, ethnicity) and background contextual factors (i.e., social support, environment) affect learning experiences, which in turn influence self-efficacy and outcome expectations. According to SCCT, career information is essential for developing realistic outcome expectations (Lent et al., 1994). With accurate and realistic career information, students can assess their values, interests, self-efficacy beliefs, and career aspirations as they relate to potential occupations and careers (Lent, 2005). However, those students who do not have accurate information can develop unrealistic career goals that can lead to failure in completing college or obtaining a rewarding career (Gray, 2009).

Consistent with other research, studies using the SCCT framework have shown that parental influence was the most important factor for rural youth in their career development (Lee, 1984). Particularly relevant for the current study, this research suggests that the career and academic aspirations of students can be influenced by various intrapersonal and systemic factors, such as the factual information they gather and the beliefs of others concerning future orientations and aspirations (Akos, Lambie, Milsom, & Gilbert, 2007; Gottfredson, 2002). Additionally, local or community values, as well as employment opportunities available within the community, have also been cited as influences on the attitudes of students and their families about the students' education and career aspirations (Barley & Beesley, 2007; Gandara et al., 2001).

Because much of the research using a SCCT framework has been applied to urban youth, little information, especially regarding career choices, is known about where rural students go for information about their futures as well as what information they find most helpful in deciding on their futures (Gibbons et al., 2006; Provasnik et al., 2007). In a recent study, Gibbons et al. (2006) found that ninth-grade students across North Carolina used a variety of sources of information, but parents and family were reported as most helpful, whereas school counselors were rated as least helpful; sources such as the Internet, teachers, and the media were reported as somewhat helpful. Given that limited research exists regarding rural schools and the large number of students attending rural schools, additional research seems warranted to explore student characteristics and school contextual factors related to high school students' career searching.

Purpose of the Study

The primary purpose of this study was to examine, using a national sample of 8,000 rural high school students (ages 14 to 18 years), the sources of information these rural youth access and find most valuable as they prepare for the transition to adulthood. On the basis of the review of literature, we examined differences in grade level, gender, and ethnicity on sources of information rural youth find most helpful through the following research questions:

Research Question 1: Where do rural high school students go to for information about their future plans?

Research Question 2: What sources of information were most helpful to rural high school students in examining their educational and occupational aspirations?

Research Question 3: What significant differences exist between rural students across lower (ninth and 10th) and upper (11th and 12th) grades, gender, and ethnicity?

Method

This investigation was conducted as part of a larger study examining the educational and occupational aspirations of rural high school youth in Grades 9–12. Data were collected during the 2007–2008 academic year. As agreed on by the university's institutional review board, recruitment and consenting procedures followed participating districts' local policies and administrative guidelines. In some districts, active consent procedures were used and parental consent forms were sent home with students. In these schools, students were allowed to participate only if they returned signed parental consent forms (unless they were legally emancipated). In other districts, waiver consent procedures were used and consent forms were sent home to notify parents of the study. If parents did not want their children to participate, they were asked to return a signed form indicating this. All participating students also completed assent forms as part of their participation in the broader survey on their postsecondary aspirations and school adjustment.

Participants

The student sample for this study included 8,754 rural youth. (See Table 1 for demographic information.) Sampling was based on a two-stage design. Schools were selected using the U.S. Department of Education's Common Core of Data (CCD). Attempts were made to sample all students from selected schools. The sampling design placed a special emphasis on Rural and Low-Income School Program (RLIS) and Small, Rural School Achievement Program (SRSA) schools; schools from Metro-Centric Locale Codes 6 (small town), 7 (rural, outside major statistical area), and 8 (rural, inside major statistical area); and schools from Urban-Centric Locale Code 43 (rural, remote). According to the metro-centric locale system, six schools (8.2%) were classified as Locale Code 6, 57 schools (78.1%) were classified as Locale Code 7, and 10 schools (13.7%) were classified as Locale Code 8. According to the urban-centric locale system, eight schools (11.0%) were classified as small town schools (Locale Codes 31, 32, and 33); three (4.1%) were classified as rural, fringe schools (Locale Code 41); 19 (26.0%) were classified as rural, distant schools (Locale Code 42); and 43 (58.9%) were classified as rural, remote schools (Locale Code 43). In addition, 19 schools (26.0%) qualified for the RLIS and 22 (30.1%) qualified for the SRSA. Thirty-six schools had 50% or more students who were eligible to receive free or reduced-price lunch, and 15 had 50% or more students who were identified as ethnic minorities.

TABLE 1

Participant Characteristics

Characteristic	*n*	%
Gender		
Male	4,224	48.5
Female	4,488	51.5
Ethnicity		
White	5,514	64.1
Black	599	7.0
Hispanic	928	10.8
Other	1,565	18.2
Grade level		
Ninth	2,443	27.9
10th	2,383	27.3
11th	2,191	25.1
12th	1,724	19.7
Locale[a]		
Small town	1,799	20.6
Rural, distant	371	4.2
Rural, remote	3,041	34.7
Rural, fringe	3,543	40.5
English as native language		
Yes	7,346	91.9
No	651	8.1

Note. N = 8,754, but some students chose not to provide this information and thus not all numbers will sum to 8,754. Percentages may not equal 100% because of rounding.
[a]Locale classification based on the urban-centric locale system.

Procedure

Participants who gave consent were gathered in their school's cafeteria and were assigned alternating seats such that no student was directly beside or across from another student. They were informed about confidentiality and told that they were not required to participate and that they could withdraw from the study at any time. The instructions for completing the surveys and the individual survey items were read aloud by a trained administrator. Additional research staff provided mobile monitoring to assist students. Small group or individual assessments were conducted with students whom teachers identified as having reading or spelling difficulties. This was done in separate administrations that did not draw attention to the students. Students who participated in the study received a special pencil.

Measures

Student characteristics. Students in this study were asked to provide gender, ethnicity, and grade level information as part of the student survey. Questions about gender and ethnicity were asked near the end of the survey. For the ethnicity question, students were given a list and told that they could mark all that apply. Students' self-reported responses on grade, gender, and ethnicity were used in this analysis.

School characteristics. The current study included two school level variables derived from information gathered from the National Center for Education Statistics (NCES; 2004):

school locale and school poverty. Each factor was dichotomously coded. Schools located within Locale Codes 31, 32, and 33 were collapsed into *small town schools*, whereas schools located within Locale Codes 41, 42, and 43 were collapsed into *rural schools*. NCES data were used to classify each school in the study according to the percentage of students receiving free lunch. Those schools with 50% or more students receiving free lunch were classified as low-income schools.

Sources of career information. The student survey included two questions that asked students to indicate where they had gone for information about their futures. For the first question ("Where have you gone for information about what you plan to do after high school?"), students could select from a list of 13 choices: school counselor; teacher; coach; principal or other school staff; parent or guardian; friend; brother or sister; other relative; pastor/priest/other religious leader; other adults in the community; college representatives; college search guides, publications, or websites; and a visit to a college campus. Students could select sources without restriction. For the second question ("Where have you gotten information that was most helpful for your plans after high school?"), students were asked to review their previous selections and indicate the three that were the most helpful.

Results

The results are presented in two steps. First, descriptive summaries are provided to give an overview of where students have gone for information about their futures. Next, contingency table analysis with chi-square tests was used to explore individual and school level differences regarding students' career exploration activities. Although this analysis may produce several statistically significant results, only differences of 5% or greater between groups were considered meaningfully significant and thus interpreted further for this study. For example, a number of statistically significant individual and school level differences were found on the basis of the results of chi-square analysis in this study. However, some of these differences were small (e.g., 1% to 3%) and would have little meaningful value for practitioners and other investigators. We reported statistically significant findings for all variables but chose to discuss only those findings for which differences were approximately 5%. Given this particular sample, a 5% difference on where students went for information or what sources were most helpful would represent approximately 400 students. This provides a balance between statistical significance and meaningful significance to the readers of this study. Other studies that have used contingency table analysis with chi-square tests have used similar cut scores when reporting and interpreting findings (e.g., Levesque et al., 2008). This analytic strategy was then repeated for the follow-up question, which asked students to report on which sources were most helpful.

Where Do Students Go for Information?

The majority of students reported going to various sources for information regarding their choices after high school, and most reported going to their parents or guardians for information on their future. Of the students who reported where they went for information, 52.7% indicated that they have gone to between one and four sources on the provided list, 40.5% have gone to between five and eight sources, and 6.8% have gone to more than nine sources to find information about their futures in the past year. The majority of students (72.2%) talked to a parent or guardian about future plans, followed by friends (55.4%), teachers (46.2%), and school counselors (41.9%). Table 2 contains totals for all categories.

TABLE 2

Where Rural High School Students Have Gone for Information About Plans After High School

		Grade			Gender			Ethnicity			
Source	Total	9–10	11–12	χ^2	Male	Female	χ^2	White	Black	Hispanic	χ^2
Parent or guardian	72.2	71.7	72.8	1.1	66.6	77.4	122.5***	75.9	63.7	55.2	181.3***
Friend	55.4	50.8	61.0	88.4***	48.3	61.9	158.8***	58.1	46.1	45.9	66.5***
Teacher	46.2	41.2	52.4	106.0***	41.0	51.1	86.2***	46.2	49.6	45.0	3.1
School counselor	41.9	29.0	57.7	707.4***	35.1	48.3	150.1***	44.6	39.8	34.6	32.7***
Other relative	38.6	39.7	37.4	4.6*	33.8	43.1	77.2***	39.2	39.5	32.6	13.9**
Brother or sister	33.1	33.0	33.1	< 1	29.3	36.4	48.3***	34.0	27.4	33.2	10.1**
College search guides, publications, or websites	30.9	22.1	41.7	375.0***	23.0	38.2	227.1***	31.9	35.3	26.7	13.4**
A visit to a college campus	25.6	17.5	35.3	349.3***	21.9	29.0	55.1***	26.9	24.7	19.1	23.7***
College representatives	23.0	11.4	37.0	780.6***	20.1	25.5	34.8***	23.1	27.2	22.4	5.2
Other adults in the community	21.6	19.2	24.5	34.5***	19.0	24.0	30.9***	22.6	20.2	15.1	25.5***
Coach	16.3	15.3	17.6	8.4**	20.0	12.9	77.2***	16.0	21.4	15.4	11.7**
Principal or other school staff	10.9	9.8	12.1	11.1***	10.4	11.2	1.3	10.7	11.1	10.8	< 1
None of the above	8.6	10.7	5.9	61.2***	12.3	5.0	143.1***	7.1	8.6	12.5	30.7***
Pastor/priest/other religious leader	7.8	7.5	8.2	1.4	7.2	8.4	3.7	7.8	10.5	3.5	28.4***

Note. Students could select sources without restriction. Numbers other than chi-square values indicate percentages.
*$p < .05$. **$p < .01$. ***$p < .001$.

Grade level differences. Overall, students in the upper grades were more likely than those in the lower grades to report having sought out information across a number of sources. Compared with students in the lower grades, students in the upper grades were much more likely to have gone to a school counselor, $\chi^2(1, N = 8467) = 707.4$, $p < .001$; talked to a teacher, $\chi^2(1, N = 8467) = 106.0$, $p < .001$; spoken with a friend, $\chi^2(1, N = 8467) = 88.4$, $p < .001$; talked to a college representative, $\chi^2(1, N = 8467) = 780.6$, $p < .001$; visited a college campus, $\chi^2(1, N = 8467) = 349.3$, $p < .001$; or read college publications or website material, $\chi^2(1, N = 8467) = 375.0$, $p < .001$. Students in the lower grades were more likely to report that they had not gone to any of the sources on the list than were students in the upper grades, $\chi^2(1, N = 8467) = 61.2$, $p < .001$.

Gender differences. Overall, female students were more likely than male students to report having sought out information about future plans across most of the sources, including school counselors, $\chi^2(1, N = 8446) = 150.1$, $p < .001$; teachers, $\chi^2(1, N = 8446) = 86.2$, $p < .001$; friends, $\chi^2(1, N = 8446) = 158.8$, $p < .001$; parents or guardians, $\chi^2(1, N = 8446) = 122.5$, $p < .001$; college publications or website material, $\chi^2(1, N = 8446) = 227.1$, $p < .001$; campus visits, $\chi^2(1, N = 8446) = 55.1$, $p < .001$; college representatives, $\chi^2(1, N = 8446) = 34.8$, $p < .001$; relatives, $\chi^2(1, N = 8446) = 77.2$, $p < .001$; siblings, $\chi^2(1, N = 8446) = 48.3$, $p < .001$; and community members, $\chi^2(1, N = 8446) = 30.9$, $p < .001$. However, compared with female students, male students were more likely to report going to a coach, $\chi^2(1, N = 8446) = 77.2$, $p < .001$, and were twice as likely to report that they had not gone to any of the sources on the list, $\chi^2(1, N = 8446) = 143.1$, $p < .001$.

Ethnicity differences. White students were more likely to report talking with parents or guardians, $\chi^2(2, N = 6840) = 181.3$, $p < .001$; friends, $\chi^2(2, N = 6840) = 66.5$, $p < .001$; and school counselors, $\chi^2(2, N = 6840) = 32.7$, $p < .001$, about their futures, whereas Black students were more likely to report talking with coaches, $\chi^2(2, N = 6840) = 11.7$, $p < .01$; consulting religious leaders, $\chi^2(2, N = 6840) = 28.4$, $p < .001$; and using college search guides, publications, or websites, $\chi^2(2, N = 6840) = 13.4$, $p < .01$. Hispanic students were more likely to report that they had not gone to any of the 13 sources of information provided on the survey, $\chi^2(2, N = 6840) = 30.7$, $p < .001$. Additionally, Hispanic students were less likely than White and Black students to report seeking information about their futures across almost all sources. No differences were found on talking to teachers, principals, or other school staff.

School level differences. Students in both low-income, $\chi^2(1, N = 7630) = 12.8$, $p < .001$, and more rural schools, $\chi^2(1, N = 8479) = 16.5$, $p < .001$, were more likely than students in higher income and small town schools to talk to teachers about their futures (49.8% vs. 44.6% and 47.3% vs. 41.9%, respectively). No meaningful school level differences were found for any other source of information.

Which Sources of Information Are Most Helpful?

In most cases, less that 30% of students reported a particular source of information as helpful. Overall, 54.0% of students reported parents or guardians as most helpful. Next, 28.9% of students reported that school counselors were most helpful, followed by teachers (25.5%) and friends (24.4%). Table 3 contains totals for all categories.

TABLE 3

What Sources of Information Rural High School Students Have Found Most Helpful for Plans After High School

		Grade			Gender			Ethnicity			
Source	Total	9–10	11–12	χ^2	Male	Female	χ^2	White	Black	Hispanic	χ^2
Parent or guardian	54.0	59.0	47.9	104.3***	52.2	55.7	10.0**	57.3	47.2	38.7	115.6***
School counselor	28.9	22.4	36.8	211.4***	25.5	32.1	44.5***	30.3	28.8	24.0	14.4**
Teacher	25.5	25.2	25.9	< 1	24.9	26.1	1.7	23.8	33.9	28.2	32.7***
Friend	24.4	24.5	24.3	< 1	23.5	25.2	3.3	24.6	20.9	22.5	5.1
College search guides, publications, or websites	20.7	16.2	26.2	128.6***	14.9	26.1	160.5***	21.0	27.2	18.3	16.7***
Brother or sister	20.0	21.5	18.1	15.1***	19.6	20.4	< 1	20.9	15.4	20.3	9.5**
Other relative	18.5	21.8	14.4	75.5***	17.0	19.8	11.2**	17.9	18.9	18.4	< 1
A visit to a college campus	16.4	11.2	22.8	203.4***	13.5	19.2	49.0***	17.6	16.0	12.2	15.7***
College representatives	14.7	8.0	22.9	374.1***	13.0	16.3	17.8***	14.6	17.2	15.4	2.9
None of the above	9.0	10.8	6.7	42.9***	11.6	6.4	71.5***	7.6	6.1	13.9	42.6***
Coach	8.5	9.1	7.8	4.2*	12.1	5.3	126.8***	7.9	12.8	8.7	15.9***
Other adults in the community	7.7	7.5	8.0	< 1	7.1	8.3	3.9*	7.7	8.1	5.9	3.7
Principal or other school staff	3.9	4.1	3.6	1.5	3.9	3.9	< 1	3.3	6.5	5.2	20.2***
Pastor/priest/other religious leader	3.4	3.6	3.2	1.1	3.2	3.6	< 1	3.4	5.3	1.4	16.9***

Note. Students were asked to review their previous selections and indicate the three that were most helpful. Numbers other than chi-square values indicate percentages.
*$p < .05$. **$p < .01$. ***$p < .001$.

Grade level differences. Although more than half of the students (54.0%) reported that parents were most helpful, students in the lower grades reported parents as being more helpful than did students in the upper grades, $\chi^2(1, N = 8467) = 104.3, p < .001$. School counselors were reported as being most helpful by 28.9% of the students. However, results suggest that school counselors become increasing more helpful to students as they approach graduation, $\chi^2(1, N = 8467) = 211.4, p < .001$. In addition, students in the upper grades found college resource materials, $\chi^2(1, N = 8467) = 128.6, p < .001$; campus visits, $\chi^2(1, N = 8467) = 203.4, p < .001$; and college representatives, $\chi^2(1, N = 8467) = 374.1, p < .001$, to be more helpful than did those in the lower grades. Finally, students in the upper grades reported that relatives, $\chi^2(1, N = 8467) = 75.5, p < .001$, and siblings, $\chi^2(1, N = 8467) = 15.1, p < .001$, were less helpful than did students in the lower grades.

Gender differences. Compared with male students, female students reported that several sources of information were more helpful. Female students reported that school counselors, $\chi^2(1, N = 8446) = 44.5, p < .001$; college search guides, publications, and websites, $\chi^2(1, N = 8446) = 160.5, p < .001$; and campus visits, $\chi^2(1, N = 8446) = 49.0, p < .001$, were more helpful than did male students. Male students, on the other hand, were twice as likely as female students to report that coaches were most helpful, $\chi^2(1, N = 8446) = 126.8, p < .001$. In addition, male students were almost twice as likely as female students to report that none of the sources on the list were most helpful, $\chi^2(1, N = 8446) = 71.5, p < .001$. No meaningful gender differences were found for parents or guardians, teachers, or friends.

Ethnicity differences. White students were more likely than Black or Hispanic students to report that parents or guardians were most helpful, $\chi^2(2, N = 6840) = 115.6, p < .001$. In addition, Hispanic students were less likely to report school counselors as most helpful compared with White and Black students, $\chi^2(2, N = 6840) = 14.4, p = .01$. However, both Black and Hispanic students were more likely than White students to report that teachers were most helpful, $\chi^2(2, N = 6840) = 32.7, p < .001$. In addition, Black students were more likely than White and Hispanic students to report that college search guides, publications, and websites were more helpful, $\chi^2(2, N = 6840) = 16.7, p < .001$, whereas siblings were less helpful, $\chi^2(2, N = 6840) = 9.5, p < .01$. Finally, Hispanic students were nearly twice as likely as White and Black students to report that none of the sources on the list were most helpful, $\chi^2(2, N = 6840) = 42.6, p < .001$.

School level differences. Students in more rural and low-income schools were more likely to report that teachers were most helpful compared with students in small town (26.6% vs. 21.2%), $\chi^2(1, N = 8479) = 19.2, p < .001$, or higher income schools (30.3% vs. 23.8%), $\chi^2(1, N = 7630) = 20.8, p < .001$. No meaningful school level differences were found for any other source of information.

Discussion

This study was conducted as part of a larger study on the educational and occupational aspirations of rural high school youth. We explored where students go to find out information about their aspirations and which sources they find most helpful. Our analyses revealed that there were significant and meaningful differences among rural high school students in their quest for information in terms of grade (lower level [Grade 9–10] and upper level [Grades 11–12]), gender, ethnicity, and school differences (rural and low income).

The data show that students sought out a variety of sources of information, but the most widely used sources were parents or guardians, friends, teachers, and school counselors. This finding is consistent with research that suggests that high school students in rural and remote areas will often seek advice on career choices from family, friends, teachers, and guidance personnel (Buikstra, Eley, & Hindmarsh, 2007). Overall, students in the upper grades, as they approached graduation, were more likely to seek information than were those in the lower grades. Furthermore, students in the upper grades reported school counselors, college resource materials, campus visits, and college representatives as most helpful, whereas students in the lower grades felt that parents or guardians, relatives, or siblings were the most helpful sources of information. These findings are consistent with earlier studies in which parents or friends were rated as providing good or excellent support in decision-making situations regarding careers (Brodsky & Cooke, 2000). It is interesting that counselors, who are often overloaded with counseling duties, tend to work more closely with those in the upper grades regarding career and college information (Corwin et al., 2004). Consequently, students in the lower grades may make academic decisions based on the information received from other sources. This finding points to the need for a more comprehensive approach to providing career information to rural high school students. The fact that friends are important resources for students indicates the need for college and career information to be disseminated early and consistently to the entire student population. Additionally, students, teachers, and parents or guardians need to have access to updated printed resource materials, given that this source of information was also found to be helpful for students.

Regarding gender differences, female students were more likely than male students to report using various sources for information about their educational and occupational aspirations. The female students in this study reported school counselors and college resource materials to be more helpful than did male students. This finding is consistent with recent research on who sees school counselors for college information, in which it was found that 12th graders who contact the school counselor for information are more likely to be Black and female (Bryan et al., 2009). Furthermore, recent research suggests that female students currently explore a wider range of career opportunities, which makes school counselors' advice more helpful (Sharf, 2010). Male students who reported seeking information listed coaches as their top selection in receiving information; however, they were also more likely than female students to report that none of the sources on the survey were helpful. This result points to the need for school counselors to work with the coaching staff as a possible avenue to get necessary career and educational information to students.

Compared with White students, students of color were less likely to report going to the sources on the survey, with the exception of teachers, whom Black and Hispanic students were more likely to use than were White students. However, Hispanic students reported that they were less likely than White and Black students to seek out information from any source, and they believed that school counselors were the least helpful source for them. This result is consistent with studies that suggest that Hispanic students feel that their career goals may not be validated or valued by counselors, so they are less likely to use them for information (Vela-Gude et al., 2009). Black students reported using coaches, religious leaders, and college resource materials to find out information. Other studies of Blacks also demonstrate that an important strength of the Black community is the reliance on extended relationships that can include family, friends, community members, churches, and important religious leaders (Boyd-Franklin, 2003; Day-Vines, Patton, & Baytops, 2003).

Results also show that students in more rural areas and in schools of lower income were more likely to go to their teachers for information, which indicates the need for counselors to work with teachers. In rural schools, counselors may have limited involvement in career counseling because of the need to participate in other nonguidance activities (Trusty & Niles, 2003), or students may seek out teachers because of a lack of other resources (e.g., internships, job mentoring; Crockett et al., 2000). Overall, parents or guardians, school counselors, teachers, friends, and college resource materials were reported as being the most helpful sources of information.

Implications for School Counselors

On the basis of these findings, there are three important implications for school counselors providing career and educational information to students. First, although students reported that some sources were better than others, the results demonstrate that students do indeed use a variety of sources for career information. It is pertinent that the career information students receive is accurate because erroneous information can lead to unrealistic expectations that may cause students to select goals and take actions that can actually limit positive career outcomes (Lent, 2005). Furthermore, students need to have access to various forms of information. School counselors should have updated brochures, pamphlets, and other print media regarding various career and educational opportunities. Internet-ready computers should also be equipped with career exploration programs to help provide students with a more comprehensive knowledge of various occupations.

Second, the fact that students are going to school counselors, teachers, parents, peers, coaches, and religious leaders as sources of information over the course of their high school tenure points to the need for collaboration to exist among the teachers, families, and communities. Counselors need to work more closely with parents to provide accurate information regarding colleges and careers. Counselors can collaborate with parents to make sure that they have access to accurate and useful information to help them as they discuss their student's plans. Collaboration between parents and counselors has been identified as an important role in college advising and planning (Trusty & Niles, 2003), and good relationships need to exist between parents and school personnel because parents seem to be a major resource for information for rural high school students, especially as they begin their high school years. Those parents with low levels of educational attainment can also benefit the most from collaborating with school counselors and teachers or other school staff (Kim & Schneider, 2005).

Teachers were also used as a source for low-income students and students of color, which is consistent with the literature stating that teachers also serve as an alternative to school counselors for career information (Vela-Gude et al., 2009). Therefore, school counselors should work in tandem with teachers to ensure that they are giving accurate and helpful information to their students, particularly Black and Hispanic students and students in low-income and more rural schools. Counselors could include teachers when developing career and college guidance lessons for their students. Furthermore, counselors could capitalize on the knowledge teachers have of college and careers by having them speak to students about their personal experiences.

Given that students reported community members as being influential, especially Black students, collaboration also needs to occur within the community. School counselors are an ideal resource for community collaboration. Indeed, a recent study demonstrated that school counselors are more involved in community collaborations than in any other partnership activity (Griffin & Steen, 2010). Furthermore, collaborating with parents and using community resources have been shown to be effective in mitigating barriers to academic success in both male and female students of color (Bryan & Henry, 2008). Because community members may have access to students and their families that school staff may not have access to, school counselors need to be proactive in seeking out sources of support for Black students and collaborate with them to provide career information to the students. For example, career nights can be held in community churches or other community businesses and can be led by community members or other people of influence for Black students. Additionally, school counselors can collaborate with coaches of Black students. For example, school counselors can team with coaches to provide career information to their students during supervised study hall or team meetings before practices or during preseason. Coaches also have parent meetings to describe team goals, schedules, and rules, and this time can also be used to provide career information to students and parents.

Rural families often have deep roots in their community, are often tight knit, have a community spirit, and have social activities in which the entire community participates (Bauch, 2001). These things can serve as a foundation for building partnerships needed to help students as they prepare for life after high school. Partnerships can be developed to provide opportunities for students to participate in job shadowing activities and internship possibilities. Given that some students in this study used pastors, priests, or other religious leaders as sources of information, it may behoove counselors to use the church as a resource in the school. In rural communities, research has demonstrated that the local church was helpful in providing resources and volunteers in the school (Bauch, 2001).

Third, it is important for schools to provide Hispanic students with the information needed to prepare them for higher education (Vela-Gude et al., 2009) or occupational options. School counselors are in the position to provide Hispanic students with information needed to pursue higher education (Villalba, Akos, Keeter, & Ames, 2007). Thus, school counselors need to be more intentional about working with Hispanic students regarding their career aspirations. School counselors should begin to develop and have expectations for all students and take professional development workshops to learn how to best work with the Hispanic population.

Limitations and Future Directions

There are certain limitations of this study that need to be addressed. First, students were not asked to identify their educational or occupational aspirations after high school, so we cannot consider their aspirations as a mediating factor in the analyses. Future studies can explore the relationship between their educational and occupational expectations and having goals that are in line with their career expectations. Second, we did not ascertain why students believed that some sources were more helpful than others. Future research can explore this avenue to help pinpoint what students find helpful and the role school counselors can play to best help students get the information they need to make the best decisions about their educational and career aspirations. It would also be important to focus future studies on certain populations, such as Hispanic and Black students, because these groups indicated they either did not use sources or did not find sources helpful. Also, these student populations are the ones that may need more support in helping inform their career and educational aspirations. Knowing where students go to for information, what sources they perceive to be most helpful, and why can be the starting point in developing career-related interventions that can meet the needs of all students (Gibbons et al., 2006).

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Educational Master Plan

Information Submission Form

1) Title: Interagency Initiatives: Education, Climate Science, And Nanotech All Grow

2) Author: Susan R. Morrissey Cheryl Hogue Britt Erickson

3) Source: Chemical & Engineering News (FEBRUARY 28, 2011 VOLUME 89, NUMBER 9)

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- [ ] Society
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- [ ] Other: ____________

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Interagency Initiatives: Education, Climate Science, And Nanotech All Grow

Susan R. Morrissey
Cheryl Hogue
Britt Erickson

Following through on his State of the Union challenge to prepare 100,000 STEM teachers over the next decade, the President requests $100 million for programs at the Department of Education and NSF. This includes $80 million to expand STEM teacher preparation models in the Education Department's Teacher & Leader Pathways program. At NSF, $20 million would go to the Teacher Learning for the Future program, which studies teacher preparation.

The 2012 budget request also provides $90 million to create an Advanced Research Projects Agency-Education at the Education Department. The mission of ARPA-Ed is to drive transformative improvement in education technology by stimulating the development and deployment of new tools and technology to improve student learning.

Meanwhile, President Obama wants to pump up federal research on climate change. The multiagency U.S. Global Change Research Program (USGCRP) would get $2.6 billion in 2012, up 20.4% from 2010's level of $2.2 billion. The White House Office of Science & Technology Policy (OSTP), which oversees this program, did not supply estimates for 2011 funding.

One notable funding increase proposed for the global change program is at the Department of Energy. Its portion of this program would get a 31.0% boost to $224 million in 2012. The funding would support DOE development of a prototype to directly measure greenhouse gas emissions.

Nanotechnology research would also benefit in 2012 under the President's proposed budget. The National Nanotechnology Initiative (NNI), which coordinates nanotech R&D among 25 federal agencies, would receive $2.1 billion, an increase of 10.4% compared with 2010. Values for 2011 were not reported.

Agencies that participate in NNI plan to invest in three key areas: nanoelectronics, sustainable manufacturing, and solar energy collection and conversion. They would also continue to focus on responsible development, including assessing the potential environmental, health, and safety risks of nanotechnology.—SRM, CH, BEE

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Educational Master Plan

Information Submission Form

1) Title: Uncensored

2) Author: Orchowski, Margaret (Peggy Sands)

3) Source: The Hispanic Outlook in Higher Education Article date: November 1, 2010

4) Taxonomy Area:

- ☐ Society
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5) Relevance: Transfer

6) Page / Section: __________

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Magazine

UNCENSORED

Article from: **The Hispanic Outlook in Higher Education** Article date: **November 1, 2010** Author: **Orchowski, Margaret (Peggy Sands)**

TRANSFERRING IS GOOD FOR STUDENT, COUNTRY - Because of the rising costs of a university education and the (consequent) rising student dropout rates, a new degree pathway is becoming more acceptable. Increasingly, a student (Any student! You! Your child, even!) may start at a community college and then transfer to a public four-year university. The University of California-San Diego (UCSD) had a record number, 38 percent, of transfers among their new students this year - 2,943 out of 7,000. Public universities in Virginia and Maryland accepted an unprecedented 34 percent more transfer students this year. The main reason is financial. But the gain is often greater diversity for the university and a "new" student who is more mature, experienced and motivated. One medical student at UCSD told The San Diego Union-Tribune "the stigma that you go to a community college because you weren't smart enough to get into a university" is being replaced by reality. "I'm planning on going to medical school so I'll already be $150,000 in debt for that; I don't want to add to that the first two years debt." Watch for the trend to grow!

TALK ABOUT DROPOUTS - LOOK AT INTERNET CLASSES! - Here's the mantra: "We work online; we shop ordine; let's learn online!" Educational technology consultants (like J. Edgar Garr) love to write about "Johnny" who is bored, bored, bored by his textbook but loves to read his class assignments online, devour interesting tidbits that are linked, compose his report online and attach images and quotes he's researched on the Web (OK, so he plagiarizes, but never mind) and send it on to his teacher, who might even suggest corrections that the now supposedly highly motivated Johnny might even do - and all by high-speed (lord forbid it should not be high-speed!) Internet access! Of course, some experts admit that there will need to be a new type of thinking to truly take advantage of this approach. And some teachers who have embraced the idea of teaching students personally, unseen, while still in their pajamas (does anyone wear those anymore?) are finding that most of their time is spent telling a student which button to push on the new technology (yes, even the young ones!). What analysts need to start looking at, however, are the online course completion rates. At one community college last year (name, class, teacher - available on a need-to-know basis only), the new online class started with 35 students, and the excited teacher got full pay for not having to appear in a classroom. The completion rate 10 weeks later: zero!

B.A. DEGREE IN THREE YEARS? FEW HAVE THE TIME - It may sound counterintuitive, but an idea that has been pushed by two George Washington University (GWU) professors for a bachelor's degree in three full years would be impossible for most students because they don't have the time - not even for studying. A recent AEI (American Enterprise Institute) report found that full-time students at four-year colleges spend only 14 hours a week studying on average (versus 24 hours in 1971). Is because of having to work? In 2009, 79-3 percent of part-time college students worked, and 39 percent of ftill-time students, according to the Labor Department. "Working is an obstacle for a degree in three," admitted the GWU profs, and AEI found that working students spent even less time studying than nonworking ones. But that wasn't the main reason for the general reduction in studying time. "Students at evei level appear to be studying less in order to have more leisure time," the AEI report concludes.

CONGRESSIONAL GAMES WIN COMPETES ACT - Congressman Bart Gordon of Tennessee, chairman of the Science and Technology Committee, probably hastened his desire to retire after his long battle in the House to pass the COMPETES Reauthorization Act extending STEM training and research programs. The exhausting congressional procedural games Gordon played would make an interesting political science class project. Look up: "structural rules," "special rules," "motion to recommit the bill with instructions," "motion to instruct with immediate report back" and "with amendments forthwith," "suspension of the rules," and (a highly unusual) "demand for a division of the question." Whew! Now the bill faces the hardest obstacle of all: the U.S. Senate.

DIVERSITY IS FEVE - BUT IN ALL CAMPUS CLUBS? - Everyone in higher education of course supports diversity. So the recent 5-4 riding of the Supreme Court that all student organizations must accept any student who wants to join should be welcomed. "The theories of sabotage have no basis in fact in the history of American education," the University of California Hastings Law College lawyer said, adding, "The ruling does not unfairly target faith groups." But it's going to be tricky. Republicans hi a Democratic club? Might mean fewer "official" campus clubs.

[Author Affiliation]

Margaret (Peggy Sands) Orchowski was a reporter for AP South America and for the

United Nations in Geneva, Switzerland. She earned a doctorate in international educational administration from the University of California-Santa Barbara. She lives in Washington, D.C., where she was an editor at Congressional Quarterly and now is a freelance journalist and columnist covering Congress and higher education.

Educational Master Plan

Information Submission Form

1) Title: An Education for All Seasons of LIfe

2) Author: Reese, S.

3) Source: Techniques: Connecting Education & Careers (Feb. 1, 2011)

4) Taxonomy Area:

- ☐ Society
- ☐ Technology
- ☐ Economy
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An Education for All Seasons of Life

BY SUSAN REESE

"Learning is what most adults will do for a living in the 21st century," author and humorist S.J. Perelman says with what is probably a good deal of accuracy. With rapid-fire changes in technology and innovative new ideas emerging constantly, achieving success in today's global workplace means making a commitment to the philosophy of lifelong learning. Career and technical education (CTE) programs that provide 21st century skills may begin in secondary education, but they are not educating just high school students. Many adults are benefiting from these programs, often at one of our nation's community colleges. According to the American Association of Community Colleges (AACC), in the fall of 2007, 11.8 million students were enrolled at 1,173 community colleges in the United States. That includes both full-time and part-time, and credit and non-credit students.

Among those who have recognized the significant contribution community colleges have made to expand educational opportunities is Federal Reserve Chairman Ben Bernanke. According to Bernanke, "Attendance at one of these institutions is associated with higher wages, even if a degree isn't completed. Evidence suggests that each year of credit at a community college is worth almost as much, in terms of increased earning potential, as a year at a four-year college."

In the November 2009 issue of *Governing* magazine, an article by Ventura, California, Mayor William Fulton is titled, "Community Colleges: Today's Best Source for Job Training?" His answer to that question includes this: "The path to economic security, especially for the working class and children of immigrants, leads to a community college, where you can get a combination of academic education and technical training—life skills and job skills." Fulton doesn't see that path as just for the working class and immigrant families, however. "Academic learning still matters, but it's not enough," he notes. "To get a good job, a lot of people need a good technical education as well. They need to have practical, problem-solving knowledge that they can put to use in the real world."

The reality is that CTE programs at today's community colleges are training not only economically disadvantaged young people, but working professionals as well.

Access for All

The Association for Career and Technical Education (ACTE) has recognized the Community College of Denver (CCD) as a best practice example in adult education, citing its success in narrowing a serious attainment gap. CCD is Colorado's most ethnically and racially diverse higher education institution, with 46 percent minority enrollment (minority data reported from Student Union Record Data System enrollment file, Fall 2009 End of Term), primarily Hispanic and African-American.

CCD is dedicated to expanding access in particular for underserved, first-generation and minority students. In 1990, it set out to eliminate gaps in outcomes between students of color and their white peers. It improved recruitment and outreach, developmental education, advising and student support systems targeted to first-generation college-goers and students who arrive underprepared to succeed in college.

In 2004, CCD received the MetLife and Jobs for the Future Community College Excellence award. In its December 2009 report, "Strong Students, Strong Workers: Models for Student Success through Workforce Development and Community College Partnerships," the Center for American Progress cited CCD because of several accelerated programs the school offers, among them Fast Start, a program for students whose skills and test scores are not strong enough for college-level coursework.

CCD describes Fast Start as "a holistic approach to developmental education." It is designed to accelerate students through multiple semesters of developmental coursework enabling them to take two courses in the time usually allowed for one, while still receiving two grades. Students also have the opportunity to participate concurrently in short-term career exploration in their area of interest through the career planning student experience component. The program has a learning community approach with an hour study group per week with peers, as well as staff and instructor support to help the students complete the program successfully and possibly go on to another level of education.

The report also discusses the CCD Essential Skills Program, which began as a welfare-to-work program and includes basic adult education, English as a Second Language (ESL) and GED instruction. These skills are taught in the context of Career Clusters that include business, early childhood education, and information technology.

Innovations geared toward student success have continued. In July 2010, CCD purchased the first Virtual Environment Radiation Therapy Training (VERT) machine to be sold in the United States. This virtual environment allows students to do their learning in a simulated hospital radiotherapy treatment room prior to being in a clinical setting with real patients. The system went live in August 2010, and has positioned CCD students to be almost a month ahead in their learning compared to students without this technological advantage.

CCD President Karen Bleeker states in her welcome message on the school's Web site that, "We are proud to offer a college experience that is affordable and accessible—one that celebrates learning, diversity, friendship and cooperation," and she concludes, "At Community College of Denver, opportunity is everything."

CTE for Career Advancement

Community colleges are often the gateway to postsecondary education and training for young adults, but the benefits offered by community colleges are not limited to individuals who are just entering the workplace. Working professionals are also finding these schools to be great resources for the training necessary to remain current in their industry, and even for acquiring the skills and certifications to move into managerial positions.

Portland Community College (PCC), which is the largest institution of higher learning in Oregon, serves more than 1 million college-age residents in a five-county area of the state. As PCC District President Preston Pulliams notes, "Wherever you're coming from and wherever you're going in life, PCC probably has the classes and the programs to get you there." That seems to be an accurate description, since PCC's programs range from adult basic skills and pre-college programs to help students complete their GEDs, improve their English skills or prepare for college, to university transfer programs and continuing education designed to help adults advance their careers with additional professional training.

PCC's Management and Supervisory Development Department offers a program designed to help individuals who want to advance within their organizations, make themselves more marketable, prepare for a career change, or enhance their professional skills. The adults enrolled in this training may earn an Employment Skills Training Certificate, or even an Associate of Applied Science Degree in Management and Supervisory Development.

The Employment Skills Training Certificate is a state-approved program with 18-credit-hour certificates available in human resource management, leadership, customer service, management and supervisory development, project management, conflict management, and change/innovation management. The associate degree program requires a minimum of 90 credit hours, with 45 of those hours being management/supervisory development courses.

Roane State Community College, which has nine locations across East Tennessee, offers a Contemporary Manage-

PHOTO COURTESY OF THE COMMUNITY COLLEGE OF DENVER

The Community College of Denver was recognized by ACTE for its best practices in adult education.

PHOTO COURTESY OF ROANE STATE COMMUNITY COLLEGE

The Contemporary Management Program at Roane State Community College is designed for working adults.

Business administration is part of the Roane State Community College program.

ment Program with reduced in-class time designed specifically for full-time working adults to earn an Associate of Applied Science degree. Classes meet one night a week for five weeks, and there is an additional eight-hour summary session. The program offers different formats that students may choose to complete their management classes, including traditional, video conferencing and hybrid. In the traditional format, classes meet face-to-face one night a week for five weeks, and there is an additional eight-hour summary session. The video classes also meet one night a week for five weeks, but via video conferencing. In the hybrid format, classes meet twice face-to-face while completing most of the work via the Internet.

The program includes 24 credit hours of management courses, 21 credit hours of general education courses, and 15 credit hours of electives. It is also possible, through a portfolio process, for students to earn credit toward a degree for prior college-level learning, through cooperative work experience or for their previous work experience.

For working students in East Tennessee, the Roane State Contemporary Management Program offers the education and credentials to help them advance their careers, move into a management position, or even start their own businesses.

Education for All Ages

Another school recognized by ACTE for best practices in adult education is Indian River State College (IRSC) in Ft. Pierce, Florida, which was until recently known as Indian River Community College. A recipient of the 2006 Community College Excellence Award presented by Jobs for the Future and MetLife, and the 2008 Florida Chancellor's Award for Workforce Development for Adult Education/Career Pathways, IRSC offers more than 150 programs leading to bachelor's degrees, associate degrees, applied technology diplomas and technical certificates at its five campuses. The college is the region's state-designated career and technical center. Its mission statement emphasizes a 50-year commitment to "advancing the educational, cultural, career training, workforce and economic development of its surrounding area."

When ACTE acknowledged IRSC with best practice recognition, among the accomplishments cited were the college's track record as one of the top high school diploma-granting institutions on Florida's Research Coast, and one of the state's largest providers of adult education due in part to its investment in adult education for the growing minority and immigrant population. The free adult education classes include GED review and adult high school classes, vocational classes, civics and citizenship, and English language learning.

IRSC adult education is focused on helping students successfully continue their education beyond high school. Each year, more than 1,000 students begin postsecondary classes while still enrolled in adult education. In fact, about 25 percent of the college's associate degree graduates began as IRSC adult education students. The college's Adult Education Career Pathways program offers seven

Y OF ROANE STATE COMMUNITY COLLEGE

PHOTO COURTESY OF INDIAN RIVER STATE COLLEGE

PHOTO COURTESY OF ROANE STATE COMMUNITY COLLEGE

Michael Harding earned his GED and completed the Law Enforcement Academy at Indian River State College (IRSC), and now works for the Ft. Pierce, Florida, Police Department.

Rosie Santos Kolp, who completed the IRSC Certified Nursing Assistant program while enrolled in ESL and GED, is now pursuing her LPN credential.

tracks: business, advanced technology, health science, public safety, education, industrial education, and STEM. Because of the program's success, IRSC is working directly with the Florida Department of Education, leading a statewide team to develop a career pathways adult education system for the state.

"The future of Florida's adult education lies in helping students enter postsecondary programs that develop technical skills for skilled jobs," says IRSC Dean of Developmental Education Anthony Iacono. Following the same philosophy, IRSC is working actively with the U.S. Department of Education to develop career pathways for adult education across the nation.

IRSC's name change reflects the transition to offering bachelor's degree programs, and last month, the school launched three new ones—in biology, digital media and human services. They were selected based on a needs assessment of student interest, employer demand for graduates, economic development trends, projected job growth, and an in-depth analysis of the college's resources.

Adult education is an important aspect of state and local economic development because it helps prepare a skilled workforce to attract and retain businesses and industries that support the local economy. However, it must also be responsive to changing needs, and that's what schools such as IRSC are doing by adding programs that meet critical workforce needs. IRSC President Edwin R. Massey notes, "As our region continues to evolve into the Research Coast, these new bachelor's degree programs will create a pipeline of highly skilled employees for the new types of knowledge-based jobs that are being attracted to our area. With our state economy beginning to strengthen and diversify, it is very important that residents of our region have access to higher education which will prepare them for 21st century careers."

Adult education is too often thought of as just remedial education, and it does play an important role in providing young adults with the necessary life and career skills they need, but it is so much more—especially when CTE is included. All across the country—and at community colleges in particular—CTE is addressing the needs of adult students of all ages. It truly is an education for all seasons. T

Explore More

For more information about the schools featured in this article, visit these Web sites.

Community College of Denver
www.ccd.edu

Indian River State College
www.irsc.edu

Portland Community College
www.pcc.edu

Roane State Community College
www.roanestate.edu

Susan Reese

is a *Techniques* contributing writer. She can be contacted at susan@printmanagementinc.com.

ACTE Interested in exploring this topic further? Discuss it with your colleagues on the ACTE forums at **www.acteonline.org/forum.aspx**.

Educational Master Plan

Information Submission Form

1) Title: Success Rates for Students Taking Compressed & regular Length Developmental Courses in the CC

2) Author: Sheldon, C & Durdella, N.R

3) Source: Community College Journal of Research & Practice

4) Taxonomy Area:

- [ ] Society
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SUCCESS RATES FOR STUDENTS TAKING COMPRESSED AND REGULAR LENGTH DEVELOPMENTAL COURSES IN THE COMMUNITY COLLEGE

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In recent years, developmental education in the community colleges has received much attention. However, there has been little research examining the relationship between course length and course success in developmental education. Using historical enrollment data from a large, suburban community college in southern California, this study examines the relationship between course length and course success in developmental education when social and academic background characteristics are controlled. The study hypothesized that there would be no significant or practical difference in success rates for students taking compressed (i.e., courses less than eight weeks in length) or regular length developmental English, reading, or math courses when social or academic characteristics are controlled. Results demonstrate that developmental course length was associated with statistically and practically significant differences in course success observed across all categories of age, gender, and ethnicity. Students enrolled in compressed-format courses were more likely to succeed than students enrolled in regular-length courses. Higher successful course completion rates for compressed courses were observed across all departments, with the highest successful course completion

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rates in the eight-week format in English. Further, students—irrespective of age, race, or gender—were more likely to successfully complete compressed-format courses than their counterparts in regular-length courses. Findings point to an educational benefit for students who enroll in compressed courses. Future research in this area includes an examination of students' progress through a sequence of developmental education courses and a look into the effect of college experience and environment factors related to success in compressed courses.

In recent years, developmental education in the community colleges has received much attention. Previous scholarship has focused on several themes related to student success in developmental education including the following: organizational and administrative practices, program components, staff or professional development, support services and counseling, and instructional practices (Center for Student Success, 2007). Within the instructional practices literature, scholarship has focused on learning theory, holistic development of developmental learners, culturally responsive instruction, and faculty cohort models (Center for Student Success, 2007). Further, research in this area has examined the effects of course sequencing, and clustering courses, including the articulation of entry and exit skills among all courses within a sequence, alignment of comprehensive academic support mechanisms, and development of innovative learning communities (Center for Student Success, 2007).

To be sure, the prevalence of developmental education in the community colleges, the long-standing identity of community colleges as gateways to opportunity and baccalaureate attainment for students who have been historically excluded from higher education, and recently adopted accountability initiatives, such as those in the California Community Colleges, related to developmental education outcomes, makes student success and achievement in community college developmental education a high stakes issue. In California, only 51.3% of students succeed in basic skills courses (California Community College Chancellor's Office [CCCCO], 2009), and 51.2% of developmental students advance to the next course level (CCCCO, 2009). Nationally, the average number of community college developmental math courses offered was 3.6 (Lewis & Farris, 1996). And yet, in spite of scholarship that demonstrates a negative relationship between the length of time required for remediation and successful completion of a remediation program or course of study (Boylan & Bliss, 1997; Kangas & Ma, 1992a,b,c), there has been relatively little research about the relationship between the length of developmental education courses at community colleges and student success.

This study explored the relationship between course length and course success in community college developmental education courses. In so doing, the study elaborates our understanding of curriculum delivery strategies and their relationship to student success in developmental education courses. Specifically, this study explores the success rates and characteristics of community college students who succeed in developmental education courses of varying lengths.

FACULTY AND STUDENT PERCEPTIONS OF THE COMPRESSED COURSE APPROACH

Compressed courses (i.e., courses offered for the same number of units in less-than-full-term instruction) appear to benefit both faculty and students (Daniel, 2000). With respect to student and faculty perceptions of their experiences in compressed courses, Daniel reported that students in an intensive English program indicated a higher level of motivation in compressed courses when compared to their counterparts in traditional-term courses. Further, Daniel reported that students believed that compressed courses allowed for more time for student-faculty interaction but less time to complete assignments. Carley (2002) concluded that the majority of students in his single institution study preferred meeting two days per week for fewer weeks.

While students who enrolled in compressed courses generally perceived a positive experienced, Daniel (2000) reported that faculty felt that compressed courses allowed for more in-depth discussions and experiential activities. Rosen, Howell, and Johnson (1982) found that instructors of compressed courses in accounting perceived greater effectiveness under the conditions. Beachler (2003) also found that over a third of faculty surveyed in a single institution study reported that students were more successful and less likely to withdraw from classes in compressed versus regular-length courses. By contrast, Beachler reported that 40% of faculty in her study reported that the compressed-course format adversely affects students' levels of anxiety and stress. Rosen et al. (1982) confirm this finding in their evaluation of compressed formats in accounting courses. They found that students in compressed courses perceived stress under the conditions. Still, faculty who teach in compressed courses in the summer generally felt that they were able to establish rapport with students more quickly (Kretovics, Crowe, & Hyun, 2005). With respect to student performance in compressed courses offered in the summer, Kretovics et. al. found that faculty whom they surveyed reported that students are more focused on learning outcomes, participate more in class discussions, and attend class more regularly.

STUDENT PERFORMANCE IN COMPRESSED COURSES

While studies demonstrate that both faculty and students perceive aspects of compressed course formats positively, research demonstrates that course length affects student performance (Geltner & Logan, 2001; van Scyoc & Gleason, 1993). In fact, van Scyoc and Gleason observed that students enrolled in compressed courses scored better on tests than students enrolled in traditional semester-length courses, with one notable exception. Van Scyoc and Gleason noted that the effect of course length seemed to disappear when knowledge retention was measured. These findings appear to support research that has observed that students who enroll in short-term, time-intensive courses perform on par with or better than students enrolled in semester-length courses.

While the notion of offering accelerated or compressed courses to developmental education students may seem counterintuitive, there is evidence indicating the viability of the concept. The study most relevant to the discussion of student success in compressed-format courses at community colleges was conducted at Santa Monica Community College (Geltner & Logan, 2001). The authors examined successful course completion, or the percentage of students passing courses with a grade of C or better and withdrawal rates for native students enrolled in compressed format courses and compared them with the success and withdrawal rates of native students enrolled in regular length classes. Native students were identified as continuing students not transferred to the college from another institution. University students enrolled in one summer school course at the college were excluded from the analysis. Grades received were aggregated across variables based upon the length of the course. Assuming that instructors with higher than average grade distributions were not over represented in the compressed scheduling format, the effect of grading variation by instructor should have been removed as a factor influencing success rates.

In Geltner and Logan's study, analyses of success rates by department revealed that with the exception of two subject areas, successful course completion rates were higher for courses offered in compressed formats than in traditional semester-length courses. In general, shorter course length corresponded to higher successful course completion rates. For example, in math, those courses offered in the 6-week compressed format had successful course completion rates of 67% compared to 61% for courses compressed in an 8-week time period and 52% for the regular length 16-week course. Withdrawal rates were 17% for the 6-week course, 21% for the 8-week course, and 26% for the 16-week course.

The authors also observed the same relationship between course length and success rates when controlling for demographic characteristics such as age and ethnicity and for student performance characteristics such as cumulative grade point average and student probationary status. While the authors note that better students tended to enroll in the compressed courses, even those students with lower cumulative grade point average or probationary status achieved higher success rates in aggregate than their counterparts enrolled in traditional-length courses. Forty percent of probationary students enrolled in 6-week courses successfully completed them compared to 33% of those enrolled in 8-week courses, and only 23% of probationary students enrolled in 16-week classes. The same general pattern of higher success rates for compressed courses was observed for all ethnic and age groups.

REMEDIATION, STUDENT ACHIEVEMENT, AND COMPRESSED COURSES

As primary providers of developmental education, community colleges have accommodated increased demand for developmental education services by extending their curriculum to serve a greater variety of student preparedness levels. The most recent study on the subject from the National Center for Education Statistics (Lewis & Farris, 1996), documents that community colleges, on average, offer a greater number of developmental courses than other higher education institutions, a trend particularly apparent in math (Lewis & Farris, 1996). In fall 1995, the average number of developmental mathematics courses offered in the community colleges was 3.6 compared to 2.0 for public four-year universities (Lewis & Farris, 1996).

Extension of the developmental math curriculum in the community colleges, although appropriate in terms of accommodating disparate levels of preparation, may exacerbate the problem associated with the length of time required for successful remediation and the achievement of college level skills.

Even though a negative relationship between the length of time for remediation, student persistence, and college success is well documented (Boylan & Bliss, 1997; Kangas & Ma, 1992a,b,c), current scheduling practices and curriculum structures within community colleges often demand that seriously deficient students who desire to transfer successfully complete three to four developmental courses in each subject area, often over a period of two or more years, before even attempting transferable courses in English and mathematics. In their efforts to accommodate various levels of preparation by extending the developmental curriculum, community colleges may have unintentionally imposed an institutional barrier to transfer.

Although Geltner and Logan's study addresses the overall success rates of community college students enrolled in compressed courses, it does not specifically address the performance of students enrolled in developmental classes offered in the compressed format. It is also unclear whether the compressed math and English courses in the Santa Monica study contain an overrepresentation of transfer-level courses. Because of the limitations of the Santa Monica study and the lack of published research in the area of developmental courses offered in a compressed format, this study of community college students enrolled in compressed developmental math, English, and reading courses was conducted in order to assess whether a relationship between course length and course success exists.

RESEARCH QUESTIONS AND HYPOTHESES

This study addressed two fundamental questions: Is there an educational benefit to community college students when developmental courses are offered in a compressed format? And, if so, what is the nature of the benefit? That is to say, are there any observable differences in benefits based upon a student's age, gender, or ethnicity? If there is no relationship between developmental course length and success in developmental courses, we would expect the following hypotheses to hold true:

- H1: **There is no statistical or practical difference in success rates for students taking compressed or regular length developmental English, reading, or math courses.**
- H2: **There is no statistical or practical difference in success rates for students taking compressed or regular-length developmental English, reading or math courses when social or academic characteristics such as ethnicity, gender, age, or cumulative grade point average are controlled.**

METHOD

Data Source and Analytic Approach

The data for this study are drawn from historical enrollment records of a large, suburban community college with a large percentage of historically underrepresented students. The population of interest for this study was native or continuing community college students who enrolled in at least one developmental English, reading, or math course offered in either a compressed or regular-length format. To identify the population of interest, student enrollment records for spring 1998 through fall 2001 were extracted from the college's database, compiled, and aggregated by type of course. Courses in the database are identified as basic skills, vocational, or transfer. Courses categorized as basic skills represent developmental education courses.

In an attempt to control for variation in success rates that might be attributed to university students enrolling in developmental education courses at the local community college, students categorized as new to college or transfers from other colleges were excluded from the analysis. Only those records for students enrolled in courses designated as developmental were included in the study, and only those students identified as native or continuing students were included in the study. Additionally, an attempt was made to control for variation in success rates that might be attributable to high school concurrent enrollees. As a result, students below the age of 17 were also excluded from the analysis.

A total of 21,165 enrollment records were examined. Of those included in the study, 3,360 enrollment records were for students enrolled in compressed developmental courses and 17,805 were for students enrolled in regular length courses. For the purpose of this study, compressed courses are defined as those courses offered for the same amount of units in less than 15 weeks; regular length courses are defined as those courses offered in the standard 15-to-18 week format. During the period under study, these compressed courses were offered in six and eight week formats. Table 1 presents the distribution of enrollment records by course type and length.

Table 1. Percent distribution of students in developmental education courses, spring 1998 to fall 2001

Course	5–6 week course	8–9 week course	15–18 week course
English 20	28.67	32.39	20.38
Math 20	35.43	6.58	25.64
Math 40	0.00	60.70	29.60
Reading 42	5.90	0.00	4.48
Reading 43	19.82	0.25	13.91
Reading 54	10.10	0.08	6.04

Note. The total number of students is 21,165 for all classes and 4,636 for English 20; 5,410 for Math 20; 6,000 for Math 40; 926 for Reading 42; 2,907 for Reading 43; and 1,286 in Reading 54.

In this investigation, the goal was to explore the nature of the relationship between success in developmental courses and course length. Due to the exploratory nature of the study and the structure and availability of the data contained in the database, the analytic approach to the data was largely descriptive and employed the following analytic techniques: contingency tables, chi-square analysis, and percent difference. (Percent difference was selected as the means of assessing the potential strength of association between the variables because of the limitations associated with using Cramer's *V* when large sample sizes are present. As well, Lambda was also deemed inappropriate due to percent differences larger than 5% and consistency in the mode for the dependent and independent variables.) The data were first examined to assess whether any significant differences based on academic and social characteristics were present for compressed versus regular-length course enrollees. Next, the data were analyzed to determine whether evidence of a relationship between course length and course success was present. Finally, the data were examined to assess the relationship between course length and course success when social and academic characteristics were controlled.

Variables and Their Indicators

The data source provides a number of institutional and student-level variables previously demonstrated to be related to student success in courses. For the purpose of this study, course success in developmental education courses is theorized to be related to course length even when type of course and academic and social background characteristics are controlled.

Dependent Variable

The dependent variable for this study is the success rate of students enrolled in developmental courses. It is constructed as the percentage of students who received a grade of A, B, C, or CR divided by the total number of students attempting the course and receiving a final grade disposition in the course, inclusive of course withdrawals.

Independent Variables

Independent variables include type of course and several academic and social background characteristics such as age, gender, ethnicity, and cumulative grade point average. Type of course includes the three areas of offerings for developmental education at the community college where the study was conducted—English, mathematics, and reading. For English, only one course, English 20, Basic Writing, was examined because it was the only developmental English course offered in both a compressed and regular length-format. English 20 is considered to reflect students with English skills two levels below college level. In math, Math 20, Basic Mathematics, and Math 40, Survey of Mathematics, were examined. These courses are designed for students three and two levels below college level math skills, respectively. In reading, three courses were examined: Reading 42, Reading Access for College Students; Reading 43, Basic Reading Skills; and Reading 54, Developmental Reading. These courses are for students with skill levels, respectively, three levels, two levels, and one level below college level.

Age is reflective of the student's age at the time of taking the developmental course. It is constructed dichotomously as traditional versus nontraditional age students. Traditional age students are defined as those below the age of 25, while nontraditional are defined as those 25 years of age and above. Ethnicities are categorized as follows: Asian and Pacific Islanders (including students identifying as Filipino), African American, Latino, White, and Other (including Native American, and students who did not indicate their ethnicity). Cumulative grade point average is also constructed dichotomously; categories include students with cumulative grade point averages below 2.0 and those with grade point averages at or above 2.0.

RESULTS

Students Enrolling in Compressed and Regular-Length Courses

Table 2 presents the distribution of enrollment records by social and academic background characteristics. As is illustrated in Table 2, Asian and Pacific Islander students are slightly overrepresented in compressed courses compared to their overall representation in the study while Latino students are slightly underrepresented. These differences were statistically and practically significant ($X^2 = 456.652$, $\alpha = .000$, $df = 5$). Students aged 25 and older were also slightly over-represented ($X^2 = 24.888$, $\alpha = .000$, $df = 1$) as were students with cumulative grade point averages 2.0 and above ($X^2 = 29.606$, $\alpha = .000$, $df = 1$).

Success Rates in Compressed Versus Regular Length Courses

When an analysis of success rates in compressed and regular-length developmental courses was performed, a pattern of higher successful

Table 2. Percent distribution of enrollment by course length and background characteristics

Characteristic	Compressed course	Regular length course
Gender	$x^2 = 2.232^*$	
Male	33.10	34.43
Female	66.90	65.57
Ethnicity	$x^2 = 456.652^{**}$	
Asian/Pacific Islander	14.11	7.46
African American	10.54	8.82
Latino	50.83	57.12
White	4.20	7.09
Other	20.33	19.50
Age	$x^2 = 24.888^{**}$	
Below 25	68.87	73.06
25 and older	31.13	26.94
GPA	$x^2 = 29.606^{**}$	
Below 2.0	26.28	30.98
2.0 and above	73.72	69.02

Note. The total number of students is 21,165 for gender, ethnicity, age, and GPA.
$^*\alpha = .328$.
$^{**}\alpha \leq .000$.

course completion rates for compressed developmental courses was observed across each of the departments under study. Table 3 presents the results of success rates by department. Of the three departments studied, the highest successful course completion rates occurred in courses offered in the eight-week format. (Only four students took a reading course offered in the eight-week format; success rates for reading are for six-week format classes.) Among eight-week format courses, English had the highest successful completion rate

Table 3. Success rates by department and course length

Department and success	5–6 week course	8–9 week course	15–18 week course
English	$x^2 = 195.175^*$		
Percent successful	75.80	86.90	56.70
Math	$x^2 = 69.553^*$		
Percent successful	57.91	65.35	51.15
Reading	$x^2 = 52.9591I^*$		
Percent successful	77.68		66.30

Note. The total number of students in English is 4,636; in math 11,410; and in reading 5,115.
$^*\alpha = .000$.

at approximately 87%. In examining success rates for courses offered in the six-week format, reading had the highest success rate. Nearly 77% of students attempting a compressed reading course successfully completed that course compared to approximately 76% for English and 58% for math. As is indicated in Table 3, these differences were both statistically and practically significant.

An examination of success rates by course for English, reading, and math reveals that students enrolling in compressed-format courses were more likely to succeed. Indeed, a clear pattern of students who were more likely to successfully complete compressed-course formats than students enrolled in regular-length courses was observed. Table 4 presents the success rates by course of students enrolled in compressed-format courses compared to those enrolled in regular-length courses. Among compressed math courses, Math 40, Survey of Mathematics, had a higher successful course completion rate than Math 20, Basic Math. The success rate for Math 40 in the eight-week compressed format was 67% compared to 49% for Math 20 offered in the eight-week format. Reading 54, Developmental Reading, and Reading 42, had the highest successful course completion rates among the three developmental reading courses offered in compressed form. The successful course completion rates

Table 4. Success rates by course and course length

Course and success	5–6 week course	8–9 week course	15–18 week course
English			
English 20	$x^2 = 195.175^*$		
Percent successful	75.80	86.90	56.70
Math			
Math 20	$x^2 = 23.804^*$		
Percent successful	57.91	49.37	48.38
Math 40	$x^2 = 47.344^*$		
Percent successful		67.08	53.56
Reading			
Reading 42	$x^2 = 15.072^{**}$		
Percent successful	80.62		63.11
Reading 43	$x^2 = 21.165^*$		
Percent successful	75.00		63.53
Reading 54	$x^2 = 17.557^*$		
Percent successful	81.19		66.82

Note. The total number of students in English 20 is 4,636; in Math 20; 5,410; in Math 40; 6,000; in Reading 42; 926; in Reading 43; 2,904; and in Reading 54; 1,285.

$^*\alpha \leq .000$.

$^{**}\alpha \leq .001$.

for compressed reading courses offered in the six-week format were approximately 81% for Reading 54 and Reading 42 compared to 75% for Reading 43, Basic Reading Skills.

When controlling for social and academic background characteristics, success rates by course length were examined. Table 5 presents the distribution of success rates by selected social and academic background characteristics for students enrolled in developmental courses. With the exception of gender, a statistically and practically significant pattern of higher success rates in compressed-format courses was observed across all social and academic background characteristics. Students, irrespective of age, gender, and ethnicity, were more likely to successfully complete developmental courses offered in a compressed format than their counterparts enrolled in regular-length developmental education courses. This pattern was observed for students of all ethnic backgrounds, categories of age, as well as for students with cumulative grade point averages above and below 2.0. With respect to gender, a similar pattern was observed without statistical but with practical significance. That is, women experienced higher course success rates when both 6- and 8-week compressed classes were compared to their counterparts in 15-week classes.

Table 5. Success rates by course length and a set of social and academic background characteristics

Characteristic and success	5–6 week course	8–9 week course	15–18 week course
Gender	$x^2 = 1.348^{*}$		
Male	69.13	69.19	51.92
Female	71.98	74.12	57.34
Ethnicity	$x^2 = 214.667^{**}$		
Asian/Pacific Islander	77.78	87.75	62.20
African American	53.78	58.91	42.78
Latino	71.28	70.52	55.79
White	62.79	78.18	61.12
Other	72.22	69.96	55.70
Age	$x^2 = 10.785^{***}$		
Below 25	66.29	71.57	52.78
25 and Over	78.82	74.29	62.80
GPA	$x^2 = 77.554^{**}$		
Below 2.0	54.45	122.51	38.09
2.0 and over	76.91	77.42	63.28

Note. The total number of students is 21,165 for gender, ethnicity, age, and GPA.
$^{*}\alpha = .510$.
$^{**}\alpha \leq .000$.
$^{***}\alpha \leq .005$.

Although success rates for women and men enrolled in compressed-format courses exceeded corresponding rates for regular-session courses, women were more likely to be successful in compressed courses than men. For women enrolled in compressed developmental education courses, the success rate was about 73% compared to a success rate of 67% for men enrolled in compressed developmental courses. Higher success rates for women were also observed in regular-length session courses.

Higher success rates in compressed developmental courses also were observed for all of the major ethnic groups at the college. Asian and Pacific Islander students enrolled in compressed developmental courses had the highest successful course completion rates (82%), followed by Latino students (71%), White students (69%), and African American students (56%). A nearly identical pattern was observed for regular-length developmental courses with one notable difference. In regular-length courses, slightly higher success rates were observed for White students compared to Latino students. In compressed developmental courses, the success rate for Latino students was 71.0% compared to 69% for White students. Success rates for Latino and White students enrolled in regular-length developmental courses were 56% and 61% respectively (see Table 5).

Students of all age groups performed better in compressed developmental courses than did students enrolled in regular length courses. Students aged 25 years and above had a success rate of 77% in compressed courses compared to 63% for their counterparts enrolled in regular-length courses. Traditional age students followed the same pattern. The success rate for traditional age students in compressed courses was 68% compared to 53% for their counterparts enrolled in the regular-length courses. However, nontraditional age students (those aged 25 and older) were more likely to succeed than traditional students (those ages 17 to 24 years) in compressed format courses. The success rate for nontraditional students was 77% compared to 68% for traditional students.

Students with cumulative grade point averages below 2.00 performed better in compressed-format courses than their counterparts enrolled in regular-length courses. Among students with cumulative grade point averages below 2.00, approximately 54% successfully completed compressed courses compared to approximately 38% successfully completing regular-length courses. Students with grade point averages above 2.00 also fared better in compressed courses. The success rate for students with grade point averages above 2.00 enrolled in compressed basic skills courses was nearly 77% compared to 63% for their counterparts enrolled in the equivalent courses offered during the regular session.

DISCUSSION AND CONCLUSION

Evaluation of Research Questions and Hypotheses

The results of this study clearly demonstrate that for students enrolled at this particular community college, developmental course length is associated with statistically and practically significant differences in course success in developmental education courses, and these differences are consistently observed across all categories of age, gender, and ethnicity. With regard to the research questions and hypotheses, the results of this study provide evidence that there is a benefit to offering community college developmental education courses in a compressed format, and the benefit extends to all categories of students.

IMPLICATIONS FOR PRACTICE AND FUTURE RESEARCH

The results of this study offer key insights for the practice of developmental education in the community college and future research in this area. With regard to the practice of developmental education in the community college, it is imperative that practitioners understand that the notion that developmental students need more time (i.e., longer courses offered over a greater number of weeks) to master developmental material may be faulty. This study demonstrates that developmental students are quite capable of successfully assimilating course material in a shorter amount of time when the material is presented in a more intense, compressed format. Practitioners at the community college may want to reconsider the way that they offer developmental courses so that the achievement and progress of students through the developmental education curriculum can be maximized.

Experimenting with offering developmental courses in a compressed format also affords community colleges the opportunity to further examine developmental students' progress and achievement through a sequence of developmental education courses. Specifically, are students who take a sequence of compressed developmental courses better able to retain material and progress through the developmental curriculum than those students who take a sequence of developmental courses offered in a more traditional format? While this study demonstrates the efficacy of compressed developmental education offerings for community college students enrolled in one course, it does not address the efficacy of offering a sequence of compressed developmental education courses. Future research in this area is crucial for practitioners faced with making instructional policy decisions with respect to their developmental education programs. Such research is important to support community colleges in successfully developing innovative and effective programs and services that increase developmental students' achievement and progress toward educational goals.

It should be noted that while this study demonstrates that course length is associated with success in one developmental course, it does not illuminate the elements of compressed courses that may play a substantive role in developmental student success nor does it address the role of student motivation and commitment in course success. For example, does the intensity of compressed courses offer community college students more opportunities for getting to know one another and, thus, facilitate the creation of informal learning communities among students who might not ordinarily participate in such experiences? Or do compressed courses simply reduce opportunities for students' life experiences, such as family and work responsibilities, to interfere with successful course completion?

This study does not examine the relationship between motivation and commitment and successful course completion. For example, are higher successful course completion rates in compressed courses a reflection of a higher degree of commitment and motivation on the part of students? Is there a possibility that higher success rates would still be observed after the effects of motivation and commitment are accounted for? All of these issues need to be further examined in order to more fully understand the efficacy and benefits of offering a compressed developmental education program for community college students. Future research should attempt to discover the nature of the relationship between curriculum delivery strategy and student attitudes and behavior.

This study represents an exploration into the efficacy of a different curriculum delivery strategy for community college developmental education students: offering developmental education courses in a compressed format. It reveals that there is a relationship between successful course completion in developmental education courses and course format. It adds to the practice of education by proposing further exploration of alternative curriculum delivery strategies for community college developmental education programs that are based upon developing and offering curriculum in ways that are demonstrated to have empirically-based positive outcomes for students. Further research should be conducted to more adequately assess the efficacy of compressed developmental education courses and programs for community college students.

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Educational Master Plan

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Switching To Green

UC Berkeley continuing education program helps professionals add green chemistry to their résumés

Elizabeth K. Wilson

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UC Berkeley Extension's certificate program in green chemistry includes core courses and electives

REQUIRED COURSES	ELECTIVES
Principles of Green Chemistry	Developmental Biology
Green Chemistry & Chemicals Policy	Introduction to Bioethics
Business & Financial Planning for Green Chemistry Innovation	Sustainability Leadership: Strategies & Paradigms
Current Topics in Green Chemistry	Greening Your Supply Chain: Life Cycle Assessment Tools
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There's no doubt green chemistry is making its way into academia, as universities shift gears to prepare their students for a world in which issues such as energy conservation, toxicology, waste reduction, and environmental preservation will share the spotlight with efficiency and cost-effectiveness, not just in the chemical industry but in all sectors.

For example, leaders in the field include the University of Oregon with its green chemistry programs; the University of Massachusetts, Boston, which was the first to offer a Ph.D. in green chemistry; and the University of California, Berkeley, which recently opened its Center for Green Chemistry, an academic institute.

But what about those professionals who already have educations and established careers? They could eventually learn some green chemistry principles on the job, but many want to take a more proactive approach, with educational augmentation that might allow them to expand or even switch careers to more green-oriented ones.

UC Berkeley Extension—the university's continuing adult education department—hopes to fill that niche with a new certificate program, Essentials of Green Chemistry.

Barbara Peterson, program director for sciences and mathematics at UC Berkeley Extension, spearheaded development of the program, which began officially with last fall's semester. It's designed for professionals of all stripes, from materials scientists to environmental managers. "I think this certificate is broad enough to work for natural scientists and engineers," Peterson says.

According to the extension program's brochure, the rationale for the new program is that "growing public concern about product safety, along with new chemical policies in the U.S. and the European Union, poses an imperative for decision makers in business, government, and nongovernmental organizations to understand the business strategy and market drivers for green chemistry."

Requirements include a series of core classes, all of which eventually will be available online, as well as a handful of electives. The courses are letter graded, and completion of the program results in a certificate.

"There are so many people out there, particularly chemists, who have not been trained in green topics as part of graduate or undergraduate education," notes Mary M. Kirchhoff, former assistant director of green chemistry at the American Chemical Society and now director of ACS's education division, who recently spoke at a symposium on green chemistry in higher education at UC Berkeley. The extension program "is a way of gaining expertise in an area that may not have been part of their education," she says.

The students—fewer than a dozen—who have just completed the program's first semester are a diverse lot. For example, Natalia Aurrecoechea is a medicinal chemist who was recently laid off and hopes to develop greener reactions at a future job; Madanodaya Sundhoro wants to bolster his applications to graduate school in chemistry; Saskia van Bergen is a research chemist who wants to shift her focus to environmental chemistry; and John Holbrook, an investment analyst with no background in chemistry, plans to switch to a career involving renewable energy.

Extension student Jesse Christensen, a former research coordinator at UC San Francisco, says he feels personally drawn to green philosophy. At his old job, he says, "I lost track of why I love research. I feel extremely motivated to create better products."

Sheryl Mebane taught the program's flagship course on the principles of green chemistry. "I like working with people who are this close to applying everything" covered in the course, she says. Mebane, who has a Ph.D. in chemistry from UC Berkeley and is a jazz musician, has just changed the course of her career: This month, she moved to the Environmental Protection Agency as technology transfer specialist in Cincinnati.

Her class resembled a Socratic dialogue: Students and instructor tossed ideas back and forth with the enthusiasm of an animated social gathering. During the last class, the students gave presentations on topics related to green chemistry. For example, Laxmi Gandhi, a government consultant, described her project, a study of pesticide use in cotton production, and Aurrecoechea discussed waste-reducing variants of the industrially important Wittig reaction.

The students recognize that they're pioneers of what will likely be a sea change in the way science is done. Van Bergen notes that at first her colleagues "rolled their eyes, saying everything is overgreened." But now, she says, they're asking her questions.

Green chemistry will become as important as the energy field is now, Peterson predicts. Carbon emissions, toxicology, water conservation, social issues, and economic factors such as technology costs will be inextricably linked in a wide range of different fields. That's a problem for people now—"how to take it all into account," she says.

"You've got to have students trained, and we have to have industry requesting this as a skill."

Peterson, who came from a background in neurobiology, also developed a biomedical sciences program for UC Berkeley Extension. She developed the green chemistry certificate program with the UC Berkeley School of Public Health, drawing on the expertise of Berkeley's Center for Green Chemistry.

She sought input from industrial employers such as Dow and Chevron, as well as from EPA and nonprofit organizations. The program's tuition is about $4,000, and "a lot of employers will reimburse employees for tuition," Peterson notes.

UC Berkeley chemistry professor John Arnold, who heads the university's Center for Green Chemistry, is on the advisory board for the extension program. "We have a lot of overlap in outlook in terms of courses," he says. "Our clientele is probably different, but I think we share a lot of same goals when it comes to promoting green chemistry. The two efforts are very synergistic."

Kirchhoff notes that training is the key to spurring the greening of both academia and industry. "If you look at job ads, you don't see industry asking for expertise in green chemistry—it's pretty rare. You've got to have students trained, and we have to have industry requesting this as a skill."

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Educational Master Plan

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College hopping: exploring the occurrence, frequency, and consequences of lateral transfer. (Report)

Article from: **Community College Review** Article date: **April 1, 2009**
Author: **Bahr, Peter Riley**

Lateral transfer (between community colleges) is second only to upward transfer (to a 4-year institution) among community college students' most common patterns of transfer. Yet, upward transfer is the focus of innumerable studies, while lateral transfer has received very little empirical attention. This study explores the occurrence and frequency of lateral transfer in California and its consequences for the measurement of one particular outcome, namely, completion of a credential. The results indicate that students transfer laterally quite frequently, leading to substantial undercounts in rates of credential completion when measured from the standpoint of a single community college or single district. Furthermore, the frequency of lateral transfer varies systematically with a number of student characteristics of recurrent interest in the literature, leading to exaggerated differences in the likelihood of credential completion between some groups of students and inaccurately attenuated differences between other groups, when measured under the single-college and single-district analytical frameworks.

Keywords: student transfer; student achievement; associate's degrees; certificates; college outcomes assessment performance; accountability; persistence; attrition; retention; departure

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Lateral transfer between community colleges (also known as horizontal or parallel transfer) is second only to upward transfer to 4-year institutions among community college students' most common patterns of transfer (Peter & Cataldi, 2005; Yang, Brown, & Brown, 2008). Yet, upward transfer is the focus of innumerable published studies (e.g., Armstrong, 1993; Bahr, 2008a, 2008b; Bahr, Hom,& Perry, 2005; Fredrickson, 1998; Ishitani, 2008; Kisker, 2007; McMillan & Parke, 1994; Prager, 1993; Roksa & Calcagno, 2008; Wassmer, Moore, & Shulock, 2004), while lateral transfer has received very little empirical attention. This comparative lack of attention is somewhat surprising in light of the strong and growing interest in outcomes-based accountability with respect to the performance of community colleges (Bahr, Hom,& Perry, 2004; Bailey, Calcagno, Jenkins, Leinbach, & Kienzl, 2006; Bailey & Morest, 2006a; Dellow & Romano, 2002; Dougherty & Hong, 2006; Dowd & Tong, 2007) and in light of the logical expectation that lateral transfer may contribute to underestimation of student achievement when student progress is tracked only within individual institutions or districts (Bailey, Jenkins, & Leinbach, 2005; Goldberger, 2007).

In this study, I explore the occurrence and frequency of lateral transfer and examine the consequences of lateral transfer for the measurement of one student outcome of particular concern in the ongoing debate about accountability--the completion of a credential (i.e., earning a certificate or associate's degree). I employ data from 6 years of enrollment records for the entire cohort of fall 1995 first-time students who enrolled in any of the 106 semester-system community colleges in California. I find that community college students transfer laterally quite frequently, leading to a substantial negative bias in rates of credential completion when measured from the standpoint of a single community college or a single district. Additionally, the frequency of lateral transfer varies systematically with a number of variables of recurrent interest to researchers, policy makers, and other stakeholders. This systematic variation contributes to exaggerated differences in the likelihood of credential completion between some groups of students and inaccurately attenuated differences between other groups. I conclude with a discussion of implications for educational policy and future research.

Background

Patterns of Transfer

Empirical attention to students' various patterns of transfer between colleges has grown considerably in recent years (e.g., Adelman, 1999; Herzog, 2005; Porter, 2003; Rab, 2004), and not without good reason. Estimates suggest that as many as 2 out of 5 first-time postsecondary students (40%) attend 2 or more institutions within 4 years of initial enrollment (Peter & Cataldi, 2005). The rate is even higher (47%) among students in community colleges (Peter & Cataldi). Thus, transfer between colleges is an exceptionally common event in the diverse educational pathways of students.

The expanding body of research on this subject indicates that patterns of transfer are remarkably complex (Bach et al., 2000; de los Santos & Wright, 1989; Townsend, 2001), although a number of common patterns have been identified. Among community college students, common patterns include upward transfer to a 4-year institution, lateral transfer to another community college, downward transfer to a less-than-2-year institution, and simultaneous enrollment in two or more community colleges (Adelman, 1999; Berkner, He, & Cataldi, 2002; Peter & Cataldi, 2005; Romano & Wisniewski, 2005). A fifth common pattern, known as reverse transfer, is mentioned with some frequency in the literature (e.g., Brimm & Achilles, 1976; Winter & Harris, 1999; Yang, 2006) refers to transfer from 4-year institution to a community college. However, this type of transfer arguably is characterized more accurately as a pattern exhibited by 4-year-college students as opposed to a pattern exhibited by community college students (DesJardins & Pontiff, 1999; Peter & Cataldi, 2005).

Among these patterns of transfer, lateral transfer between community colleges is of particular interest, in part because it is the second most common pattern of transfer after upward transfer to a 4-year institution (Peter & Cataldi, 2005). Estimates suggest that 2 out of every 15 (13%) community college students transfer laterally at some point, although this figure likely is a fairly severe underestimate of lateral transfer because it considers only the student's first transfer and because it excludes all students who eventually (as much as 6 years later) transfer back to the community college of origin (Peter & Cataldi, 2005).

Lateral Transfer and Educational Policy

Although lateral transfer is of interest in its own right as researchers seek to understand students' varied patterns of enrollment, it also has important implications for educational policy. These implications arise from the fact that the single-college, first-time freshmen cohort study is the mainstay of institutional research, particularly research on community colleges (Dellow & Romano, 2002; Porter, 2000; Seidman, 2004). Although analyses of nationally representative data are becoming more common (e.g., Attewell, Lavin, Domina, & Levey, 2006), as are analyses of statewide data (e.g., Bahr, 2007), a large percentage of studies that focus on community colleges employ data collected in a single college (Bailey & Alfonso, 2005). Thus, much of what we understand about community colleges students, and about the outcomes experienced by these students, is based on the single-college analytical framework.

Obviously, such empirical work does not occur in a policy vacuum. To the contrary, much greater scrutiny of the performance of community colleges is occurring now than perhaps at any time in the past (Bailey & Morest, 2006a; Dougherty & Hong, 2006; Dowd & Tong, 2007). In turn, the single-college analytical framework constitutes the backbone of this movement toward accountability and the operationalization of institutional performance (Bahr et al., 2005; Bailey et al., 2005).

Of particular interest in measuring institutional performance is the rate of credential completion (Bailey et al., 2006; Dougherty & Hong, 2006), a measure on which community colleges often are judged to perform inadequately (Bailey & Alfonso, 2005; Bailey et al., 2005; Bailey & Morest, 2006a; Seidman, 2004). As Adelman (1999) argued, "Degree completion is the true bottom line for college administrators, state legislators, parents, and most importantly, students--not retention to the second year, not persistence without a degree, but completion" (p. v).

Unfortunately, it is precisely on this point that the single-college study is found to have one of its greatest weaknesses. The open-enrollment nature of community colleges (Bailey & Alfonso, 2005; Bailey et al., 2005), combined with a focus on convenient availability to the local community (Bailey & Morest, 2006a; Willett & Hom, 2007), makes lateral transfer between community colleges remarkably uncomplicated for students. In fact, these features--open enrollment and community access--are hallmarks of the community college system. However, under the single-college framework, a student who transfers laterally (or, for that matter, upward or downward) appears to have dropped out or stopped out even as the student continues in his or her educational pursuits (Hawley & Harris, 2005; Porter, 2003). Thus, one inopportune result of the ease of lateral transfer is the underestimation of credential completion when measured with reference to a single college (Dougherty & Hong, 2006). Accordingly, Adelman (1999) argued, "It is not wise to blame a college with superficially low graduation rates for the behavior of students who swirl through the system" (p. ix). Likewise, Bailey et al. (2005) observed, "Simply looking at the absolute graduation rate of any individual college is probably going to be misleading...." (p. 2). Yet critical attention to college-specific rates of credential completion persists (Bailey et al., 2006).

Lateral Transfer and Empirical Research

Policy issues aside, the lateral transfer phenomenon also may affect a sizeable segment of the research literature (Adelman, 1999). To elaborate, consider that the numerous single-college studies that have sought to test the significance of particular predictors of credential completion (and other outcomes of interest) have been forced by restrictions in the data to assume (whether stated explicitly or not) that lateral transfer is a statistically random event. In other words, given some independent variable of interest (e.g., race/ ethnicity, age, sex), one must assume under the single-college framework that lateral transfer is no more likely for a group defined by one value of an independent variable than for a group defined by another value of that variable. If, in fact, it is true that lateral transfer is a statistically random event, the only meaningful consequence is a downward bias in the estimated rate of credential completion within a given cohort. Because the measurement error that is generated by lateral transfer is distributed evenly across the values of a given predictor, the estimated effect of that predictor will not be biased systematically in a fashion that is likely to alter the core findings of a study.

However, statistical randomness is a strong assumption, particularly when it concerns the active decision making process that underlies lateral transfer. It seems more reasonable to assume that lateral transfer varies systematically with many variables of common interest to researchers, policy makers, administrators, and other stakeholders. Under this less restrictive assumption, any systematic variation in lateral transfer across key independent variables may alter the findings of a study, possibly producing the appearance of relationships that actually do not exist or, equally important, suppressing relationships that do exist. Consequently, developing an understanding of lateral transfer is vital not only because of the implications for educational policy but also because of the possibly inaccurate conclusions that researchers might draw from analyses of single-college data. As Bailey and Morest (2006a) explained, "More than for any other postsecondary institution, data from single institutions give only a partial and misleading picture of community college performance and the experience of community college students" (p. 17).

Study Purpose

Given the evidence of the fairly commonplace nature of lateral transfer and the potential impact of lateral transfer on the evaluations of college performance and on the findings of a sizeable portion of the literature concerning community colleges, it seems prudent to extend the ongoing research on transfer to include a detailed analysis of this phenomenon. In this study, I address several key questions concerning lateral transfer of community college students. First, how frequently does lateral transfer occur? Second, how do the likelihood and frequency of lateral transfer vary as a function of a set of demographic and financial aid characteristics of recurrent interest among researchers, policy makers, administrators, and other stakeholders? Finally, to what extent does lateral transfer influence estimates of credential completion both globally and across this set of demographic and financial aid characteristics? Answering these questions constitutes an important step forward in developing a comprehensive understanding of students' patterns of transfer as well as an understanding of the particular phenomenon of lateral transfer itself.

Data and Measures

Data

To address these questions, I drew on data collected by the Chancellor's Office of the California Community Colleges. The Chancellor's Office collects data each term from the 109 community colleges in California. These data constitute a census of California's community college students and include transcripts, demographics, financial aid awards, credential awards, and a variety of other information.

I selected for this analysis the fall 1995 cohort of first-time college students who enrolled in any of California's 106 semester-based community colleges (N = 167,997). (Note that the definition of first-time college student used here excludes "special-admit" students who were concurrently enrolled in high school.) From this larger cohort, I dropped all students for whom data were missing on sex, age, race and ethnicity, or the identification variable used to track students' records across colleges. This resulted in an analytical cohort composed of 156,188 students. I observed the records of these students across all of the semester-system community colleges (regardless of the first institution of attendance) for 6 years, through the spring semester of 2001. Finally, in 2003, I refreshed the data with updated information about students' credential awards through the spring semester of 2003. Although students from three community colleges were excluded from this analytical cohort to standardize the interval on which time is measured (semesters vs. quarters), this cohort may be viewed as approximating a systemwide, or statewide, population of community college students.

Dependent Variables

Two dependent variables are of primary interest in this study: lateral transfer and the completion of a credential. Concerning the first of these, lateral transfer between community colleges appears, on the surface, to be a straightforward concept. In practice, however, it is complicated by students' periodic absences from college (i.e., stopouts) and by the possibility of simultaneous enrollment in two or more colleges, a phenomenon that is called variously overlapping enrollment, dual enrollment, or coenrollment (Peter & Cataldi, 2005). To determine when a lateral transfer occurred in these data, I monitored the number of courses in which each student enrolled in each semester and in each of the 106 colleges. In each semester, each student was assigned to the college in which he or she enrolled in the greatest number of courses. A lateral transfer was deemed to have occurred when the college to which a student was assigned in a given semester differed from the college to which the student was assigned in the most recent prior semester of attendance.

The second dependent variable of interest in this study is the completion of a credential, including both associate's degrees and certificates. The measurement of credential completion, like the measurement of lateral transfer, is considerably more complicated than it might appear, due largely to the possibility that a student may be awarded multiple credentials of varying ranks (i.e., associate's degrees vs. certificates) by several community colleges. In the interest of parsimony, I focused on students' first and highest credential earned. More specifically, I gave primary preference to the highest credential earned, focusing first on associate's degrees and considering certificates only when no associate's degree was awarded during the observation period. I then considered the question of which college was the first to award this highest credential. Here, the awarding college was the first college to confer the highest credential earned by the student within the observation period. For example, if a student earned two or more associate's degrees from several colleges, the awarding college is the college that conferred the first of these associate's degrees.

Using this logic, three measures of credential completion were derived, each of which corresponds to a different analytical framework: single college, single district, and systemwide. The single-college measure of credential completion is a dichotomous variable that addresses whether a given student's first and highest community college credential, earned at any time through the spring semester of 2003, was awarded by the college to which he or she was assigned in the fall semester of 1995 (1 = awarded a credential by first college, 0 = not awarded a credential by first college). Likewise, the single-district measure of credential completion addresses whether a given student's first and highest credential was awarded by any college located in the same district as the college to which the student was assigned in the fall semester of 1995. This second measure was included to test whether a more expansive definition of credential completion eliminates any error (resulting from lateral transfers) that is observed under the single-college framework. Finally, the systemwide measure addresses whether a given student was awarded a credential at any time by any of the 106 colleges included here. Note that any student who was not awarded a credential at any time during the observation period is assigned a value of zero on each of these three measures of credential completion.

Independent Variables

Several independent variables were employed in this analysis, including sex, age at college entry, race/ethnicity, receipt of financial aid, and duration of attendance. Sex, age, and race/ethnicity are self-reported measures that were collected at the time of initial admission in the fall semester of 1995. Receipt of financial aid includes three measures: a dummy variable that indicates receipt of a fee waiver during the first year, a dummy variable that indicates receipt of any grants during the first year, and a continuous variable that indicates the total value of any grants received during the first year. Duration of attendance is operationalized as the number of terms (including summer terms, but excluding winter intersessions) in which a given student enrolled in courses from the fall semester of 1995 through the spring semester of 2001.

Limitations

Although the data employed here are strong in many respects, there are several limitations that should be mentioned. First, because each student is assigned to one and only one college in any given semester, the definition of lateral transfer that is used here effectively ignores simultaneous enrollment in two or more community colleges. Ultimately, this is an expedient, and even necessary, concession for the purpose of exploring the phenomenon of lateral transfer.

Second, the definition of lateral transfer employed in this study masks student behavior characterized by a lateral transfer followed by a return to the community college of origin. In such cases, both the outbound transfer and the return were counted as instances of lateral transfer. Whether this is a problem or not depends on one's perspective. Although Peter and Cataldi (2005) disregarded students who transferred laterally and then returned (as much as 6 years later) to the college of origin, I included such students because this behavior has the potential to affect rates of credential completion and other outcomes of interest, and because it is relevant to the larger issue of student movement between community colleges. In addition, the measure used in this study has at least one substantial advantage over the measure used by Peter and Cataldi, namely, that it counts how many lateral transfers a given student experienced during the observation period. In contrast, the measure used by Peter and Cataldi indicated only whether or not a given student's first transfer was lateral in nature (assuming that the student did not return subsequently to the initial college of enrollment).

Third, the focus on "first and highest" credential earned, which, as mentioned earlier, is practical from the perspective of data management, potentially could miss some students who completed a credential in the initial college or district of enrollment. In particular, those students who completed a certificate in the initial college or district of enrollment and then transferred to another college or district and subsequently completed an associate's degree will be missed under the single-college or single-district measures of credential completion employed here. Likewise, those students who transferred out of the initial college or district of enrollment, completed an associate's degree, and then transferred back to the initial college or district and completed another associate's degree, also will be missed. However, a preliminary investigation of the suitability of the "first and highest" method of determining the awarding college indicated that, although most community college students are not awarded a community college credential of any kind, in these data the vast majority of students who earned multiple credentials were awarded those credentials by a single college rather than by several separate colleges. Thus, with a few rare exceptions, the "first and highest" method of determining the awarding college appears to be a robust approximation of reality.

Fourth, although this study gives detailed attention to the effect of lateral transfer on the measurement of rates of credential completion, the completion of a credential is only one of many possible positive outcomes that community college students may achieve (see, for example, California Community College System Office, 2008). This study does not seek to determine the effect of lateral transfer on the measurement of other possible outcomes, such as upward transfer or the completion of course sequences that do not result in a credential (e.g., successful remediation in a particular subject; Bahr, 2007, 2008a).

Finally, the reader should keep in mind that the focus of this study is on first-time college students. Consequently, the results of this study with respect to the impact of lateral transfer on estimated rates of credential completion, and on the estimated effects of various independent variables on credential completion, likely would differ if incoming transfer students were included. In other words, the results of single-college and single-district analyses that include incoming transfer students will not necessarily be biased in the same way, or to the same extent, as those that include only first-time college students.

Analysis

Descriptive Analysis of Lateral Transfer and Credential Completion

As the first step in this analysis, I calculated the mean number of lateral transfers within the observation period, the percentage of students who transferred laterally at least once during the observation period, and the rate of credential completion within the first college of enrollment (i.e., single-college framework), within the district of the first college of enrollment (i.e., single-district framework), and across all 106 of the semester-system colleges (i.e., systemwide framework), as a function of a set of demographic and financial aid characteristics of recurrent interest in the literature. The results are presented in Table 1. Note that both the mean number of lateral transfers and the percentage of students who transferred laterally were calculated to account for the possibility of serial lateral transfer. More specifically, it may be that relatively few students exhibit a relatively high frequency of lateral transfer (a right-skewed distribution), which would tend to make the mean less representative of the distribution. Distinguishing between the mean number of lateral transfers and the percentage of students who experienced lateral transfer assists in identifying any problem in this regard.

The findings presented in Table 1 demonstrate several important points. First, although the mean number of lateral transfers in the population is fairly low (0.459), the percentage of students who experienced lateral transfer is quite high. More than 1 out of every 4 students (27.69%) transferred laterally at least once during the 6-year observation period. Thus, although there may be some small segment of the population who experience serial lateral transfer, it appears that the dominant pattern is described more accurately as many students experiencing lateral transfer relatively few times. In fact, additional analyses (not shown) indicate that 93% of students who transferred laterally did so 3 or fewer times, which is comparable to the findings presented by Yang, Brown, and Brown (2008).

Second, both the likelihood and frequency of lateral transfer are distributed unevenly across the independent variables included in Table 1. For example, more than one third (34%) of students who were 20 years of age or younger at college entry (the two youngest groups of students) transferred laterally at some point, whereas about 1 in 15 (7%) of the oldest students (older than 50 years of age) did so. Thus, the likelihood of lateral transfer among younger students is 5 times that of the oldest students. The frequency of lateral transfer differs to an even greater extent: The mean number of lateral transfers among students in the two youngest categories (0.583) is nearly 6 times that of students in the oldest category (0.098). Sizeable differences in the likelihood and frequency of lateral transfer also are evident between the categories of race and ethnicity and between the various levels of grant-based financial aid.

The third point to draw from Table 1 concerns the relationship between lateral transfers and the underestimation of rates of credential completion under the single-college and single-district frameworks. This relationship is illustrated in Figure 1, using age at college entry as an example. In Figure 1, I plot the mean number of lateral transfers, the ratio of the odds of credential completion in any college versus the odds of credential completion in the initial college of enrollment, and the ratio of the odds of credential completion in any college versus the odds of credential completion in the initial district of enrollment. Odds ratios are used here to correct for the fact that older students are less likely to complete a credential than are younger students.

As a point of clarification, the odds of an outcome are the probability of occurrence of that outcome divided by the probability of nonoccurrence (Agresti & Finlay, 1997). Although not immediately intuitive, odds actually are a fairly straightforward concept and somewhat similar to percentages. Consider, for example, that the phrase "one in ten" indicates a 10% chance of an outcome, or a probability of 0.10. The odds of this outcome are "1 to 9," or 0.11. In other words, one case experienced the outcome for every nine cases that did not experience the outcome. An odds ratio, then, is the odds of one possible outcome divided by the odds of an alternate outcome. As employed here, these odds ratios may be interpreted as a relative gauge of the underestimation of credential completion under the single-college and single-district analytical frameworks.

One may observe in Figure 1 that, perhaps with the exception of students who are 21 to 25 years of age, the relative likelihood of underestimating credential completion using single-college data varies positively with the mean number of lateral transfers: a declining mean number of lateral transfers is associated with a declining likelihood of underestimating credential completion. A similar relationship, although smaller in absolute size, is observed for the single-district framework. Thus, one may perceive here the first hint of a systematic relationship between variables of common interest to researchers (e.g., age) and bias in the estimated rate of credential completion as a result of variation in lateral transfer.

[FIGURE 1 OMITTED]

As a whole, the lateral transfer phenomenon does appear to have a fairly sizeable effect on the observed rate of credential completion. In the last row of Table 1, one may observe that a focus on credential completion in only the first college of enrollment underestimates the actual rate of credential completion by approximately 2 and 2.5 percentage points relative to a systemwide focus. Although this may seem at first glance to be a small figure, in fact it means that the rate of credential completion is underestimated by more than 18% (see Table 2). Said another way, almost one out of every five students who completes a credential is not counted when the focus is placed on credential completion in the initial college of enrollment. A focus on all colleges within the district in which the initial college of enrollment is located (i.e., single-district framework) improves moderately the accuracy of the observed rate of credential completion, reducing underestimation to about 15% (see Table 2).

Regression Analysis of Lateral Transfer

As the second step in this analysis, I sought to determine whether the lateral transfer phenomenon varies systematically with independent variables of common interest to researchers, policy makers, and other stakeholders. Although such systematic relationships appear to be evident in the descriptive analysis (Table 1 and Figure 1), a more sophisticated test that accounts for the total duration of attendance in the community college system is desirable. Duration of attendance (i.e., persistence) is an important variable to consider here because the length of time that a student is enrolled in the system defines the window in which lateral transfer is possible (Peter & Cataldi, 2005), and it is expected that most, if not all, of the independent variables addressed in this study are correlated with duration of attendance.

To that end, I used negative binomial regression (Long, 1997) to model natural variation in the frequency of lateral transfer as a function of this same set of independent variables and with an exposure variable (Powers & Xie, 2000) equal to the student's duration of attendance across all of the 106 community colleges. Negative binomial regression is akin to Poisson regression and is used to analyze variation in the count of the number of times that a phenomenon of interest has occurred (Long, 1997). In this case, count refers to the total number of lateral transfers that a given student experienced. One method of deciphering the results of a negative binomial regression model involves exponentiating the estimated coefficients. These exponentiated coefficients, which are called incident rate ratios, are interpreted in terms of the factor change in the count that is associated with a one-unit increase in the independent variable.

The results of the negative binomial regression, which are presented in Table 3, indicate that the frequency of lateral transfer varies systematically with sex, age, race/ethnicity, and two of the three measures of financial aid. In other words, the frequency of lateral transfer does vary with many of the variables of common interest in the literature, even after accounting for variation in duration of attendance. In particular, Black students and Asian students exhibit a significantly higher number of lateral transfers than do White students, whereas Hispanic, Filipino, and Native American students exhibit a significantly lower number of lateral transfers, net of controls. For example, Black students experience nearly 1.4 times ([e.sup.0318] [approximately equal to] 1.4) as many lateral transfers as do White students, all else being equal. Female students exhibit a significantly lower number of lateral transfers than do male students. Likewise, as suggested by the descriptive analysis, age is associated negatively with the number of lateral transfers; that is, older students experience fewer lateral transfers than do younger students, on average. Finally, although receipt of a fee waiver does not have a statistically significant relationship to the number of lateral transfers, grant recipients exhibit, on average, a lower number of lateral transfers than do students who do not receive grants. Moreover, the greater the value of the grant, the lower the number of lateral transfers, all else being equal.

As a way of illustrating the absolute sizes of the differences in the frequency of lateral transfer, I calculated the predicted mean number of lateral transfers for each category of race/ethnicity. These predicted values were calculated by setting all of the other variables to their respective means (for continuous variables) or modes (for categorical variables), and then adjusting race and ethnicity systematically. The results (Table 4) indicate small, but substantively meaningful, differences across racial and ethnic groups after controlling for other variables. For example, Black students experience an average of 0.58 lateral transfers, compared with an average of 0.42 lateral transfers among White students, net of other variables.

Regression Analysis of Credential Completion

As discussed earlier, any systematic differences in the occurrence or frequency of lateral transfer across key variables implies that single-college and single-district analyses underestimate credential completion to a greater extent for some groups than for others. For example, the greater rate of lateral transfer among Black students suggests that the estimated rate of credential completion for Blacks, as calculated under the single-college or single-district analytical frameworks, likely is depressed relative to White students, due in part simply to the greater rate at which Black students who complete credentials are miscounted. In other words, the estimated rate of credential completion for Black students is less accurate than that of White students. Thus, any difference in credential completion between Black and White students that is observed under a single-college or single-district analytical framework is, in part, a consequence of measurement error that results from variation in lateral transfer.

To explore the substantive consequences of this systematic variation, I used logistic regression (Powers & Xie, 2000) to analyze the likelihood of completing a credential under the single-college, single-district, and system-wide frameworks. The results are presented in Table 5. Logistic regression is used to analyze variation in a dichotomous (0 or 1) outcome variable. Like negative binomial regression, a typical method of deciphering logistic regression models involves exponentiating the estimated coefficients. Exponentiated coefficients are interpreted in terms of the factor change in the odds of the outcome that is associated with a one-unit increase in the independent variable. However, the reader should note that the focus of this table is not on the coefficients for any given model but, rather, on the magnitude of the differences in the coefficients for a given variable across the three models. Thus, in Table 6, I present the results of the Wald test (Long, 1997) of differences between the coefficients in each of the three logistic regression models.

As expected, the results of these regression models demonstrate, for example, that the likelihood of credential completion among Black students (relative to Whites) is artificially depressed under a single-college analytical framework, compared with the systemwide analytical framework. Said another way, the observed difference in the likelihood of credential completion between Black and White students is exaggerated under a single-college analytical framework. Conversely, observed differences on some of the variables (e.g., Hispanic vs. White, younger vs. older) are suppressed under the single-college framework because the group that is less likely to transfer laterally (e.g., Hispanics relative to Whites) is also less likely to complete a credential. That is to say, the subgroup that is more likely to complete a credential is also more likely to be missed due to lateral transfer, leading to underestimation (rather than overestimation) of differences in the likelihood of credential completion. These findings concerning the exaggeration or suppression of observed differences in the likelihood of credential completion under the single-college and single-district analytical frameworks are summarized in Table 7.

In terms of accuracy of estimation, the single-district framework appears to fall mid-way between single-college and systemwide analytical approaches on some, but not all, of the variables. This discrepancy implies that the propensity for out-of-district lateral transfer varies systematically with some of the variables addressed here. In other words, out-of-district lateral transfer, as a specific type of lateral transfer, appears to have a unique relationship to some of these independent variables. For example, net of other variables, Asian students are slightly more likely to transfer laterally and slightly less likely to complete a credential than are White students. This contributes to an overestimation of the difference in credential completion between the two groups under the single-college framework. However, the single-district framework underestimates the difference between the two groups slightly (relative to the systemwide framework), which suggests that Whites are more likely than are Asians to experience out-of-district lateral transfer.

Supplementary Analysis of Nonreturning Transfers

As mentioned earlier, one notable difference between this study and prior work on the topic is the use of an outcome measure that addresses how many times a given student transferred laterally, as opposed to the use of a dichotomous measure of whether or not a student's first transfer was lateral in nature (e.g., Peter & Cataldi, 2005). Another notable difference of this study is the inclusion of students who transferred laterally back to their initial college of enrollment, as opposed to the complete exclusion of such students from the analysis. To explore the substantive consequence of this latter difference, I replicated the negative binomial regression of the number of lateral transfers (Table 3) using a modified outcome measure that removes from the count of lateral transfers any return transfers back to the initial college of enrollment. The results are presented in Table 8.

In comparing Table 3 (the original count of lateral transfers) with Table 8 (the modified count of lateral transfers), one may note that the results are very similar. With the exception of minor variations in the coefficients, the magnitudes and directions of the coefficients remain largely the same. The comparability of these results is supported by an examination of descriptive statistics. In particular, the mean number of all lateral transfers is 0.45 (SD = 0.92), whereas the mean number of nonreturning lateral transfers is 0.37 (SD = 0.74). Although the latter statistic is somewhat smaller than the former, the comparable size of the means indicates that return transfers do not dominate the phenomenon of lateral transfer. This conclusion makes sense in light of the earlier observation that, although many students experience lateral transfer, most students who transfer laterally do so relatively few times.

Discussion

For many decades, the term transfer in the context of community colleges has referred almost exclusively to upward transfer to a 4-year institution. It is only recently that students' varied and swirling patterns of transfer between colleges have begun to receive intensive empirical attention (e.g., Bach et al., 2000). What we find when we look more closely at transfer behavior is students "filling their undergraduate portfolios with courses and credentials from a variety of sources [institutions], much as we fill our shopping bags at the local mall" (Adelman, 1999, p. 39). Nevertheless, with the exception of upward transfer, research on patterns of transfer between colleges is still very much in a formative stage.

In this study, I explored the occurrence and frequency of lateral transfer (between community colleges) as a particular type of transfer behavior exhibited by students. I examined the relationships between lateral transfer and a set of variables of widespread interest to researchers, policy makers, administrators, and other stakeholders in the community college environment, including sex, age, race/ethnicity, and receipt of financial aid. I also explored the effect of lateral transfer on estimated rates of credential completion under single-college, single-district, and systemwide analytical frameworks, and with respect to this same set of independent variables.

The findings of this study indicate that lateral transfer is remarkably common among community college students, but that serial lateral transfer (i.e., numerous lateral transfers by a single student) is relatively rare. As implied by the literature (e.g., Bailey et al., 2005), the regularity of lateral transfer tends to depress rates of credential completion under the single-college and single-district analytical frameworks, thereby contributing to a view of students' attainment that is more dire than reality.

In addition, this study indicates that the frequency of lateral transfer varies systematically with sex, age, race/ethnicity, and receipt of grant-funded financial aid, even after accounting for variation in duration of attendance. More specifically, female students exhibit a lower average frequency of lateral transfer than do male students, and older students exhibit a lower average frequency of lateral transfer than do younger students. Black students and Asian students exhibit a higher-average frequency of lateral transfer than do White students. In contrast, Hispanics, Filipinos, Native Americans, and students of "Other" racial and ethnic groups exhibit lower average frequencies of lateral transfer than do Whites. Finally, grant recipients exhibit a lower average frequency of lateral transfer than do students who did not receive grant-based financial aid, and the frequency of lateral transfer declines still further as the dollar value of the grant-based aid increases.

This systematic variation in lateral transfer exaggerates observed differences in credential completion between some groups of students, whereas it suppresses observed differences between other groups. In particular, the single-college analytical framework exaggerates observed differences in credential completion between females and males, Black students and White students, Asians and Whites, and between students who received grant aid and those who did not. Conversely, the single-college analytical framework suppresses observed differences in credential completion between older students and younger students, between Hispanics and Whites, and between students of "Other" racial and ethnic groups and Whites. The results for the single-district analytical framework are similar except that the single-district framework suppresses observed differences between Asians and Whites and between Native Americans and Whites, and exaggerates observed differences between students who received greater amounts of grant-based financial aid and those who received lesser amounts of grant-based aid.

Finally, although the single-district framework appears to improve the accuracy of estimated rates of credential completion over estimates that are generated under the single-college framework, it does not alleviate entirely the problem of missed successful students. Moreover, it does not fully ameliorate the problem of systematic variation in lateral transfer across key independent variables of interest. In fact, in some instances, the single-district framework generates less accurate estimates of the effects of these independent variables on the likelihood of completing a credential than does the single-college framework.

Importantly, however, although the global effect of lateral transfer on measured rates of credential completion calculated under single-college and single-district analytical frameworks is sizeable, it does not appear to be enormous. More important still, the single-college and single-district analytical frameworks do not create the appearance of differences between groups of students that, in fact, do not exist (i.e., disappear under the more accurate systemwide analytical framework) nor hide differences that do exist. (The one exception is the comparison of students of "Other" racial and ethnic groups with White students, between whom a statistically significant difference in credential completion was identified only under the more accurate systemwide analytical framework.) In other words, statistically significant differences across categories of sex, age, race/ethnicity, and receipt of financial aid that were identified with the single-college and single-district analyses generally were sustained in both significance and direction under the systemwide framework. These differences simply decreased or increased in size under the more accurate systemwide framework. This is an encouraging finding because, as mentioned earlier, single-college and single-district studies form the backbone of much of the research on community colleges (Bailey & Alfonso, 2005; Porter, 2000).

Implications and Future Research

One obvious implication of the findings of this study is the very real need to account for lateral transfer when assessing the performance of community colleges with respect to students' outcomes. As has been urged in prior work (e.g., Bailey & Morest, 2006b; Goldberger, 2007), the expansion of institutional capacity to track student progress throughout the postsecondary system is imperative. One example of such an effort may be found in California's program for Accountability Reporting for the Community Colleges (ARCC; California Community College System Office, 2008).

As a related matter, performance accountability strategies should account for the contribution of a college to the attainment of students who transfer laterally and subsequently complete degrees or achieve other milestones (e.g., upward transfer, successful remediation) in successive institutions. As Dougherty and Hong (2006) suggested, colleges should receive "partial credit for partial completions" (p. 78). However, some qualifications have been raised and should be deliberated, such as distinguishing between a college at which a student made a "false start" and the first college at which a student actually "made a go of it" (Adelman, 1999, p. 42).

Perhaps less obvious, but no less important, this study highlights the need to account for additional institutional performance indicators, over and above credential completion. For example, California's ARCC program considers a number of institutional-level indicators of performance, including the successful completion of 30 or more college credits, the annual rate of successful completion of vocational courses, and the annual rate of successful completion of remedial courses, among others (California Community College System Office, 2008).

Concerning future research, this study has demonstrated that lateral transfer is quite common, that it varies systematically with common variables of interest, and that it has a meaningful effect on the measurement of at least one important student outcome. Yet this study has not addressed the underlying causes of lateral transfer in any respect. Thus, one future research objective is to explore and delineate the causes of lateral transfer, as distinct from the causes of formal departure from postsecondary pursuits.

Furthermore, research on the causes and implications of lateral transfer should distinguish between in-district and out-of-district lateral transfer, as the findings of this study suggest that these two types of lateral transfer have, to some extent, unique relationships to the variables addressed here. Yet many community college systems do not employ multicollege districts. In such cases, it may be useful for analytical purposes to define community college regions, the boundaries of which delineate community colleges that are located within relatively close proximity to one another.

As a related matter, two other aspects of the lateral transfer phenomenon that were not addressed in this study, but that should be considered in future research, are the role of distance education and the role of geography in selecting a community college (Willett & Hom, 2007; Yang, Brown, & Brown, 2008). Geography, in particular, may play a strong part in the extent to which students of a particular community college exhibit lateral transfer behavior, as students who reside within easy driving distance of two colleges in the same district, or who reside on the border of two separate districts, may be especially likely to transfer laterally.

Finally, a particular point of interest regarding lateral transfer concerns when (in the course of a student's academic career) lateral transfer is most likely to occur. For example, one might ask whether lateral transfer is primarily a behavior of new students who are experimenting with college, or whether it is equally common among established students in their second or third year of attendance (perhaps due to job relocation or other causes). Research on this question may prove particularly informative as we seek to develop a complete understanding of the lateral transfer phenomenon.

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Table 1
Distribution of the Occurrence and Frequency of Lateral Transfer, and Distribution of Credential Completion in the Community College of First Enrollment, the District of First Enrollment, and Any of the 106 Semester System Community Colleges, by Selected Independent Variables

			Percentage of Students Who ...
Variables	Number of Students	Mean Number of Lateral Transfers	Transferred Laterally
Sex			
Male	74,224	0.459	27.69
Female	81,964	0.440	26.31
Age			
< 18 years	10,255	0.625	36.19
18-20 years	84,009	0.578	33.75
21-25 years	17,706	0.330	21.58
26-30 years	11,884	0.268	17.87
31-35 years	9,640	0.241	15.78
36-40 years	7,459	0.208	14.05
41-50 years	8,676	0.188	12.67
>50 years	6,559	0.098	6.77
Race			
White	68,676	0.452	27.41
Black	14,775	0.508	30.80
Hispanic	45,695	0.384	23.98
Asian	17,105	0.561	29.95
Pacific Islander	1,090	0.494	30.28
Filipino	5,290	0.536	31.30
Native American	1,766	0.299	19.25
Other	1,791	0.314	19.26
Fee waiver			
Waiver	43,874	0.461	27.24
No waiver	112,314	0.445	26.86
Grants			
No grants	132,345	0.442	26.82
<$501	1,837	0.415	26.40
$501-$1,000	3,432	0.457	28.15
$1,00141.500	4,425	0.453	26.76
$1,501-$2,000	3,132	0.477	27.30
$2.001-$2.500	5,955	0.505	27.74
$2.501-$3,000	2,226	0.524	28.21
>$3,000	2,836	0.585	30.01
Total	156,188	0.449	26.97

	Percentage of Students Who ...		
Variables	Completed Credential in Same College	Completed Credential in Same District	Completed Credential in Any College
Sex			
Male	9.11	9.55	11.47
Female	12.40	13.00	14.94
Age			
< 18 years	15.37	16.21	19.20
18-20 years	13.55	14.12	16.61
21-25 years	7.43	7.92	9.25
26-30 years	6.80	7.23	8.49
31-35 years	7.06	7.48	8.48
36-40 years	6.46	6.86	7.71
41-50 years	6.18	6.59	7.27
>50 years	2.23	2.33	2.56
Race			
White	11.81	12.28	14.59
Black	6.55	6.98	8.55
Hispanic	9.95	10.35	11.90
Asian	12.59	13.75	15.59
Pacific Islander	10.00	10.46	12.48
Filipino	12.87	13.52	15.71
Native American	8.55	8.89	9.97
Other	11.45	11.73	12.67
Fee waiver			
Waiver	14.02	14.62	16.47
No waiver	9.59	10.08	12.05
Grants			
No grants	9.30	9.79	11.70
<$501	12.08	12.68	14.21
$501-$1,000	10.78	10.98	13.00
$1,00141.500	12.95	13.65	15.86
$1,501-$2,000	18.45	19.13	20.85
$2.001-$2.500	23.71	24.53	26.45
$2.501-$3,000	26.73	27.72	30.32
>$3,000	30.50	31.52	33.85
Total	10.84	11.36	13.29

Note: Total number of students in the study population: N = 156,188. Same college = first and highest credential earned was awarded by the college in which the student first enrolled; scone district = first and highest credential earned was awarded by any college in the same district as the college in which the student first enrolled; any college = first and highest credential earned was awarded by any of the 106 semester-system community colleges, including the college of first enrollment.

Table 2

Rate of Credential Completion and Percentage of Successful Cases Missed When a First-Time Freshman Cohort is Analyzed With Attention to the Community College of First Enrollment, the District of First Enrollment, and Any of the 106 Semester-System Community Colleges

	Same College	Same District	Any College
Number of students who completed a credential	16,925	17,741	20,760
Percentage of students who completed a credential	10.84%	11.36%	13.29%
Number of successful students who are missed	3,835	3,019	=0.00
Percentage of successful students who are missed	18.47%	14.54%	=0.00%

Note: Total number of students in the study population: N = 156,188. Same college = first and highest credential earned was awarded by the college in which the student first enrolled; same district= first and highest credential earned was awarded by any college in the same district as the college in which the student first enrolled; any college = first and highest credential earned was awarded by any of the 106 semester-system community colleges, including the college of first enrollment.

Table 3

Negative Binomial Regression of the Number of Lateral Transfers Between Community Colleges Within Six Years of First Enrollment

Variables	Coefficient	Incidence Rate Ratio	SE
Sex			
Female (vs. male)	-.075 ***	0.928	0.009
Age			
Years	-.029 ***	0.972	0.001
Race			
Black (vs. White)	.318 ***	1.374	0.017
Hispanic (vs. White)	-.165 ***	0.848	0.012
Asian (vs. White)	.081 ***	1.085	0.015
Pacific islander (vs. White)	.040	1.041	0.055
Filipino (vs. White)	-.050 *	0.952	0.025
Native American (vs. White)	-.211 ***	0.810	0.052
Other (vs. White)	-.351 ***	0.704	0.050
Financial Aid			
Receipt of fee waiver (vs. not)	-.024	0.976	0.014
Receipt of a grant (vs. not)	-.163 ***	0.849	0.026
Total value of grants ($1,000s)	-.046 ***	0.955	0.010
Constant	-1.686 ***	--	0.016

Note: Total number of students in the study population: N = 156,188; exposure = duration of attendance.

* p 5 [less than or equal to] .05. *** p [less than or equal to] 5.001.

Table 4

Predicted Number of Lateral Transfers Within Six Years of First Enrollment, by Race/Ethnicity

Race	Predicted Number of Lateral Transfers
White	0.422
Black	0.581
Hispanic	0.358
Asian	0.458
Pacific Islander	0.440
Filipino	0.402
Native American	0.342
Other	0.297

Note: Total number students in the study sample: N= 156,188. Estimates are based on the model presented in Table 3. Predictions are for a female student of mean age and mean duration of attendance who received no fee waiver and no grants in her first year of attendance.

Table 5

Logistic Regression of Credential Completion in the Community College of First Enrollment, the District of First Enrollment, and Any of the 106 Semester-System Community Colleges

Variables	Same College	Same District	Any College
Sex			
Female (vs. male)	0.365 ***	0.368 ***	0.333 ***
	(0.017)	(0.017)	(0.015)
Age			
Years	-0.045 ***	-0.045 ***	-0.049 ***
	(0.001)	(0.001)	(0.001)
Race			
Black (vs. White)	-0.824 ***	-0.794 ***	-0.754 ***
	(0.036	(0.035)	(0.032)
Hispanic (vs. White)	-0.356 ***	-0.353 ***	-0.384 ***
	(0.020)	(0.020)	(0.019)
Asian (vs. White)	0.158 ***	-0.089 ***	-0.112 ***
	(0.028)	(0.027)	(0.025)
Pacific Islander (vs. White)	-0.307 **	-0.299 **	-0.305 ***
	(0.103)	(0.101)	(0.093)
Filipino (vs. White)	0.027	0.040	0.008
	(0.043)	(0.043)	(0.040)
Native American (vs. White)	-0.417 ***	-0.417 ***	-0.485 ***
	(0.087)	(0.086	(0.081)
Other (vs. White)	-0.128	-0.143	-0.251 ***
	(0.076	(0.076)	(0.073)
Financial Aid			
Receipt of fee waiver (vs. not)	-0.083 ***	-0.077 **	-0.086 ***
	(0.026	(0.025)	(0.024)
Receipt of a grant (vs. not)	0.230 ***	0.203 ***	0.167 ***
	(0.042)	(0.042)	(0.040)
Total value of grants ($1,000s)	0.339 ***	0.340 ***	0.327 ***
	(0.015)	(0.015)	(0.015)

Constant	-1.243 ***	-1.209 ***	-0.891 ***
	(0.030)	(0.029)	(0.027)

Note: Total number of students in the study population: N= 156,188. Standard errors are provided in parentheses. Same college = first and highest credential earned was awarded by the college in which the student first enrolled; .same district = first and highest credential earned was awarded by any college in the same district as the college in which the student first enrolled; an-v college = first and highest credential earned was awarded by any of the 106 semester system community colleges, including the college of first enrollment.

** p [less than or equal to] .01. *** p [less than or equal to] .001.

Table 6

Wald Test of Differences Between the Logistic Regression Coefficients of the Three Models Presented in Table 5

Variables	Same College Versus Same District	Same College Versus Any College
Sex		
Female (vs. male)	0.85	15.51 ***
Age		
Years	3.53	39.44 ***
Race		
Black (vs. White)	10.23 ***	14.43 ***
Hispanic (vs. White)	0.55	9.47 **
Asian (vs. White)	66.91 ***	11.59 ***
Pacific Islander (vs. White)	0.11	0.00
Filipino (vs. White)	1.62	0.87
Native American (vs. White)	0.00	3.78
Other (vs. White)	1.41	22.64 ***
Financial Aid		
Receipt of fee waiver (vs. not)	0.91	0.08
Receipt of a grant (vs. not)	6.64 **	11.31 ***
Total value of grants ($1,000s)	0.05	3.64

Variables	Same District Versus Any College
Sex	
Female (vs. male)	25.23 ***
Age	
Years	83.31 ***
Race	
Black (vs. White)	6.36 *
Hispanic (vs. White)	14.94 ***
Asian (vs. White)	4.55 *
Pacific Islander (vs. White)	0.02
Filipino (vs. White)	3.32
Native American (vs. White)	5.09 *
Other (vs. White)	22.92 ***
Financial Aid	
Receipt of fee waiver (vs. not)	0.75
Receipt of a grant (vs. not)	5.32 *
Total value of grants ($1,000s)	6.49 *

Note: Same college = first and highest credential earned was awarded by the college in which the student first enrolled; same district = first and highest credential earned was awarded by any college in the same district as the college in which the student first enrolled; any college = first and highest credential earned was awarded by any of the 106 semester-system community colleges, including the college of first enrollment.

* p [less than or equal to] .05. ** p [less than or equal to] .01. *** p [less than or equal to] .001.

Table 7

Exaggeration or Suppression (Due to Lateral Transfer) of Observed Differences in the Likelihood of Credential Completion Under the Single-College and Single-District Analytical Frameworks

Disadvantage or Advantage in the Likelihood of Credential Completion	Analytical Framework: Same College	Same District
Sex		
Advantage for females (vs. males)	Exaggerated	Exaggerated
Age		
Disadvantage for older students (vs. younger)	Suppressed	Suppressed
Race		
Disadvantage for Blacks (vs. Whites)	Exaggerated	Exaggerated
Disadvantage for Hispanics (vs. Whites)	Suppressed	Suppressed
Disadvantage for Asians (vs. Whites)	Exaggerated	Suppressed
Disadvantage for Pacific Islanders (vs. Whites)	No difference	No difference
No disadvantage or advantage for Filipinos (vs. Whites)	No difference	No difference
Disadvantage for Native Americans (vs. Whites)	No difference	Suppressed
Disadvantage for "Other" race or ethnicity (vs. Whites)	Suppressed	Suppressed
Financial aid		
Disadvantage for recipients of fee waiver (vs. none)	No difference	No difference
Advantage for recipients of grants (vs. none)	Exaggerated	Exaggerated
Advantage for high-value grants (vs. low-value)	No difference	Exaggerated

Note: Exaggerated means that the difference in the likelihood of credential completion between these two groups is overestimated under this analytical framework, relative to the systemwide analytical framework. Suppressed means that the difference in the likelihood of credential completion between these two groups is underestimated under this analytical framework, relative to the systemwide analytical framework. No difference means that there is no significant difference in the estimated likelihood of credential completion between this analytical framework and the systemwide analytical framework.

Table 8

Negative Binomial Regression of a Modified Measure of Number of Lateral Transfers That Ignores Any Return Transfers Back to the Initial College of Enrollment

	Coefficient		Incidence Rate Ratio	SE
Sex				
Female (vs. male)	-0.087	***	0.916	0.009
Age				
Years	-0.027	***	0.973	0.001
Race				
Black (vs. White)	0.351	***	1.421	0.016
Hispanic (vs. White)	-0.173	***	0.841	0.011
Asian (vs. White)	0.044	**	1.045	0.015
Pacific Islander (vs. White)	0.045		1.046	0.052
Filipino (vs. White)	-0.087	***	0.917	0.024
Native American (vs. White)	-0.224	***	0.799	0.052
Other (vs. White)	-0.368	***	0.692	0.050
Financial Aid				
Receipt of fee waiver (vs. not)	-0.022		0.978	0.013
Receipt of a grant (vs. not)	-0.139	***	0.870	0.026
Total value of grants ($1,000s)	-0.074	***	0.929	0.011
Constant	-1.881	***	--	0.015

Note: Total number of students in the study population: N = 156,188; exposure = duration of attendance.

** P [less than or equal to] .01. *** P [less than or equal to] .001.

Educational Master Plan

Information Submission Form

1) Title: UC SAN DIEGO RECEIVES 53,000 FRESHMAN AND 17,000 TRANSFER APPLICATIONS...

2) Author: Christine Clark

3) Source: States News Service Article date: January 20, 2011

4) Taxonomy Area:

- [ ] Society
- [ ] Technology
- [ ] Economy
- [ ] Environment
- [ ] Politics and Legal Issues
- [x] Education
- [ ] Other: ____________

5) Relevance: Transfer

6) Page / Section: ____________

7) Link to document: ____________

<u>or</u>

8) Attach Document Here: [ ]

UC SAN DIEGO RECEIVES 53,000 FRESHMAN AND 17,000 TRANSFER APPLICATIONS FOR FALL 2011 UNIVERSITY RECEIVES SECOND HIGHEST NUMBER OF APPLICATIONS IN THE UC SYSTEM.

Article from: **States News Service** Article date: **January 20, 2011**

LA JOLLA, Calif. -- The following information was released by the University of California - San Diego:

By Christine Clark

The University of California, San Diego has received 70,474 freshman and transfer applications for Fall 2011, the second highest number of applications received by a UC campus.

Freshman applications were up 12.1 percent with a total of 53,455 applicants. Transfer student applications showed an increase again this year, up 19.9 percent from 2010 with a total of 17,019 applications, reflecting a record number of applications from both transfer and freshmen students. The mean high school grade point average (GPA) is a 3.77; the average GPA among transfer students is 3.29.

"We are pleased to receive a record number of applications from students with such outstanding academic qualities," said Chancellor Marye Anne Fox. "As our outreach efforts continue to attract more talented first-generation and underrepresented students, we are concerned about the persistent decline in state funding for higher education and how it will affect access for our prospective hard-working and promising students."

Gov. Brown's recent budget proposal cuts $500 million from the University of California budget. In response, a letter from UC President Mark Yudof stated "the collective tuition payments made by University of California students for the first time in history would exceed what the state contributes to the system's general fund." He continued, "All of this comes at a time when more California students than ever are applying to attend a University of California campus. My hope is that going forward, Californians will begin to ponder the implications of declining state support for their university."

Diverse applicants continue to increase among freshmen and transfer students. Data for UC San Diego freshman applications of underrepresented students for Fall 2011 show a 27.4 percent increase. A total 2,192 African-American freshmen (up 12.8 percent from 1,943 last year) applied along with 620 African-American transfers (up 16.8 percent from 531 in Fall 2010). Applications from Latinos surged this year, with 10,780 applicants from freshmen (up 31.8 percent from 8,176 last year) and 2,917 applications from transfers (up 48.5 percent from 1,964 in Fall 2010).

The increase of underrepresented applicants can be attributed to UC San Diego's numerous outreach efforts, noted Mae Brown, assistant vice chancellor for Admissions and Enrollment Services. In addition, UC San Diego has developed several programs to attract first-generation and low-income students. Preliminary applications data shows that more first-generation and low-income freshmen and transfer students applied for Fall 2011.

Brown noted the impressive growth among transfer applicants is a reflection of UC San Diego's diligent work to recruit students from California's community colleges. "UC San Diego has been working with our community college partners to broaden our outreach and service to transfer students," she said. "More than 90 percent of our transfer students come from the community colleges in California. UC San Diego is dedicated to recruiting transfer students as they bring a real-world perspective to our diverse student body."

The University of California received a record number of applications for admission to the Fall 2011 term. Overall application volume for Fall 2011 admission increased by 6.1 percent over Fall 2010 (from 134,029 to a record high of 142,235), which includes a 5.7 percent increase (from 100,320 to 106,070) at the freshman level, and a 7.3 percent increase (from 33,709 to 36,165) at the transfer level.

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GROSSMONT-CUYAMACA
COMMUNITY COLLEGE DISTRICT

Education Master Plan
Information Submission Form

The GCCCD is starting a year-long process to develop an Educational Master Plan that will serve as the blueprint for our future. The Educational Master Plan is a long-range, comprehensive document intended to guide institutional and program development at both the college and district levels. The priorities established in the Educational Master Plan will serve to guide College and District decisions about growth, development and resource allocation.

As the first step in this planning process, everyone in the GCCCD community (faculty, staff, students and community members) are invited to identify and submit information sources to be reviewed for the trend analysis in one of six taxonomy areas - society, technology, economy, environment, politics, and education. We are not asking you to do new research - only to identify information you already have or that you encounter during the search period (March 21 - April 25) and bring it to the attention of the Scan Teams for review.

Please feel free to submit as many of these forms as you would like. Please answer the following questions for each submission:

1) What is the document we should review? : Considering the Future: Trends in Distance Education

2) Author: Distance Education University - no specific author named

3) Source: http://www.distanceeducationuniversitye.com/considering-the-future-trends-in-distance-education.html

4) Which of the following taxonomy areas does it fit into? (Please select only one):

- ☐ Society
- ☐ Technology
- ☐ Economy
- ☐ Environment
- ☐ Politics and Legal Issues
- ☒ Education
- ☐ Other:

5) Relevance: Discusses future trends in distance education

6) Page / Section:

7) **Add Attachment/Hyperlink Here**: http://www.distanceeducationuniversitye.com/considering-the-future-trends-in-distanc

To attach a document use **Tools-Comments and Markups-Attach A File As A Comment**

Submit *this document by scrolling to the top of the page and clicking on the Submit button at the top right corner. You cannot print once the document is submitted.*

Questions: lynne.davidson@gcccd.edu *Research, Planning and Institutional Effectiveness*

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GROSSMONT-CUYAMACA
COMMUNITY COLLEGE DISTRICT

Education Master Plan
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Please feel free to submit as many of these forms as you would like. Please answer the following questions for each submission:

1) What is the document we should review? : UCSD policy limits community college students Raising GPA requirement to 3

2) Author: By Pat Flynn

3) Source: San Diego Union Tribune

4) Which of the following taxonomy areas does it fit into? (Please select only one):

- ☐ Society
- ☐ Technology
- ☐ Economy
- ☐ Environment
- ☐ Politics and Legal Issues
- ☒ Education
- ☐ Other:

5) Relevance: The raising of GPA requirement will make it more challenging for our students to TAG into a UC university.

6) Page / Section: entire article

7) **Add Attachment/Hyperlink Here**: http://www.signonsandiego.com/news/2011/mar/18/ucsds-new-transfer-standard-roils

To attach a document: ***Reader 9:*****Tools-Comments and Markups-Attach A File As A Comment**
Reader X: Comment (upper right), select paper clip icon under Annotations

Questions: lynne.davidson@gcccd.edu *Research, Planning and Institutional Effectiveness*

Educational Master Plan

Information Submission Form

1) Title: Don't Stop Thinking About the Future

2) Author: Barbara Kaufman

3) Source: www.universitybusiness.com (feb 2011)

4) Taxonomy Area:

- [ ] Society
- [ ] Technology
- [ ] Economy
- [ ] Environment
- [ ] Politics and Legal Issues
- [x] Education
- [ ] Other: __________

5) Relevance: Budget issues

6) Page / Section: 45-48

7) Link to document: __________

or

8) Attach Document Here:

Don't Stop Thinking About the Future

Surviving budget cuts to keep professional development and the institutional mission moving forward.

By Barbara Kaufman

WITH FURLOUGHS, LAYOFFS, AND slashed budgets becoming a "business as usual" occurrence in higher education, professional development is taking a hard blow. In some cases, it has been dramatically cut or eliminated for the foreseeable future. Yet, even in these trying times, a few proactive leaders have found new tools and creative tactics to keep people learning and growing. They are energizing their teams and raising morale with minimal expense. By providing opportunities to achieve in ways that advance the institution, the team, and the individual, they keep employees connected and committed to the mission and to making a difference.

Leveraging Technology

Technology offers a cost-effective way to engage employees in continuous learning. "In the past, our system-wide office used to travel to campuses and deliver professional development seminars," says Gail Brooks, vice chancellor of human resources for **California State University** (CSU). "Now we deliver information via highly interactive webcasts specifically geared to HR professionals. People across campuses can hear the information simultaneously and share their best practices while enhancing their skills. We've had very high marks for these webcasts and they've kept interest high. A virtual lobby allows people to exchange information before or after the webcast or participate in online polling." The webcasts are converted into e-learning and kept available on the web as just-in-time information. Similarly, CSU's academic support staff used to hold annual in-person conferences, but are now conducting many of their conferences on the web using interactive technology.

ACE's Office of Women in Higher Education (OWHE) understands the need to offer cost-effective ways to provide professional development opportunities for its members. ▶

Don't Stop Thinking About the Future

Karen Haynes, president of **California State University, San Marcos**, and presidential sponsor of the Southern California region for ACE OWHE, worked with two other women to create webinars for nationwide delivery. "Rather than holding one conference a year, we can now provide two or three mini-conferences every semester," says Haynes.

Creating Synergy

The challenge of dealing with California's budget crisis has prompted innovative "synergy projects" at CSU that encourage campus administrators to partner with each other. This has led to both cost savings and new professional development opportunities. Shawn Bibb, vice president of administration and finance/CFO at **California State University, East Bay**, explains, "CSU's 23 campuses work independently under the guidance of the Chancellor's office and don't usually share resources. We sought out expertise, experience, resources, and excess capacity on other campuses we could import to CSUEB. **San Jose State University**, for instance, has its own cogeneration plant and a great deal of expertise in energy management and conservation. The corresponding department on our campus consists of only one employee whose role is limited to program management. Applying San Jose State's expertise to CSUEB is allowing us to develop one effective program across campuses. In the process, our energy manager is gaining exposure to San Jose State's best practices and methods and has grown in her role." While San Jose State University is ahead in energy management, CSUEB has greater expertise in environmental health and safety, which will be leveraged at San Jose State to help it grow its own EHS program.

A welcome way to create "white space" on a busy leader's calendar is to delegate tasks to direct reports that provide them with portfolio-building opportunities.

In another synergy project, CSUEB collaborated with **California State University, Northridge** to pilot a virtual computing lab. They are scheduled to close 20 of the 60 computing labs at CSUEB by the end of this June, at a savings of $225K a year, and the project offered innovative opportunities for IT staff to design and implement this virtual lab. John Charles, CSUEB's chief information officer, says, "We expect that as other campuses observe our efforts, they will also want to participate and share in the savings and professional development opportunities for staff."

"Although every campus tends to believe it has its own systems and processes, they all have administrative work that is transactional," says Mohammad Qayoumi, CSUEB's president. "Through synergy projects, employees can build their portfolios by enhancing their core competencies. This means they have to be willing to leave their comfort zone and think out of the box to change their paradigms."

At the **University of California**, too, campuses are sharing best practices, especially around cost control. "We initiated a payroll project, for example, because we have at least 10 divergent approaches to payroll," says Dwaine Duckett, vice president of human resources for the system. "Twenty administrators from our campuses met to brainstorm how to adopt common practices related to automation and the need to provide training if a new approach is adopted. It is also a portfolio-building opportunity for the administrators to have this type of enterprise systems implementation experience under their belts." The exchange of information and practices will defintitely poise the project for success.

Sharing Services

Several years ago, CSUEB moved from an embedded IT team structure in each college to a shared services model, an effort that saved money and provided professional development opportunities. "Specifically, many of our IT professionals had never worked in a shared services model," says Charles. "They had to learn to be held accountable by a professional IT manager and also received mentoring. Further, when the new shared services team began comparing best practices, they were shocked to learn that some of them had more innovative practices and more effective tools than others. This was quite a learning experience."

Another level of learning: All 100 IT staff were sent to ITIL (Information Technology Infrastructure Library) certification training, Charles says. "The training introduced them to a set of best practice standards for delivering services. While many of the IT staff had computer science degrees and on-the-job experience, they had had little professional training. Passing the certification test was a life-changing experience and a source of pride for many."

Making the Best of Limited Travel Budgets

At UC, all out-of-state travel has to be approved at the vice president level, and even travel within the state gets scrutiny if it exceeds $500. "However, local travel is not an issue and we have many hot beds of training and development activity on campuses," says Duckett. "In HR, conference attendance and travel are restricted to one or two events a year. The approach is judicious, ensuring that the learning experience is linked to a strategic objective. For example, my conference attendance this year will be limited to benefit and pension program design, which ties in with one of HR's strategic objectives."

CSUSM remains committed to semiannual working retreats for the senior team, but limits travel. "The retreats provide individual professional development and help us develop as a team so we can work together more effectively," says Haynes. "The sessions always focus on moving the university forward, keeping up the energy and creating synergy on the campus even when the financial outlook is dismal. We reexamine our strategic priorities and discover ways to utilize communication strategies and tools more effectively."

Delegating for Portfolio Building

A welcome way to create "white space" on a busy leader's calendar is to delegate tasks to direct reports that provide them with portfolio-building opportunities. "I give people new challenges that require research and keep them engaged as they learn to perform tasks outside their daily routines," says Brooks.

Haynes strategically delegates the delivery of core messages that represent development opportunities and portfolio building for her senior team while increasing her own productivity. "The president is not the only one who can address the external community," she says. "For example, we've developed a basic university message to service organizations like Rotary and AAUW that can give vice presidents and deans presentation skills and visibility."

As part of this strategy, CSUSM has created a unique "Chamber of Champions." "The institution joined 11 regional city chambers of commerce," explains Haynes. "We asked for faculty and management volunteers to be spokespersons to chambers and the university's eyes and ears at chamber meetings. Every year about 60 people have eagerly volunteered, which has greatly expanded our visibility in the region and proven effective in developing skills and commitment among our ambassadors."

Low-Cost and No-Cost Creative Ways to Learn and Work

California's severe budget crisis has forced state-funded institutions to implement staff furloughs of two days per month.

"One way to continue to deliver our services on limited staff schedules was to put academic advising, tuition payment, scheduling meetings, and getting help with financial aid online, which students prefer anyway," says Bibb. "The campus is also moving toward more online classes, for which there is a huge demand. Our staff has to learn new technical skills to deliver services online rather than face to face. They have to plan, and planning always improves the end product. In the process, staff members also gain a better awareness of how their jobs impact the campus and individual students." ▶

Don't Stop Thinking About the Future

"Despite the fact that we have a number of fiscal and finance challenges, the university and the president are convinced that we have to continue to invest in human capital," says Duckett. "In particular, with regard to training and development, we want to develop our next generation of leaders and to ensure great employees report to great managers and leaders. Therefore, we are creating a new generation of training experiences, one of which is the Business Officers Institute, which just ran in November. It was totally revamped to reflect managing in today's complex environment at UC. The president's Leadership Series and Academy will also begin later this winter. It will emphasize building a greater service orientation and leadership competencies for administrative leaders at the Office of the President."

At its senior leadership retreats, CSUSM has used mind mapping—a nonlinear process for generating ideas—in two ways.

"We used the technique prospectively to examine issues and create strategies going forward," says Haynes. "We explored how different constituencies—such as student affairs professionals, faculty, facilities staff, or alumni—would view an issue differently. This allowed us to create a multi-step communication strategy, for example, to target messages about the university's budget to different stakeholders. We also used mind mapping retrospectively to do a post-mortem on a less than successful course of action."

Also at CSUSM, 25 people from across campus participate each year in a nine-month "Campus Connect" program, which resembles in purpose and structure a city leadership program.

"They spend six hours one Friday a month looking at the university from a 30,000-foot view," says Haynes. "This makes them wonderful internal ambassadors as they network and meet new colleagues across the university. It's not traditional professional development, but it certainly is an effective way to educate people about the breadth of the institution."

CSUSM has also created a leadership academy for middle managers—a year-long, one-day-a-month, internally delivered training program—which builds talent, keeps commitment high and generates excitement. In addition, specific middle managers participate in a highly directed mentoring program. "We clearly identified a set of tasks these individuals could learn to enhance their experience base and repertoire of skills," says Haynes.

Why Professional Development? Why Now?

Effective leaders understand that they have to build for the future even as they are slashing budgets. It is not an either/or proposition.

"Bad economic times are precisely the time when you need to enhance development opportunities," says Brooks. "There are more demands on employees, fewer resources, more uncertainty and more stress as people take on increased responsibilities when we don't fill positions. It can decrease an employee's sense of self when they feel that an organization does not invest resources in their development. Today, most U.S. organizations are people intensive. In fact, 85 percent of our budget goes to payroll. When we enable our employees to be maximally proficient, and when we help them grow so they can move into positions of greater responsibility and authority, the organization benefits."

When professional development takes a back seat, serious unintended consequences can take root and grow. One is turnover. "The best and the brightest" talent no longer believe their career aspirations are achievable and they are likely to look for greener pastures. This in turn affects morale since, often, these positions are not filled. The work is incorporated into the portfolios of those who remain, who are already feeling overworked due to hiring freezes and layoffs.

Uncertainty about the future also engenders a short-term tactical focus that inhibits employees from taking risks and trying new ways to approach challenges and opportunities. They become risk averse and security driven while administrative leaders are asking for innovation and creativity to slay "sacred cows." Actively and energetically planning for the future is no longer a top priority.

Finally, people find it difficult to maintain a sense of loyalty or affiliation when they question whether the institution really cares about them. In the current economic climate, low-cost or no-cost professional development is a vital strategy to keep employees growing in their professional lives and to keep everyone committed and focused on building for the future. U

Barbara Kaufman is president of ROI Consulting Group, Inc. (www.roiconsultinggroup.com). An executive coach and educator, she specializes in leadership effectiveness and organizational development strategies for private and public sector leadership teams and boards. Contact her at drbarbkaufman@earthlink.net.

SUGGESTED READING LIST

Managing Oneself (Harvard Business Review Classics), by Peter F. Drucker. Harvard Business School Press, 2008.

"Success that Lasts," by Laura Nash and Howard Stevenson. HBR OnPoint Enhanced Edition, April 1, 2004. *Harvard Business Review*, Product #659X.

"Beware the Busy Manager," by Heike Bruch and Sumantra Ghoshal. *Harvard Business Review*, February 2002, Reprint #R0202D.

The Mind Map Book: How to Use Radiant Thinking to Maximize Your Brain's Untapped Potential, by Tony Buzan with Barry Buzan. Plume, 1996.

Resonant Leadership: Renewing Yourself and Connecting with Others Through Mindfulness, Hope and Compassion, by Richard E. Boyatzis and Annie McKee. Harvard Business School Press, 2005.

"How Leaders Create and Use Networks," by Herminia Ibarra and Mark Hunter. *Harvard Business Review*, January 2007, Reprint R0701C.

A Sense of Urgency, by John P. Kotter. Harvard Business School Press, 2008.

Educational Master Plan

Information Submission Form

1) Title: What Students Really Need to Learn

2) Author: Lynne Munson

3) Source: E d u c a t i o n a l L e a d e r s h i p / Ma r c h 2 0 1 1

4) Taxonomy Area:

- [ ] Society
- [ ] Technology
- [ ] Economy
- [ ] Environment
- [ ] Politics and Legal Issues
- [x] Education
- [ ] Other: ______

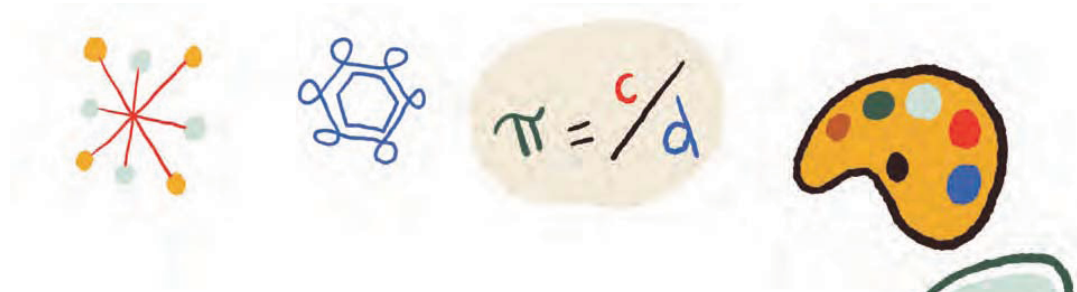
5) Relevance: Program development/Curriculum/College prep

6) Page / Section: 10-14

7) Link to document: ______

or

8) Attach Document Here:



What Students *Really* Need to Learn

Top-performing nations set their instructional sights on far more than basic reading and math skills.

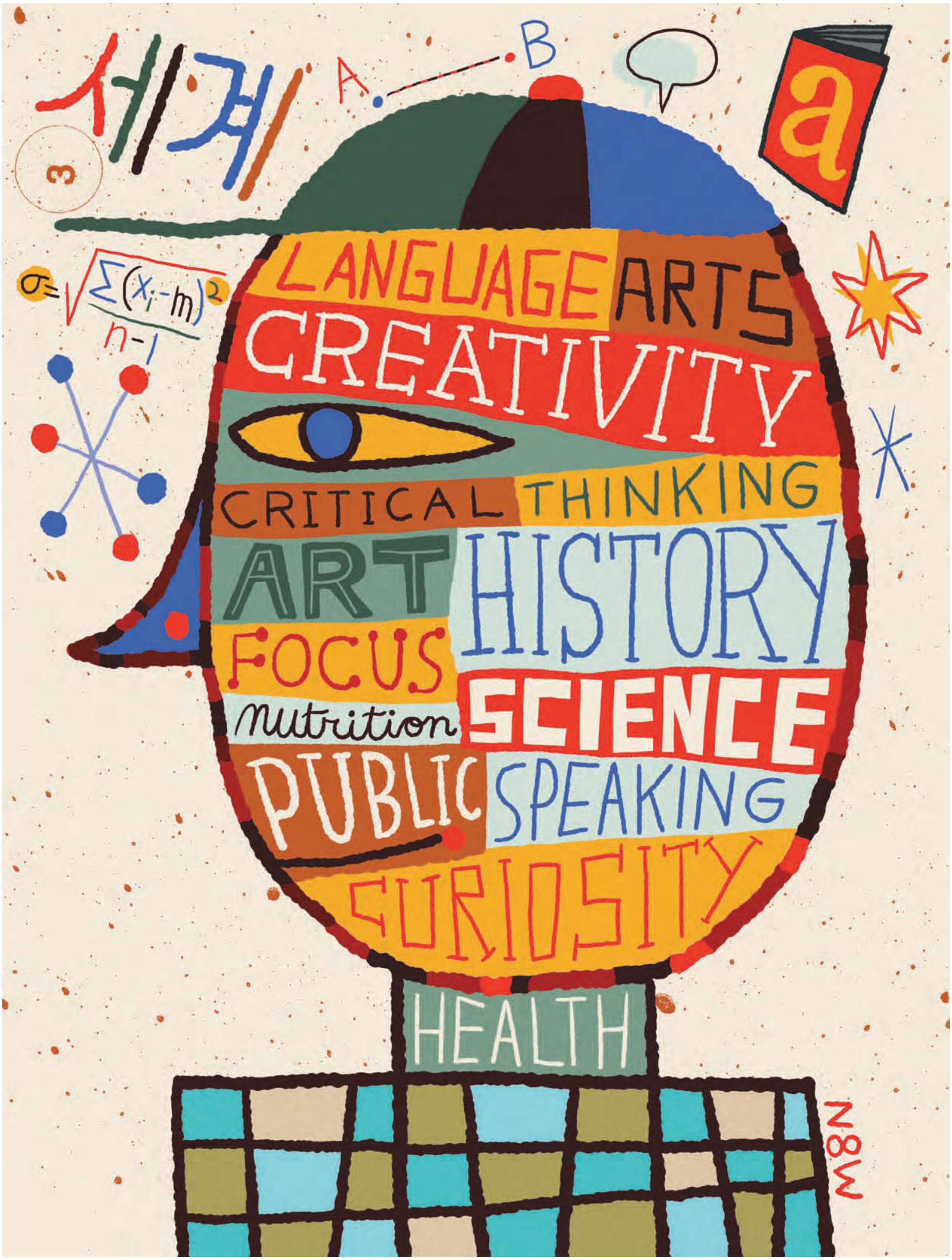
Lynne Munson

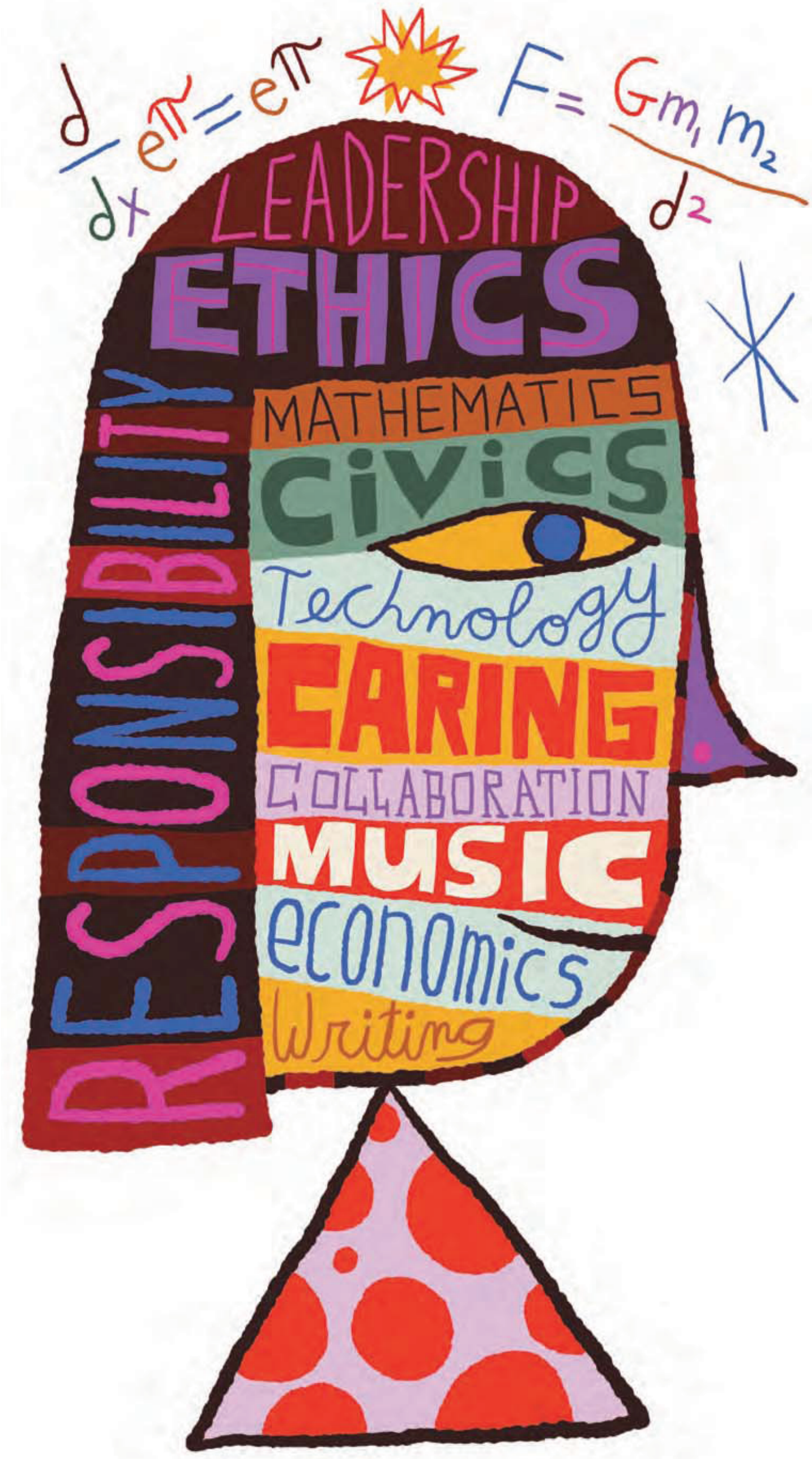
Students in the United States rank 17th in the world in reading, 23rd in science, and 31st in mathematics on the 2009 Programme for International Student Assessment (PISA). Our betters in math include Slovakia, Hungary, and Poland. Meanwhile, our economic competitors turn in performances that rank them at the top of global student achievement tests. We're far behind China, Singapore, Canada, Australia, and Japan—and we're increasingly aware of it.

Most U.S. researchers have reacted to these scores by zealously examining the country's education structures. Studies and reports abound on such topics as standards and testing, class and school sizes, and professional development. Both our data systems and our professional development do need improving. But such structural improvements alone appear unlikely to reverse the course of the United States' education decline.

When Learning Expands

We at the nonprofit research organization Common Core (not to be confused with the Common Core State Standards) spent a year looking into whether the United States' mediocre standing on international comparison tests is due to differences in the content that various nations teach (2009). We concentrated on nine nations that consistently outrank the United States on PISA: Finland; Hong Kong (a territory); South Korea; Canada; Japan; New Zealand; Australia; the Netherlands; and Switzerland.


세계
A
B
a
3
$\sigma = \sqrt{\frac{\Sigma(x_i - m)^2}{n-1}}$
LANGUAGE ARTS
CREATIVITY
CRITICAL THINKING
ART HISTORY
FOCUS
nutrition
SCIENCE
PUBLIC SPEAKING
CURIOSITY
HEALTH



There appears to be little agreement among these nations about what has become the United States' most recent education obsession—standards and testing. Some high-performing nations have national standards, but some do not. Some test at the state level, some at the national level. Some of those tests are tied to important outcomes, but some are not. This is not surprising, considering that these high-performing nations span four continents, embrace vastly different forms of government, and boast very different demographics and cultural traditions. Educationally and otherwise, the nations have little in common—which makes the one similarity we did find stand out so prominently: The nations whose students score at the top of international education tests share a dedication to providing their students with a comprehensive education across the liberal arts and sciences.

In nearly all of the top-performing nations, the study of the arts, literature, history, geography, civics, reading, science, foreign language, and mathematics is compulsory. Meanwhile, students in only three U.S. states are required to take a foreign language to graduate from high school (Education Commission of the States, 2007). A perusal of the official curriculums, standards, and examinations used in these nations illustrates both the breadth and depth of top nations' dedication to educating their students across the liberal arts. Here are some examples of what other countries are asking their students—both in standards and on national, state, and provincial examinations—to know and be able to do:

■ To meet the learning objectives in the visual arts national curriculum framework, 4th graders in Hong Kong visit an artist's studio, study Picasso's *Guernica*, and analyze the works of modernist sculptor Henry Moore.

■ Finnish 5th and 6th graders

are required to study the effects of the French Revolution and how the invention of writing changed human life; they trace a topic, such as the evolution of trade, from prehistory until the 19th century.

- Seventh graders in South Korea are expected to know not just about supply and demand, but also about equilibrium price theories, property rights, and ways to improve market function.
- Japanese 7th to 9th graders conduct experiments to find out that pressure is related to the magnitude of a force and the area to which the force is applied.
- Eighth graders from the Canadian province of Ontario are expected to create musical compositions, conduct a group of musicians, and know musical terms in Italian.
- Dutch 12th graders must know enough about seven events connected to the Crimean War to be able to put them in chronological order.
- Canadian 12th graders in British Columbia are expected to identify the poet who wrote, "Thou art slave to fate, chance, kings, and desperate men" and understand what U.S. Admiral Nimitz meant when he said, "Pearl Harbor has now been partially avenged."
- On a Swiss examination, 12th graders write an essay analyzing John F. Kennedy's October 1962 proclamation that led to the Cuban Missile Crisis.

You simply cannot put events in the Crimean War in chronological order without a deep knowledge of that conflict or analyze Kennedy's October 1962 proclamation without a thorough understanding of communism and the Cold War.

When Learning Contracts

While students in high-performing countries read literature, do chemistry experiments, make music, and delve into important historical topics, U.S. students spend countless hours preparing to take tests of their basic reading and math skills. No Child Left Behind (NCLB) is not the only culprit. In recent years, NCLB's intense focus on reading and math skills has dumbed down the curriculum, but so have trends such as the 21st century skills movement, which promotes teaching students skills like entrepreneurship and being media savvy in a manner that is disconnected from content of any significance.

Cognitive scientists have long recognized that the key to acquiring knowledge and mastering skills is to possess a considerable amount of background knowledge (Willingham, 2009b). Yet in the United States, we consistently devalue content mastery as a solution to raising student achievement, asserting that mastery of basic reading and math skills is our top education priority. When asked, "What book should students read?" too often in the United States we answer, "Any book, just as long as they learn to read!"

But reading and knowledge acquisition are not independent—they are intertwined. When we fail to teach students all subjects, their ability to read falters. Cognitive scientists like Daniel Willingham at the University of Virginia's Department of Psychology argue that teaching content is teaching reading. Prior knowledge across subjects enables students to comprehend. According to Willingham (2009a),

> Remarkably, if you take kids who score poorly on a reading test and ask them to read on a topic they know something about (baseball, say, or dinosaurs) all of a sudden their comprehension is terrific—better than kids who score well on reading tests but who don't know a lot about baseball or dinosaurs.

No nation that scores competitively on the PISA exam puts skills before content or focuses chiefly on reading and math.

Learning from the Best

As reauthorization of the Elementary and Secondary Education Act (ESEA) approaches, the federal government should hold states accountable for providing comprehensive, high-quality liberal arts education. As currently written, ESEA requires states to care for little beyond basic reading and math skills.

Common Core (the organization) advocates a renewed focus on content knowledge and warns against overemphasis on skills alone. Requiring states to adopt rigorous prekindergarten through 12th grade standards in a wider range of subjects—including the arts, history, foreign language, and civics—would broaden ESEA's emphasis. This also would encourage states to build arts and foreign language programs, rather than making them the first on the chopping block when times are tough.

When we fail to teach students all subjects, their ability to read falters.

The national education standards in the United States ensure that states will revamp their assessments. Forty-three states and the District of Columbia have adopted the Common Core State Standards, setting high expectations for all students. But the standards will mean little if implemented ineffectively. As the standards themselves state,

> Standards are not curriculum. This initiative is about developing a set of standards that are common across states. The curriculum that follows will continue to be a local responsibility. (Common Core State Standards Initiative, n.d.)

As teachers align their curriculums to meet the Common Core State Standards, states and districts should use this opportunity to provide and promote content-rich learning material that will ensure that students acquire the necessary base of knowledge to reach the expectations that the standards set forth.[1]

Content Is Key

More and more research is emerging to suggest that we need to make the *content* of education the centerpiece of discussions about education reform. Two studies by ACT have shown that students benefit most from an education that is both broad and deep.

Mind the Gaps (ACT, 2010) found that students are more likely to earn a *B* or higher in their first-year college courses in every subject tracked—from English to calculus to American history to biology—when they have taken a rigorous core curriculum in high school. Students who have taken a challenging core curriculum are less likely to drop out or need remediation. This reinforces ACT's 2006 finding: Students who take a core curriculum in high school, including four years of English and three years each of mathematics, science, and social studies, achieve higher ACT scores than those who do not, regardless of gender, family income, or ethnic background.

Far more research should be conducted into the relationship between education content and student achievement. The U.S. Department of Education's Institute for Education Sciences has begun good work in this area through its What Works Clearinghouse. Grover "Russ" Whitehurst (2009), former director of the Institute for Education Sciences and now a senior fellow at the Brookings Institution, recommends that the federal government fund many more comparative effectiveness trials of curriculums and other interventions. Moreover, he points out that states and districts should be supported in choosing curriculums that have demonstrated effectiveness.

First Things First

Every day, the United States seems to move closer to a skill-based, content-free approach to education. Class time once devoted to social studies and art has ceded to more study of reading and math. And our approach to teaching reading has lost to a considerable degree a focus on literature and quality nonfiction.

No nation that scores competitively on the PISA exam puts skills before content or focuses chiefly on reading and math. We must join our desire to compete with other nations with a willingness to learn from them. EL

[1]The nonprofit research organization Common Core has developed a content-rich curriculum map that is shaped around the new Common Core English Language Arts standards. The map is available to the public at www.commoncore.org.

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GROSSMONT-CUYAMACA
COMMUNITY COLLEGE DISTRICT

Education Master Plan
Information Submission Form

The GCCCD is starting a year-long process to develop an Educational Master Plan that will serve as the blueprint for our future. The Educational Master Plan is a long-range, comprehensive document intended to guide institutional and program development at both the college and district levels. The priorities established in the Educational Master Plan will serve to guide College and District decisions about growth, development and resource allocation.

As the first step in this planning process, everyone in the GCCCD community (faculty, staff, students and community members) are invited to identify and submit information sources to be reviewed for the trend analysis in one of six taxonomy areas - society, technology, economy, environment, politics, and education. We are not asking you to do new research - only to identify information you already have or that you encounter during the search period (March 21 - April 25) and bring it to the attention of the Scan Teams for review.

Please feel free to submit as many of these forms as you would like. Please answer the following questions for each submission:

1) What is the document we should review? : Dictating to the Schools

2) Author: Diane Ravitch

3) Source: Virginia Journal of Education

4) Which of the following taxonomy areas does it fit into? (Please select only one):

- ☐ Society
- ☐ Technology
- ☐ Economy
- ☐ Environment
- ☒ Politics and Legal Issues
- ☒ Education
- ☐ Other:

5) Relevance: Keeping educational focus clear of politics to maximize the affect of education

6) Page / Section: Paragraphs 16,17,18, & 19

7) **Add Attachment/Hyperlink Here**: http://www.veanea.org/vea-journal/1011/Nov10-ravitch.html

To attach a document use **Tools-Comments and Markups-Attach A File As A Comment**

Submit *this document by scrolling to the top of the page and clicking on the Submit button at the top right corner. You cannot print once the document is submitted.*

Questions: lynne.davidson@gcccd.edu *Research, Planning and Institutional Effectiveness*

Educational Master Plan

Information Submission Form

1) Title: Teaching the iGeneration

2) Author: Larry D. Rosen

3) Source: EDUCATIONAL LEADERSHIP/FEBRUARY 2011

4) Taxonomy Area:

- ☐ Society
- ☐ Technology
- ☐ Economy
- ☐ Environment
- ☐ Politics and Legal Issues
- ☑ Education
- ☐ Other: ______

5) Relevance: teaching trends/strategies/tech. in the classroom

6) Page / Section: 10-15

7) Link to document: ______

or

8) Attach Document Here: [ ]

Teaching the

Our children and youth are immersed in technologies that give them opportunities no previous generation has enjoyed. How will schools respond?

Larry D. Rosen

Some weeks ago, I attended a family reunion where the children ranged from age 10 to 18. As we were all talking, someone asked a question about a specific movie. Immediately, every kid pulled out a smartphone, and within 30 seconds they all had answers. Some went straight to the Internet Movie Database (using a smartphone app, of course); two quickly searched Yahoo! for movie reviews; others went to their favorite sites to sample public opinion.

I've seen adults do something similar and gloat about

iGeneration

how Internet-savvy they are and how fast their smartphones navigate cyberspace. But each and every kid acted like this practice was commonplace.

A few days later, I had another enlightening experience. A colleague's 7-year-old son, Mikey, has his own iPad courtesy of his grandpa. A week ago, he was visiting our lab and wanted to print something from his iPad. His dad said that he would have to wait until he got home because although our new printer had Bluetooth access, nobody had yet figured out how to make it work. Mikey got to work and had his document printing in 10 minutes.

My colleague told me that when the family decided to upgrade the computer operating system at home, Mikey volunteered to do it. In an hour, all the laptops in the house had the new operating system. I could go on and on about Mikey's prowess, but his dad assures me that he is just like all his friends; although he's smart, his comfort and ease in using technology are nothing special.

One last story, about an even younger child. I was at a restaurant the other night and watched a mom hand her

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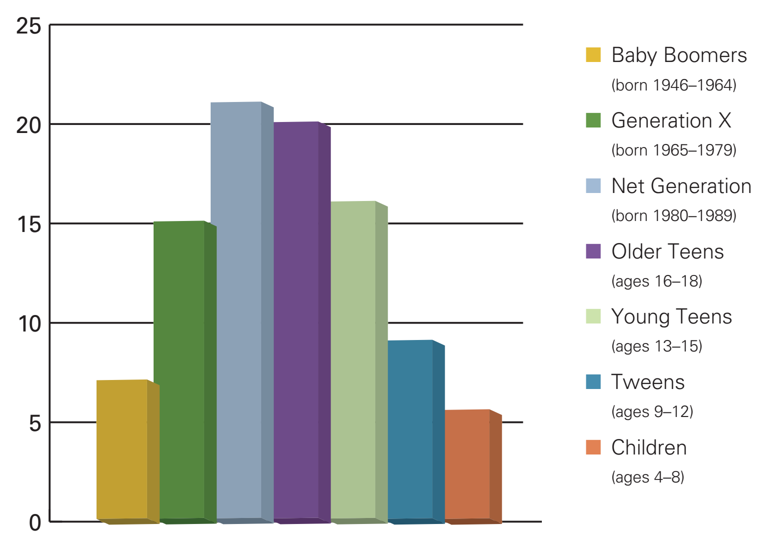
daughter her iPhone to keep her occupied. The mom later told me that she expected 3-year-old Brittani to play one of several built-in games, as she had done a couple of times before. To her surprise, Brittani asked whether she could download a game from the app store. When her mom said yes and showed her the link, she tapped the icon, watched the game load, and without hesitation began playing.

These stories give me hope for our current and future generations of learners. To them, the smartphone, the Internet, and everything technological are not "tools" at all—they simply *are*. Just as we don't think about the existence of air, they don't question the existence of technology and media. They expect technology to be there, and they expect it to do whatever they want it to do. Their WWW doesn't stand for World Wide Web; it stands for Whatever, Whenever, Wherever.

FIGURE 1. Hours Per Day of Media Use by Age Group



Note: Data were collected in studies conducted by the George Marshall Applied Cognition Laboratory. These studies encompassed an estimated 3,000 respondents, who were asked how many hours per day they engaged in the following activities: being online, using a computer but not online, sending and receiving e-mail, using instant messaging or chat, talking on the telephone, texting, listening to music, playing video games, and watching television. Totals reflect hours of time spent in all activities, including some activities done simultaneously.

New Generations

Studying generational similarities and differences can be tricky; no individual completely fits the profile of a particular generation. But research suggests that the majority of people born between a rough set of dates actually do share many characteristics (see Strauss & Howe, 1991).

Those born between about 1925 and 1946 are often called the *Traditional* or *Silent* generation. Growing up through the Great Depression, World War II, and the Cold War, they are characterized by a belief in common goals and respect for authority. The *Baby Boomer* generation, born between 1946 and 1964, tends to be optimistic, idealistic, and communicative and to value education and consumer goods. The next generation, born between 1965 and 1979, were defined by Douglas Coupland (1991) as *Generation X* in his book of the same name; the label *X* signifies that, compared with the Baby Boomers, Gen Xers are not as easily categorized.

With the 1980s and the birth of the World Wide Web, the power of cyberspace came to the masses and a new generation of web surfers, very different from their predecessors, was born. The most common label for this generation is *Generation Y,* simply meaning the generation after X. Some people stretch this generation past 1999 and refer to its members as *Millennials.* To me, these names are an insult to our first true cybergeneration. This generation should not be defined by the next letter in the alphabet or by the turn of the century. I believe that Don Tapscott's (1999) term—the *Net Generation*—better reflects the impact of the Internet on the lives of its members.

On the basis of our research with thousands of teenagers and their parents, my colleagues and I have identified a separate generation, born in the 1990s and beyond, which we label the *iGeneration.* The *i* represents both the types of digital technologies popular with children and adolescents (iPhone, iPod, Wii, iTunes, and so on) and the highly individualized activities that these technologies make possible. Children and youth in this new generation are defined by their technology and media use, their love of electronic communication, and their need to multitask.

Parenthetically, we are just starting

to examine a separate minigeneration of kids like Mikey and Brittani, who not only are facile with individualized mobile technologies, but also have the expectation that if they conceive of something, they should be able to make it happen. If an app doesn't exist for something they want to do on a smartphone, they just assume that nobody has created it yet and that it should be a piece of cake to do so. All in all, a fascinating minigeneration.

Consuming a Massive Media Diet

In our studies of thousands of children and teens at the George Marshall Applied Cognition Laboratory, my colleagues and I have found that the iGeneration consumes massive quantities of media. In anonymous online surveys, we ask young people how much they engage in a variety of activities, including being online, using computers offline, listening to music, playing video games, talking on the telephone, instant messaging, texting, sending and receiving e-mail, and watching television (see fig. 1).

Our work and that of others, including the Kaiser Family Foundation and the Pew Internet and American Life Project (Lenhart, Ling, Campbell, & Purcell, 2010; Rideout, Foehr, & Roberts, 2010), suggest that both the Net Generation and the iGeneration's older teen group are consuming massive amounts of media. Figure 1 gives the total amount of reported hours of media use for four generations. Even considering the fact that respondents are doing many of these media activities simultaneously, it appears that many children and teens spend nearly all their waking hours using media and technology.

Just as we don't think about the existence of air, kids don't question the existence of technology and media.

Our studies have also found clear differences in what each generation does with its technology. Baby Boomers, in general, prefer face-to-face or telephone communication, although many use e-mail regularly. Gen Xers—being the ambiguous, transitional generation that they are—seem to embrace both cell phones and e-mail, with a bit of instant messaging thrown in. The Net Generation began to carve out a new communication era, using many available technologies, including social networks like Facebook, instant messages, Skype, and texting.

Then we have the iGeneration, which redefined communication. According to the Nielsen company, which tracks a large sample of teens on a quarterly basis, the typical teenager sends and receives an incredible 3,339 texts a month (which translates into more than 6 messages every hour that he or she is not sleeping) while making and receiving only 191 phone calls during that same period. Two years ago, teens sent and received about the same number of texts as phone calls (Nielsen Wire, 2010).

To members of the iGeneration, a phone is not a phone. It is a portable computer that they use to tweet, surf the web, and, of course, text, text, text.

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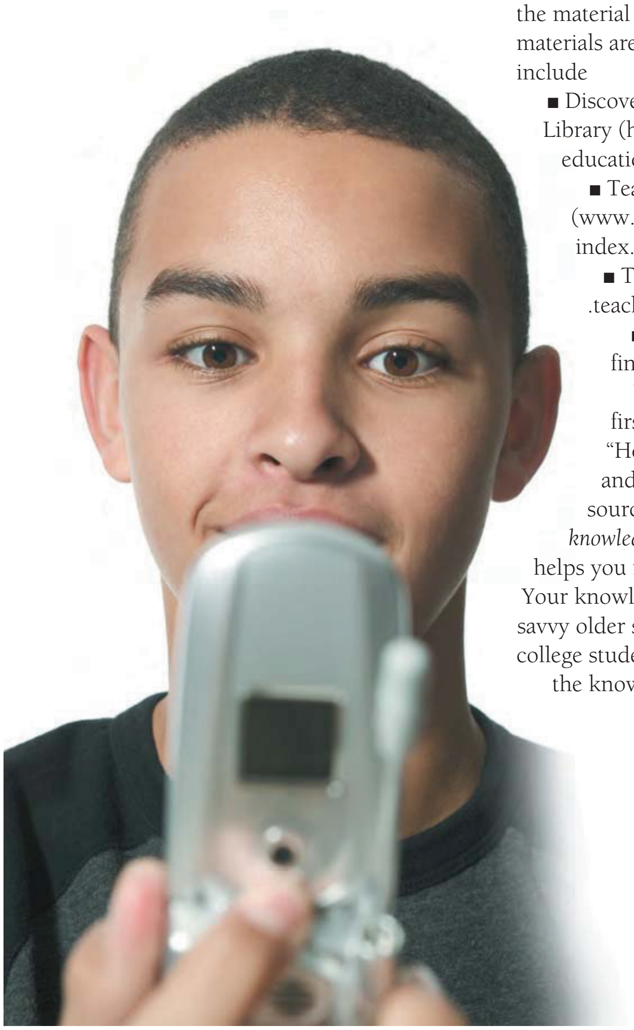
How Schools Need to Respond

Watch typical teens or preteens at home, and you will see them constantly switching between their laptop, cell phone, television, MP3 player, and video game console with apparent ease. In school, we require them to unitask by listening to the teacher, completing worksheets, writing with pen and paper, or engaging in other solitary activities. There are better ways of teaching our students.

Of course, using technology to enhance education doesn't mean that we should move classes totally online. Students need face-to-face social interaction, especially in the primary and middle school grades. It doesn't mean that teachers should simply assign work on computers and let students find their own way. It doesn't mean providing technology in the classroom for technology's sake. Interactive whiteboards and desktop computers often sit unused by teachers who did not want them and who were not trained to use them.



Nor should teachers feel responsible for finding educational technologies to use in their classrooms. Teachers are required to teach specific content. The point is not to "teach with technology" but to use technology to convey content more powerfully and efficiently.

Teachers can access an enormous amount of curriculum content online in a variety of formats, including audio and video pieces that can help bring the material to life for students. These materials are often free. Helpful sites include

- DiscoveryEducation's Lesson Plan Library (http://school.discoveryeducation.com/lessonplans).
- Teachers Helping Teachers (www.pacificnet.net/~mandel/index.html).
- TeachersFirst.com (www.teachersfirst.com/index.cfm).
- Thinkfinity (www.thinkfinity.org/lesson-plans).

When I talk to teachers, the first comment I often hear is, "How can I find time to locate and organize all these online sources?" One answer is to use a *knowledge broker*—someone who helps you identify online resources. Your knowledge broker can be a tech-savvy older student, a local community college student, or even a parent. Give the knowledge broker the task of identifying possible resources that you can use to support your curriculum.

Recently, for example, I worked with a high school history teacher who wanted to locate content that would help her teach a unit on the last year of World War II. We identified an honors student who had already taken the course and asked him to find a collection of audio files, videos, websites, and any other online material related to this topic. A week later, the student returned with links to several YouTube videos with original wartime footage, photo collections, podcasts, and other multimedia presentations on events that occurred during that year. He worked with the teacher to help her become proficient at using each of the content tools. When the teacher assigned her class to watch and listen to several of those videos and other multimedia presentations, the knowledge broker stood by to help make sure that the class (and the teacher) could access the resources effectively.

The iGeneration is immersed in technology. Their tech world is open 24/7.

The resources included videos for those who learned by more kinesthetic and auditory modalities, written newspaper reports for those who learned best by visual modalities, and even interactive websites for those with a more tactile and kinesthetic learning style. Providing information through a variety of modalities and sources helped students develop a richer, more complex mental representation of the material.

Demonstration projects around the United States have found that once teachers relegate much of the content dissemination to technology, they can spend class time more productively—helping students analyze, synthesize, and assimilate material (Johnson, Smith, Levine, & Haywood, 2010; Project Tomorrow, 2010). After all, isn't this the most effective use of class time and teacher talent?

For example, suppose you want your students to watch and discuss Act I of *Hamlet*. Instead of showing the video in class, you might have them watch it on YouTube as a homework assignment. Not only will they be engaged in a modality they use constantly, but they will also be able to access the video 24/7—they can watch and rewatch it on their own schedule. After they view the video once, you can use class time to help them deconstruct Act I and then send them back to watch it again—which they are more likely to do than if you send them back to reread the text.

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It appears that many children and teens spend nearly all their waking hours using media and technology.

Leading Education into the Future

Technology is all about engagement. Watching the intense looks on our children's and teens' faces as they play video games, text all day long, Skype, Facebook, watch YouTube videos, and juggle a dozen websites at a time, we can clearly see that they are engaged.

The iGeneration is immersed in technology. Their tech world is open 24/7. Now, we need to take advantage of their love of technology to refocus education. In doing so, we'll not only get students more involved in learning, but also free up classroom time to help them make meaning of the wealth of information that surrounds them. EL

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Educational Master Plan

Information Submission Form

1) Title: Transforming American Education: Learning Powered by Technology

2) Author: U.S. Department of Education Office of Educational Technology

3) Source: National Education Technology Plan 2010

4) Taxonomy Area:

- [ ] Society
- [ ] Technology
- [ ] Economy
- [ ] Environment
- [ ] Politics and Legal Issues
- [x] Education
- [ ] Other: ______

5) Relevance: DOE Initiatives/learning, assessment, teaching, infrastructure, and productivity

6) Page / Section: ______

7) Link to document: ______

or

8) Attach Document Here: ______

Transforming American Education

Learning

Powered by Technology

National Education Technology Plan 2010

U.S. Department of Education
Office of Educational Technology

Transforming American Education

Learning

Powered by Technology

National Education Technology Plan 2010

U.S. Department of Education
Office of Educational Technology

Section 2422 of the *Elementary and Secondary Education Act* specifies that the secretary shall update and publish, in a form readily accessible to the public, a national long-range technology plan that describes how the secretary will promote: (a) higher student academic achievement through the integration of advanced technologies, including emerging technologies, into curricula and instruction; (b) increased access to technology for teaching and learning for schools with a high number or percentage of children from families with incomes below the poverty line; and (c) the use of technology to assist in the implementation of state systemic reform strategies. In addition, Section 2422 specifies that this report should also include a description of joint activities of the Department of Education and other federal departments or agencies that will promote the use of technology in education. In accordance with that requirement, the Office of Educational Technology of the Department of Education is publishing this report.

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November 2010

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Contents

THE SECRETARY OF EDUCATION
WASHINGTON, DC 20202

November 2010

Dear Members of Congress:

Education is vital to America's individual and collective economic growth and prosperity, and is necessary for our democracy to work. Once the global leader in college completion rates among young people, the United States currently ranks ninth out of 36 developed nations. President Obama has articulated a bold vision for the United States to lead the world in the proportion of college graduates by 2020, thereby regaining our leadership and ensuring America's ability to compete in a global economy. To achieve this aggressive goal, we need to leverage the innovation and ingenuity this nation is known for to create programs and projects that every school can implement to succeed.

To that end, I am presenting you with the Administration's National Education Technology Plan, *Transforming American Education: Learning Powered by Technology*. The plan calls for applying the advanced technologies used in our daily personal and professional lives to our entire education system to improve student learning, accelerate and scale up the adoption of effective practices, and use data and information for continuous improvement.

The model of learning described in this plan calls for engaging and empowering personalized learning experiences for learners of all ages. The model stipulates that we focus what and how we teach to match what people need to know and how they learn. It calls for using state-of-the-art technology and Universal Design for Learning (UDL) concepts to enable, motivate, and inspire all students to achieve, regardless of background, languages, or disabilities. It calls for ensuring that our professional educators are well connected to the content and resources, data and information, and peers and experts they need to be highly effective. And it calls for leveraging the power of technology to support continuous and lifelong learning.

The National Education Technology Plan presents five goals with recommendations for states, districts, the federal government, and other stakeholders. Each goal addresses one of the five essential components of learning powered by technology: Learning, Assessment, Teaching, Infrastructure, and Productivity. The plan also calls for "grand challenge" research and development initiatives to solve crucial long-term problems that we believe should be funded and coordinated at a national level.

The plan's development was led by the Department of Education's Office of Educational Technology and involved the most rigorous and inclusive process ever undertaken for a national education technology plan. It builds on the insights and recommendations of a technical working group of leading education researchers, learning and assessment experts, and practitioners. We also engaged with and incorporated input received from hundreds of industry experts, thousands of educators, and the public. I urge you to consider this vision for transforming American education by using the best and most inclusive modern technology to power up the core functions of learning, teaching, assessment, and continuous improvement efforts, as described in this plan.

Sincerely,

/s/

Arne Duncan

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Executive Summary

Education is the key to America's economic growth and prosperity and to our ability to compete in the global economy. It is the path to good jobs and higher earning power for Americans. It is necessary for our democracy to work. It fosters the cross-border, cross-cultural collaboration required to solve the most challenging problems of our time.

Under the Obama administration, education has become an urgent priority driven by two clear goals:

- We will raise the proportion of college graduates from where it now stands (around 41 percent) so that 60 percent of our population holds a two-year or four-year degree by 2020.
- We will close the achievement gap so that all students graduate from high school ready to succeed in college and careers.

These are aggressive goals and achieving them is a sizable challenge. Add to the challenge the projections of most states and the federal government of reduced revenues for the foreseeable future, and it is clear we need cost-effective and cost-saving strategies that improve learning outcomes and graduation rates for millions of Americans.

Specifically, we must embrace innovation, prompt implementation, regular evaluation, and continuous improvement. The programs and projects that work must be brought to scale so every school has the opportunity to take advantage of their success. Our regulations, policies, actions, and investments must be strategic and coherent.

Transforming American Education

The National Education Technology Plan 2010 (NETP) calls for revolutionary transformation rather than evolutionary tinkering. It urges our education system at all levels to

- Be clear about the outcomes we seek.
- Collaborate to redesign structures and processes for effectiveness, efficiency, and flexibility.
- Continually monitor and measure our performance.
- Hold ourselves accountable for progress and results every step of the way.

The plan recognizes that technology is at the core of virtually every aspect of our daily lives and work, and we must leverage it to provide engaging and powerful learning experiences and content, as well as resources and assessments that measure student achievement in more complete, authentic, and meaningful ways. Technology-based learning and assessment systems will be pivotal in improving student learning and generating data that can be used to continuously improve the education system at all levels. Technology will help us execute collaborative teaching strategies combined with professional learning that better prepare and enhance educators' competencies and expertise over the course of their careers. To shorten our learning curve, we should look to other kinds of enterprises, such as business and entertainment, that have used technology to improve outcomes while increasing productivity.

We also should implement a new approach to research and development (R&D) in education that focuses on scaling innovative best practices in the use of technology in teaching and learning, transferring existing and emerging technology innovations into education, sustaining the R&D for education work that is being done by such organizations as the National Science Foundation, and creating a new organization to address major R&D challenges at the intersection of learning sciences, technology, and education.

A Model of Learning Powered by Technology

The NETP presents a model of learning powered by technology, with goals and recommendations in five essential areas: learning, assessment, teaching, infrastructure, and productivity. The plan also identifies far-reaching "grand challenge" R&D problems that should be funded and coordinated at a national level.

The challenging and rapidly changing demands of our global economy tell us what people need to know and who needs to learn. Advances in learning sciences show us how people learn. Technology makes it possible for us to act on this knowledge and understanding.

Learning: Engage and Empower

The model of learning described in this plan calls for engaging and empowering learning experiences for all learners. The model asks that we focus what and how we teach to match what people need to know, how they learn, where and when they will learn, and who needs to learn. It brings state-of-the art technology into learning to enable, motivate, and inspire all students, regardless of background, languages, or disabilities, to achieve. It leverages the power of technology to provide personalized learning and to enable continuous and lifelong learning.

Many students' lives today are filled with technology that gives them mobile access to information and resources 24/7, enables them to create multimedia content and share it with the world, and allows them to participate in online social networks where people from all over the world share ideas, collaborate, and learn new things. Outside school, students are free to pursue their passions in their own way and at their own pace. The opportunities are limitless, borderless, and instantaneous.

The challenge for our education system is to leverage the learning sciences and modern technology to create engaging, relevant, and personalized learning experiences for all learners that mirror students' daily lives and the reality of their futures. In contrast to traditional classroom instruction, this requires that we put students at the center and empower them to take control of their own learning by providing flexibility on several dimensions.

A core set of standards-based concepts and competencies should form the basis of what all students should learn. Beyond that, students and educators should have options for engaging in learning: large groups, small groups, and work tailored to the individual goals, needs, interests, and prior experience of each learner. Technology should be leveraged to provide access to more learning resources than are available in classrooms and connections to a wider set of "educators," including teachers, parents, experts, and mentors outside the classroom. It also should be used to enable 24/7 and lifelong learning.

What and How People Need to Learn

Whether the domain is English language arts, mathematics, sciences, social studies, history, art, or music, 21st-century competencies and such expertise as critical thinking, complex problem solving, collaboration, and multimedia communication should be woven into all content areas. These competencies are necessary to become expert learners, which we all must be if we are to adapt to our rapidly changing world over the course of our lives. That involves developing deep understanding within specific content areas and making the connections among them.

How we need to learn includes using the technology that professionals in various disciplines use. Professionals routinely use the Web and tools, such as wikis, blogs, and digital content for the research, collaboration, and communication demanded in their jobs. They gather data and analyze the data using inquiry and visualization tools. They use graphical and 3D modeling tools for design. For students, using these real-world tools creates learning opportunities that allow them to grapple with real-world problems—opportunities that prepare them to be more productive members of a globally competitive workforce.

Assessment: Measure What Matters

The model of learning requires new and better ways to measure what matters, diagnose strengths and weaknesses in the course of learning when there is still time to improve student performance, and involve multiple stakeholders in the process of designing, conducting, and using assessment. In all these activities, technology-based assessments can provide data to drive decisions on the basis of what is best for each and every student and that, in aggregate, will lead to continuous improvement across our entire education system.

The nation's governors and state education chiefs have begun to develop standards and assessments that measure 21st-century competencies and expertise in all content areas. Technology-based assessments that combine cognitive research and theory about how students think with multimedia, interactivity, and connectivity make it possible to directly assess these types of skills. This can be done within the context of relevant societal issues and problems that people care about in everyday life.

When combined with learning systems, technology-based assessments can be used formatively to diagnose and modify the conditions of learning and instructional practices while at the same time determining what students have learned for grading and accountability purposes. Both uses are important, but the former can improve student learning in the moment (Black and Wiliam 1998). Furthermore, systems can be designed to capture students' inputs and collect evidence of their knowledge and problem-solving abilities as they work. Over time, the system "learns" more about students' abilities and can provide increasingly appropriate support.

Using Data to Drive Continuous Improvement

With assessments in place that address the full range of expertise and competencies reflected in standards, student-learning data can be collected and used to continually improve learning outcomes and productivity. For example, such data could be used to create a system of interconnected feedback for students, educators, parents, school leaders, and district administrators.

For this to work, relevant data must be made available to the right people at the right time and in the right form. Educators and leaders at all levels of our education system also must be provided with support—tools and training—that can help them manage the assessment process, analyze relevant data, and take appropriate action.

Teaching: Prepare and Connect

Just as leveraging technology can help us improve learning and assessment, the model of learning calls for using technology to help build the capacity of educators by enabling a shift to a model of connected teaching. In such a teaching model, teams of connected educators replace solo practitioners, classrooms are fully connected to provide educators with 24/7 access to data and analytic tools, and educators have access to resources that help them act on the insights the data provide.

Professional educators are a critical component of transforming our education systems, and therefore strengthening and elevating the teaching profession is as important as effective teaching and accountability. All are necessary if we are to attract and retain the most effective educators and achieve the learning outcomes we seek. Just as leveraging technology can help us improve learning and assessment, it also can help us shift to a model of connected teaching.

In a connected teaching model, classroom educators are fully connected to learning data and tools for using the data; to content, resources, and systems that empower them to create, manage, and assess engaging and relevant learning experiences; and directly to their students in support of learning both in and out of school. The same connections give them access to resources and expertise that improve their own instructional practices and guide them in becoming facilitators and collaborators in their students' increasingly self-directed learning.

In connected teaching, teaching is a team activity. Individual educators build online learning communities consisting of their students and their students' peers; fellow educators in their schools, libraries, and after-school programs; professional experts in various disciplines around the world; members of community organizations that serve students in the hours they are not in school; and parents who desire greater participation in their children's education.

Episodic and ineffective professional development is replaced by professional learning that is collaborative, coherent, and continuous and that blends more effective in-person courses and workshops with the expanded opportunities, immediacy, and convenience enabled by online environments full of resources and opportunities for collaboration. For their part, the colleges of education and other institutions that prepare teachers play an ongoing role in the professional growth of their graduates throughout the entire course of their careers.

Connected teaching enables our education system to provide access to effective teaching and learning resources where they are not otherwise available and more options for all learners. This is accomplished by augmenting the expertise and competencies of specialized and exceptional educators with online and blended (online and offline) learning systems, on-demand courses, and other self-directed learning opportunities.

21st-Century Resources for Professional Educators

The technology that enables connected teaching is available now, but not all the conditions necessary to leverage it are. Many of our existing educators do not have the same understanding of and ease with using technology that is part of the daily lives of professionals in other sectors. The same can be said of many of the education leaders and policymakers in schools, districts, and states and of the higher education institutions that prepare new educators for the field.

This gap in technology understanding influences program and curriculum development, funding and purchasing decisions about educational and information technology in schools, and preservice and in-service professional learning. This gap prevents technology from being used in ways that would improve instructional practices and learning outcomes.

Still, we must introduce connected teaching into our education system rapidly, and therefore we need innovation in the organizations that support educators in their profession—schools and districts, colleges of education, professional learning providers, and professional organizations.

Infrastructure: Access and Enable

An essential component of the learning model is a comprehensive infrastructure for learning that provides every student, educator, and level of our education system with the resources they need when and where they are needed. The underlying principle is that infrastructure includes people, processes, learning resources, policies, and sustainable models for continuous improvement in addition to broadband connectivity, servers, software, management systems, and administration tools. Building this infrastructure is a far-reaching project that will demand concerted and coordinated effort.

Although we have adopted technology in many aspects of education today, a comprehensive infrastructure for learning is necessary to move us beyond the traditional model of educators and students in classrooms to a learning model that brings together teaching teams and students in classrooms, labs, libraries, museums, workplaces, and homes—anywhere in the world where people have access devices and an adequate Internet connection.

Over the past 40 years, we have seen unprecedented advances in computing and communications that have led to powerful technology resources and tools for learning. Today, low-cost Internet access devices, easy-to-use digital authoring tools, and the Web facilitate access to information and multimedia learning content, communication, and collaboration. They provide the ability to participate in online learning communities that cross disciplines, organizations, international boundaries, and cultures.

Many of these technology resources and tools already are being used within our public education system. We are now, however, at an inflection point for a much bolder transformation of education powered by technology. This revolutionary opportunity for change is driven by the continuing push of emerging technology and the pull of the critical national need to radically improve our education system.

Always-on Learning

An infrastructure for learning is always on, available to students, educators, and administrators regardless of their location or the time of day. It supports not just access to information, but access to people and participation in online learning communities. It offers a platform on which developers can build and tailor applications.

An infrastructure for learning unleashes new ways of capturing and sharing knowledge based on multimedia that integrate text, still and moving images, audio, and applications that run on a variety of devices. It enables seamless integration of in- and out-of-school learning. It frees learning from a rigid information transfer model (from book or educator to students) and enables a much more motivating intertwinement of learning about, learning to do, and learning to be.

On a more operational level, an infrastructure for learning brings together and enables access to data from multiple sources while ensuring appropriate levels of security and privacy. The infrastructure integrates computer hardware, data and networks, information resources, interoperable software, middleware services and tools, and devices, and connects and supports interdisciplinary teams of professionals responsible for its development, maintenance, and management and its use in transformative approaches to teaching and learning.

Productivity: Redesign and Transform

To achieve our goal of transforming American education, we must rethink basic assumptions and redesign our education system. We must apply technology to implement personalized learning and ensure that students are making appropriate progress through our P–16 system so they graduate. These and other initiatives require investment, but tight economic times and basic fiscal responsibility demand that we get more out of each dollar we spend. We must leverage technology to plan, manage, monitor, and report spending to provide decision-makers with a reliable, accurate, and complete view of the financial performance of our education system at all levels. Such visibility is essential to meeting our goals for educational attainment within the budgets we can afford.

Improving productivity is a daily focus of most American organizations in all sectors—both for-profit and nonprofit—and especially in tight economic times. Education has not, however, incorporated many of the practices other sectors regularly use to improve productivity and manage costs, nor has it leveraged technology to enable or enhance them. We can learn much from the experience in other sectors.

What education can learn from the experience of business is that we need to make the fundamental structural changes that technology enables if we are to see dramatic improvements in productivity. As we do so, we should recognize that although the fundamental purpose of our public education system is the same, the roles and processes of schools, educators, and the system itself should change to reflect the times we live in and our goals as a world leader. Such rethinking applies to learning, assessment, and teaching processes and to the infrastructure and operational and financial sides of running schools and school systems.

Rethinking Basic Assumptions

One of the most basic assumptions in our education system is time-based or "seat-time" measures of educational attainment. These measures were created in the late 1800s and early 1900s to smooth transitions from K–12 into higher education by translating high school work to college admissions offices (Shedd 2003) and made their way into higher education when institutions began moving away from standardized curricula.

Another basic assumption is the way we organize students into age-determined groups, structure separate academic disciplines, organize learning into classes of roughly equal size with all the students in a particular class receiving the same content at the same pace, and keep these groups in place all year.

The last decade has seen the emergence of some radically redesigned schools, demonstrating the range of possibilities for structuring education. These include schools that organize around competence rather than seat time and others that enable more flexible scheduling that fits students' individual needs rather than traditional academic periods and lockstep curriculum pacing. In addition, schools are beginning to incorporate online learning, which gives us the opportunity to extend the learning day, week, or year.

The United States has a long way to go if we are to see every student complete at least a year of higher education or postsecondary career training. There is no way to achieve this target unless we can dramatically reduce the number of students who leave high school without getting a diploma and/or who are unprepared for postsecondary education.

A complex set of personal and academic factors underlie students' decision to leave school or to disengage from learning, but support should start as early as possible, before children enter school, and should become intensified for those students who need it as they move through school. Practices supported with technology can help address the problem, including learning dashboards that keep students on track with their course requirements and earning credits for courses taken online.

Redesigning education in America for improved productivity is a complex challenge that will require all 50 states, the thousands of districts and schools across the country, the federal government, and other education stakeholders in the public and private sector to come together to design and implement innovative solutions. It is a challenge for educators—leaders, teachers, and policymakers committed to learning—as well as technologists, and ideally they will come together to lead the effort.

A Rigorous and Inclusive Process

This plan, led by the Department of Education's Office of Educational Technology, was developed using a rigorous and inclusive process built on the report of a technical working group of leading education researchers and practitioners.

In keeping with the White House's Open Government Directive, the Department invited extensive public participation in the development of the plan. Broad outreach efforts and state-of-the-art communications and collaboration technology enabled tens of thousands of individuals to learn about and contribute to the development of the plan over its 9-month development period.

The Time To Act Is Now

The NETP accepts that we do not have the luxury of time: We must act now and commit to fine-tuning and midcourse corrections as we go. Success will require leadership, collaboration, and investment at all levels of our education system—states, districts, schools, and the federal government—as well as partnerships with higher education institutions, private enterprises, and not-for-profit entities.

In the United States, education is primarily a state and local responsibility. State and local public education institutions must ensure equitable access to learning experiences for all students and especially students in underserved populations—low-income and minority students, students with disabilities, English language learners, students in rural and frontier schools, and others. States and districts need to build capacity for transformation. The Department of Education has a role in identifying effective strategies and implementation practices; encouraging, promoting, and actively supporting innovation in states and districts; and nurturing collaborations that help states and districts leverage resources so the best ideas can be scaled up.

Postsecondary education institutions—community colleges and four-year colleges and universities—will need to partner more closely with K–12 schools to remove barriers to postsecondary education and put plans of their own in place to decrease dropout rates. Clearly, postsecondary institutions would be key players in the national R&D efforts recommended in this plan.

Education has long relied on the contributions of organizations in both the private and not-for-profit sectors, and this will not change.

As we enter the second decade of the 21st century, there has never been a more pressing need to transform American education or a better time to act. The NETP is a 5-year action plan that responds to an urgent national priority and a growing understanding of what the United States needs to do to remain competitive in a global economy.

Goals and Recommendations

To transform education in America, we must turn ideas into action. The NETP presents five goals that address the key components of this plan—learning, assessment, teaching, infrastructure, and productivity—along with recommendations for states, districts, the federal government, and other stakeholders in our education system for achieving these goals.

1.0 Learning: Engage and Empower

All learners will have engaging and empowering learning experiences both in and out of school that prepare them to be active, creative, knowledgeable, and ethical participants in our globally networked society.

To meet this goal, we recommend the following:

1.1 States should continue to revise, create, and implement standards and learning objectives using technology for all content areas that reflect 21st-century expertise and the power of technology to improve learning.

Our education system relies on core sets of standards-based concepts and competencies that form the basis of what all students should know and should be able to do. Whether the domain is English language arts, mathematics, sciences, social studies, history, art, or music, states should continue to consider the integration of 21st-century competencies and expertise, such as critical thinking, complex problem solving, collaboration, multimedia communication, and technological competencies demonstrated by professionals in various disciplines.

1.2 States, districts, and others should develop and implement learning resources that use technology to embody design principles from the learning sciences.

Advances in learning sciences, including cognitive science, neuroscience, education, and social sciences, give us greater understanding of three connected types of human learning—factual knowledge, procedural knowledge, and motivational engagement. Technology has increased our ability to both study and enhance all three types. Today's learning environments should reflect what we have learned about how people learn and take advantage of technology to optimize learning.

1.3 States, districts, and others should develop and implement learning resources that exploit the flexibility and power of technology to reach all learners anytime and anywhere.

The always-on nature of the Internet and mobile access devices provides our education system with the opportunity to create learning experiences that are available anytime and anywhere. When combined with design principles for personalized learning and Universal Design for Learning, these experiences also can be accessed by learners who have been marginalized in many educational settings: students from low-income communities and minorities, English language learners, students with disabilities, students who are gifted and talented, students from diverse cultures and linguistic backgrounds, and students in rural areas.

1.4 Use advances in learning sciences and technology to enhance STEM (science, technology, engineering, and mathematics) learning and develop, adopt, and evaluate new methodologies with the potential to inspire and enable all learners to excel in STEM.

New technologies for representing, manipulating, and communicating data, information, and ideas have changed professional practices in STEM fields and what students need to learn to be prepared for STEM professions. Technology should be used to support student interaction with STEM content in ways that promote deeper understanding of complex ideas, engage students in solving complex problems, and create new opportunities for STEM learning throughout our education system.

2.0 Assessment: Measure What Matters

Our education system at all levels will leverage the power of technology to measure what matters and use assessment data for continuous improvement.

To meet this goal, we recommend the following actions:

2.1 States, districts, and others should design, develop, and implement assessments that give students, educators, and other stakeholders timely and actionable feedback about student learning to improve achievement and instructional practices.

Learning science and technology combined with assessment theory can provide a foundation for new and better ways to assess students in the course of learning, which is the ideal time to improve performance. This will require involving experts from all three disciplines in the process of designing, developing, and using new technology-based assessments that can increase the quality and quantity of feedback to learners.

2.2 Build the capacity of educators, education institutions, and developers to use technology to improve assessment materials and processes for both formative and summative uses.

Technology can support measuring performances that cannot be assessed with conventional testing formats, providing our education system with opportunities to design, develop, and validate new and more effective assessment materials. Building this capacity can be accelerated through knowledge exchange, collaboration, and better alignment between educators (practitioners) and experts.

2.3 Conduct research and development that explores how embedded assessment technologies, such as simulations, collaboration environments, virtual worlds, games, and cognitive tutors, can be used to engage and motivate learners while assessing complex skills.

Interactive technologies, especially games, provide immediate performance feedback so that players always know how they are doing. As a result, they are highly engaging to students and have the potential to motivate students to learn. They also enable educators to assess important competencies and aspects of thinking in contexts and through activities that students care about in everyday life. Because interactive technologies hold this promise, assessment and interactive technology experts should collaborate on research to determine ways to use them effectively for assessment.

2.4 Conduct research and development that explores how Universal Design for Learning can enable the best accommodations for all students to ensure we are assessing what we intend to measure rather than extraneous abilities a student needs to respond to the assessment task.

To be valid, an assessment must measure those qualities it is intended to measure and scores should not be influenced by extraneous factors. An assessment of science, for example, should measure understanding of science concepts and their application, not the ability to see print, to respond to items using a mouse, or to use word processing skills. Assessment and technology experts should collaborate to create assessment design tools and processes that make it possible to develop assessment systems with appropriate features (not just accommodations) so that assessments capture examinees' strengths in terms of the qualities that the assessment is intended to measure.

2.5 Revise practices, policies, and regulations to ensure privacy and information protection while enabling a model of assessment that includes ongoing gathering and sharing of data on student learning for continuous improvement.

Every parent of a student under 18 and every student 18 or over should have the right to access the student's own assessment data in the form of an electronic learning record that the student can take with them throughout his or her educational career. At the same time, appropriate safeguards, including stripping records of identifiable information and aggregating data across students, classrooms, and schools, should be used to make it possible to supply education data derived from student records to other legitimate users without compromising student privacy.

3.0 Teaching: Prepare and Connect

Professional educators will be supported individually and in teams by technology that connects them to data, content, resources, expertise, and learning experiences that enable and inspire more effective teaching for all learners.

To meet this goal, we recommend the following actions:

3.1 Expand opportunities for educators to have access to technology-based content, resources, and tools where and when they need them.

Today's technology enables educators to tap into resources and orchestrate expertise across a school district or university, a state, the nation, and even around the world. Educators can discuss solutions to problems and exchange information about best practices in minutes, not weeks or months. Today's educators should have access to technology-based resources that inspire them to provide more engaging and effective learning opportunities for each and every student.

3.2 Leverage social networking technologies and platforms to create communities of practice that provide career-long personal learning opportunities for educators within and across schools, preservice preparation and in-service education institutions, and professional organizations.

Social networks can be used to provide educators with career-long personal learning tools and resources that make professional learning timely and relevant as well as an ongoing activity that continually improves practice and evolves their skills over time. Online communities should enable educators to take online courses, tap into experts and best practices for just-in-time problem solving, and provide platforms and tools for educators to design and develop resources with and for their colleagues.

3.3 Use technology to provide all learners with online access to effective teaching and better learning opportunities and options especially in places where they are not otherwise available.

Many education institutions, particularly those serving the most vulnerable students and those in rural areas, lack educators with competencies in reaching students with special needs and educators with content knowledge and expertise in specialized areas, including STEM. Even in areas where effective teaching is available, students often lack options for high-quality courses in particular disciplines or opportunities for learning that prepare them for the modern world. Online learning options should be provided to enable leveraging the best teaching and make high-quality course options available to all learners.

3.4 Provide preservice and in-service educators with professional learning experiences powered by technology to increase their digital literacy and enable them to create compelling assignments for students that improve learning, assessment, and instructional practices.

Just as technology helps us engage and motivate students to learn, technology should be used in the preparation and ongoing learning of educators to engage and motivate them in what and how they teach. This will require synthesizing core principles and adopting best practices for the use of technology in preparing educators. Technology also should be an integral component of teaching methods courses and field experiences rather than treated as a discrete skill distinct from pedagogical application.

3.5 Develop a teaching force skilled in online instruction.

As online learning becomes an increasingly important part of our education system, we need to provide online and blended learning experiences that are more participatory and personalized and that embody best practices for engaging all students. This creates both the need and opportunity for educators who are skilled in instructional design and knowledgeable about emerging technologies. Crucial to filling this need while ensuring effective teaching are appropriate standards for online courses and teaching and a new way of approaching online teacher certification.

4.0 Infrastructure: Access and Enable

All students and educators will have access to a comprehensive infrastructure for learning when and where they need it.

To meet this goal, we recommend the following actions:

4.1 Ensure students and educators have broadband access to the Internet and adequate wireless connectivity both in and out of school.

Students and educators need adequate broadband bandwidth for accessing the Internet and technology-based learning resources. “Adequate” should be defined as the ability to use the Internet in school, on the surrounding campus, throughout the community, and at home. It should also include simultaneous use of high-bandwidth resources, such as multimedia, communication and collaboration environments, and communities. Crucial to providing such access are the broadband initiatives being individually and jointly managed by various federal agencies.

4.2 Ensure that every student and educator has at least one Internet access device and appropriate software and resources for research, communication, multimedia content creation, and collaboration for use in and out of school.

Only with 24/7 access to the Internet via devices and technology-based software and resources can we achieve the kind of engagement, student-centered learning, and assessments that can improve learning in the ways this plan proposes. The form of these devices, software, and resources may or may not be standardized and will evolve over time. In addition, these devices may be owned by the student or family, owned by the school, or some combination of the two. The use of devices owned by students will require advances in network filtering and improved support systems.

4.3 Support the development and use of open educational resources to promote innovative and creative opportunities for all learners and accelerate the development and adoption of new open technology-based learning tools and courses.

The value of open educational resources is now recognized around the world, leading to the availability of a vast array of learning, teaching, and research resources that learners of any age can use across all content areas. Realizing this value will require new policies concerning the evaluation and selection of instructional materials so that digital resources are considered and processes are established for keeping educational resource content up to date, appropriate, and tagged according to identified content interoperability standards.

4.4 Build state and local education agency capacity for evolving an infrastructure for learning.

Building an infrastructure for learning is a far-reaching project that will demand concerted and coordinated effort. The effort should start with implementing the next generation of computing system architectures and include transitioning computer systems, software, and services from in-house datacenters to professionally managed data centers in the cloud for greater efficiency and flexibility. This will require leveraging and scaling up the human talent to build such an infrastructure, which should ultimately save money and enable education IT professionals to focus more on maintaining the local infrastructure and supporting teachers, students, and administrators.

4.5 Develop and use interoperability standards for content and student-learning data to enable collecting and sharing resources and collecting, sharing, and analyzing data to improve decision making at all levels of our education system.

Fragmented content and resources and student-learning data siloed in different proprietary platforms and systems, along with a lack of common standards for collecting and sharing data, are formidable barriers to leveraging resources for teaching and learning. These barriers exist because we lack common content interoperability standards and tools to enable use of such standards. The lack of common standards affects the quality of tools because developers limit their R&D investments into narrow markets and are not able to leverage overall market advancements in research and development. Interoperability standards are essential to resolving these issues.

4.6 Develop and use interoperability standards for financial data to enable data-driven decision making, productivity advances, and continuous improvement at all levels of our education system.

Just as content, resources, and student learning data are fragmented in disconnected technology systems and throughout our education system, the same is true for financial data. Therefore, we also need financial data interoperability standards and tools that enable the use of these standards.

5.0 Productivity: Redesign and Transform

Our education system at all levels will redesign processes and structures to take advantage of the power of technology to improve learning outcomes while making more efficient use of time, money, and staff.

To meet this goal, we recommend the following actions:

5.1 Develop and adopt a common definition of productivity in education and more relevant and meaningful measures of outcomes, along with improved policies and technologies for managing costs, including those for procurement.

Education has not incorporated many of the practices other sectors regularly use to measure outcomes, manage costs, and improve productivity, a number of which are enabled or enhanced by technology. As other sectors have learned, we are unlikely to improve outcomes and productivity until we define and start measuring them. This starts with identifying what we seek to measure. It also requires identifying costs associated with components of our education system and with individual resources and activities so that the ratio of outcomes to costs can be tracked over time.

5.2 Rethink basic assumptions in our education system that inhibit leveraging technology to improve learning, starting with our current practice of organizing student and educator learning around seat time instead of the demonstration of competencies.

To realize the full potential of technology for improving performance and increasing productivity, we must remove the process and structural barriers to broad adoption. The education system must work to identify and rethink basic assumptions of the education system. Some of these include measurement of educational attainment through seat time, organization of students into age-determined groups, the structure of separate academic disciplines, the organization of learning into classes of roughly equal size, and the use of time blocks.

5.3 Develop useful metrics for the educational use of technology in states and districts.

Current data on the use of educational and information technology in our system consist of records of purchases and numbers of computers and Internet connections. Very little information on how technology is actually used to support teaching, learning, and assessment is collected and communicated systematically. Only by shifting our focus to collecting data on how and when technology is used will we be able to determine the difference it makes and use that knowledge to improve outcomes and the productivity of our education system.

5.4 Design, implement, and evaluate technology-powered programs and interventions to ensure that students progress seamlessly through our P–16 education system and emerge prepared for college and careers.

The United States has a long way to go if we are to see every student complete at least a year of higher education or postsecondary career training. Achieving this target will require dramatically reducing the number of students who leave high school without getting a diploma and/or who are unprepared for postsecondary education. A complex set of personal and academic factors underlie students' decisions to leave school or to disengage from learning, and no one strategy will prevent every separation from the education system. Collaboration between P–12 and higher education institutions and practices supported with technology are crucial to addressing the problem.

Getting Started Now

The Department of Education has a role in identifying effective strategies and implementation practices; encouraging, promoting, and actively supporting innovation and best practices in states and districts; and nurturing collaborations that help states and districts leverage resources so the best ideas can be scaled up. To help ensure the successful implementation of this plan, the Department of Education can take action around the following priorities:

Convening education stakeholders, in person and online, to share content, insights, and expertise and to collaborate on key elements of this plan. Ideas and best practices that emerge from these convenings will be shared throughout our education system.

The Department of Education can

Convene learning science researchers, developers of educational technology, curriculum developers, public and private sector organizations, and Universal Design for Learning experts to share information and research for developing the next generation of technology-based learning platforms, resources, courses, and tools.

Facilitate collaboration between states and private and public sector organizations to design, develop, validate, and scale up new technology-based assessment resources for both formative and summative uses. These efforts should include exploring the use of embedded assessment technologies, such as simulations, collaboration environments, virtual worlds, and games in new assessment resources.

Convene P–12 and higher education institutions, states, and districts to collaborate on strategies for creating persistent student electronic learning records and using student data for continuous improvement.

Facilitate collaboration between states, districts, universities, other research and development organizations, other agencies, and the commercial sector to develop and leverage open educational resources. Designs for use and reuse and new business models will be included.

Convene states, teacher accreditation organizations, colleges of education, and organizations representing online learning providers to promote states' consideration of voluntary standards for online courses and for online teaching. This activity should include the promotion of reciprocity agreements between states for certifying online teachers.

Convene states and education leadership organizations to identify and rethink basic assumptions in our education system, starting with but not limited to the measurement of educational attainment through seat time. Other assumptions that should be reexamined are the organization of students into static age-determined groups and the organization of learning into classes of roughly equal size, as well as the structure of separate academic disciplines. The use of online learning and combining offline and online learning to provide options for flexibility, additional learning time, and more effective use of the time allotted should be explored.

Convene states, districts, and education and technology experts from the academic, private, and public sectors to define useful metrics for the use of technology in support of teaching and learning and improved operations that states and districts can use to guide technology purchases.

Promote collaboration between two- and four-year postsecondary education institutions, P–12 programs, and educational technology developers in the private and public sectors to design programs and resources to engage and/or reengage students and motivate them to graduate from high school ready for postsecondary education. Facilitate collaboration on alternative programs that take advantage of technology to reconnect with students and help them complete learning programs.

Supporting efforts to ensure that all students and educators have 24/7 access to the Internet via devices, including mobile devices, and that states, districts, and schools adopt technologies and policies to enable leveraging the technology that students already have.

The Department of Education can

Endorse and actively support the broadband initiatives of the *American Recovery and Reinvestment Act of 2009,* which are intended to accelerate deployment of Internet services in unserved, underserved, and rural areas and to strategic anchor institutions, such as schools, that are likely to provide significant public benefits. These initiatives are the Broadband Technology Opportunities Program of the Department of Commerce's National Telecommunications and Information Administration, the Rural Development Broadband Program of the Department of Agriculture, and the interagency National Broadband Plan developed by the Federal Communications Commission.

Work with districts, states, and the private sector to articulate effective technology support models for 24/7 access including using school- and student-owned devices. New support models for this type of access will require improved security systems, more intelligent filtering systems that allow blocking and enabling access within this type of infrastructure, and personnel and/or systems capable of providing around-the-clock support for school-, student-, and educator-owned devices used for learning.

Participating in efforts to ensure that transitioning from predominantly print-based classrooms to digital learning environments promotes organized, accessible, easy-to-distribute and easy-to-use content and learning resources.

The Department of Education can

Support the development of an open architecture mapping and navigation platform that will enable the visual depiction of learning progressions across all content areas and reflect 21st-century expertise. Accessible online, these learning progressions can be used to reenvision content, resources, assessments, curricula, and professional learning for teachers and encourage the sharing of best practices and new approaches to improve teaching and learning. This platform would encourage a variety of mashups and spur innovation.

Initiate an interagency effort to create, publish, and maintain open standards for content, student learning, and financial data interoperability. State and district requests for proposals for assessment and data systems should require appropriate use of these standards.

Create a learning registry, an open-standard registry of all content developed by various agencies throughout the federal government so that states, districts, and schools can access and leverage it and combine it with their own repositories of content.

Expand the availability of digital-learning content, resources, courses, and tools and ensure their continuous improvement by funding the research and development of open educational resources. Facilitate states working together to pool resources for identifying and evaluating or issuing requirements for developing open educational resources.

Support research and evaluation efforts focused on the effectiveness of online and blended learning environments at all levels.

Encourage the use of technology and online learning courses and resources in federally funded programs that expand learning opportunities for underserved populations and others who need it most.

Encourage states, districts, P–12 programs, and postsecondary education institutions to experiment with such resources as online learning, online tutoring and mentoring, games, cognitive tutors, immersive environments, and participatory communities and social networks both within and across education institutions to give students guidance and information about their own learning progress and strategies for seamless completion of a comprehensive P–16 education.

Funding online communities of practice to ensure that teachers are connected to data, resources, experts, and peers to prepare and enable connected teaching.

The Department of Education can

Fund a contract for design research on online communities of practice and apply the design to a series of at least six communities of practice in order to leverage the use of educational technology and social networking to improve teaching, assessment, learning, and infrastructure in schools. The communities of practice will be designed to ensure teachers and other education professionals are highly connected to data, resources, content, experts, peers, and just-in-time expertise on a variety of topics.

Leverage the design work on online communities of practice to inform contracts and grants for providing technical assistance throughout the Department of Education.

Ensuring a sustained focus on R&D for education, including scaling up and sustaining innovations, technology transfer, and grand challenge problems.

The Department of Education can

Implement an approach to R&D for education that focuses on five areas:

- Transferring existing and emerging technology innovations from sectors such as business, consumer, and entertainment into education.
- Transferring appropriate developments from the Department of Defense Advanced Research Projects Administration to the public education sector.
- Supporting and sustaining the education R&D that is currently happening throughout the National Science Foundation by designing a commercialization strategy.

- Creating a new organization (the National Center for Research in Advanced Information and Digital Technologies) with the mission of serving the public good through R&D at the intersection of learning sciences, technology, and education.
- Providing competitive grants for scaling up innovative and evidence-based practices through the Department of Education's Investing in Innovation Fund.

Encouraging states and districts to move to more integrated use of technology in teaching and learning.

The Department of Education can

Encourage states to assign responsibility for educational technology to senior-level individuals who will provide leadership in connecting the planning for educational and information technology to the core functions of curriculum and instruction, assessment, and professional learning and in ensuring that the most efficient and effective purchases are made. These individuals will be invited to participate on a cross-functional team organized by the Department of Education to share insights and best practices and collaborate on technology for teaching and learning.

Encourage every federal grant program and expenditure to consider how technology can be a multiplier for support and scale in education.

Leading a national initiative to identify strategies for increasing productivity in education and work with states, districts, and schools to build their capacity for implementing them.

The Department of Education can

Start a national initiative and develop an ongoing research agenda dedicated to improving productivity in the education sector. The initiative will focus on defining productivity in education and establishing new and more useful metrics and methods for measuring it. The initiative will promote continuous improvement and data-driven decision making, leveraging technology to plan, manage, monitor, and report spending so that education decision-makers can be provided with a reliable, accurate, and complete view of the financial performance of our education system at all levels.

Encourage states to adopt common cost accounting standards to allow benchmarking and analysis of costs and provide a platform for sharing strategies for cost saving and productivity improvement and highlight policies at the federal, state, and local level that might inhibit progress, for example, in procurement.

Develop new and better ways of assessing the efficacy of technology in teaching and learning and in the financial operations of education institutions.

Introduction

> *"By 2020, America will once again have the highest proportion of college graduates in the world."*
>
> *—President Barack Obama, Address to Congress, Feb. 24, 2009*

Education is the key to America's economic growth and prosperity and to our ability to compete in the global economy. It is the path to good jobs and higher earning power for Americans. It is necessary for our democracy to work.

With this in mind, America needs a public education system that provides all learners—including low-income and minority students, English language learners, students with disabilities, gifted and talented students, early childhood learners, adult workforce learners, and seniors—with engaging and empowering learning experiences. Our education system also should help learners set goals, stay in school despite obstacles, earn a high school diploma, and obtain the further education and training needed for success in their personal lives, the workplace, and their communities.

We want to develop inquisitive, creative, resourceful thinkers; informed citizens; effective problem-solvers; groundbreaking pioneers; and visionary leaders. We want to foster the excellence that flows from the ability to use today's information, tools, and technologies effectively and a commitment to lifelong learning. All these are necessary for Americans to be active, creative, knowledgeable, and ethical participants in our globally networked society.

To accomplish this, schools must be more than information factories; they must be incubators of exploration and invention. Educators must be more than information experts; they must be collaborators in learning, seeking new knowledge and constantly acquiring new skills alongside their students. Students must be fully engaged in school—intellectually, socially, and emotionally. This level of engagement requires the chance to work on interesting and relevant projects, the use of technology environments and resources, and access to an extended social network of adults and peers who support their intellectual growth.

Education reform has been on the national agenda for decades. Still, we no longer have the highest proportion of college graduates in the world, and we have a system that too often fails our students. According to current data,

- Approximately 25 percent of young people in the United States fail to graduate on time with a regular diploma (Stillwell 2010). That number jumps to almost 40 percent for Latino and African-American students.

- Some 5,000 schools persistently fail year after year, and about 2,000 high schools produce about half the nation's dropouts and three-quarters of minority dropouts (Balfanz and Legters 2004; Tucci 2009).

- Of students who do graduate from high school, one-third are unprepared for postsecondary education, forcing community colleges and four-year colleges and universities to devote precious time and resources to remedial work for incoming students (National Center for Education Statistics 2003).

- By 2016—just six years from now—four out of every 10 new jobs will require some advanced education or training (Dohm and Shniper 2007). Fifteen of the 30 fastest-growing fields will require a minimum of a bachelor's degree (Bureau of Labor Statistics 2007).

- Only about 41 percent of young people earn a two-year or four-year college degree (OECD 2010). Enrollment rates are unequal: 69 percent of qualified white high school graduates enter four-year colleges compared with just 58 percent of comparable Latino graduates and 56 percent of African-American graduates (National Center for Education Statistics 2007).

- Thirty million adults have below-basic levels of English literacy, and another 63 million read English only at a basic level, which means that 44 percent of adults living in America could benefit from English literacy instruction (National Center for Education Statistics 2009).

As Secretary of Education Arne Duncan has said, the current state of our education system is "economically unsustainable and morally unacceptable" (Duncan 2010).

Transforming American Education: An Urgent Priority

Under the Obama administration, education has become an urgent priority driven by two clear goals set by the president:

- By 2020, we will raise the proportion of college graduates from where it now stands (about 41 percent) so that 60 percent of our population holds a two-year or four-year degree (National Center for Public Policy and Higher Education 2008).

- We will close the achievement gap so that all students graduate from high school ready to succeed in college and careers.

To accomplish these goals, we must embrace a strategy of innovation, careful implementation, regular evaluation, and continuous improvement. The programs and projects that work must be brought to scale so that every learner has the opportunity to take advantage of that success. Our regulations, policies, actions, and investments must be strategic and coherent.

To this end, Secretary Duncan has identified four major areas where our investments and efforts can have the greatest impact:

- States should adopt standards and assessments that prepare students to succeed in college and the workplace and compete in the global economy.

- States should build data systems that measure student growth and success and inform educators about how they can improve instruction.

- States should recruit, reward, develop, and retain effective educators, especially in underserved areas where they are needed most.

- States should turn around their lowest-achieving schools.

In addition, in November 2009 President Obama launched the Educate to Innovate campaign to improve the participation and performance of all U.S. students, including underrepresented groups such as girls and women, in science, technology, engineering, and mathematics (STEM).

We are guided in these and other education initiatives by Secretary Duncan's conviction that we need revolutionary transformation, not evolutionary tinkering, and we know that transformation cannot be achieved through outdated reform strategies that take decades to unfold.

We must be clear about the outcomes we seek. We must apply the core principles of process redesign to quickly evaluate our education system for effectiveness, efficiency, and flexibility and design and implement new processes where needed. We must monitor and measure our performance to continually improve learning outcomes while managing costs. We must hold ourselves accountable. To do all these things, we must apply the advanced technology available in our daily lives to student learning and to our entire education system.

Above all, we must accept that we do not have the luxury of time. We must act now and commit to fine-tuning and midcourse corrections as we go. We must learn from other kinds of enterprises that have used technology to improve outcomes and increase productivity.

Drivers of Change

The Department of Education's decisions and actions—and those of the entire education system and its stakeholders throughout the United States—must be guided by the world we live in, which demands that we think differently about education than we have in the past. Technology and the Internet have fostered an increasingly competitive and interdependent global economy and transformed nearly every aspect of our daily lives—how we work; play; interact with family, friends, and communities; and learn new things.

The context of global interdependence is especially important for this generation of students because only individuals and nations working together will solve many of today's challenges. The leadership of the United States in the world depends on educating a generation of young people who are capable of navigating an interdependent world and collaborating across borders and cultures to address today's great problems.

Another important context is the growing disparity between students' experiences in and out of school. Students use computers, mobile devices, and the Internet to create their own engaging learning experiences outside school and after school hours—experiences that too often are radically different from what they are exposed to in school. Our leadership in the world depends on educating a generation of young people who know how to use technology to learn both formally and informally.

Technology itself is an important driver of change. Contemporary technology offers unprecedented performance, adaptability, and cost-effectiveness.

Technology can enable transforming education but only if we commit to the change that it will bring to our education system. For example, students come to school with mobile devices that let them carry the Internet in their pockets and search the Web for the answers to test questions. While such behavior traditionally has been viewed as cheating, with such ubiquitous access to information is it time to change what and how we teach? Similarly, do we ignore the informal learning enabled by technology outside school, or do we create equally engaging and relevant experiences inside school and blend the two?

We know from our rankings in the world in terms of academic achievement and graduation rates that what we have been doing to fill our education pipeline and ensure students graduate is not working. Getting students to stay in school is crucial, and equipping them with the skills they need to learn to be successful throughout their lives is equally important.

The essential question facing us as we transform the U.S. education system is this: What should learning in the 21st century look like?

Learning Powered by Technology

Building on the report of a technical working group of leading researchers and practitioners and on input received from many respected education leaders and the public, this National Education Technology Plan tackles this essential question and other important questions. The plan presents goals, recommendations, and actions for a model of learning informed by the learning sciences and powered by technology. Advances in the learning sciences give us valuable insights into how people learn. Technology innovations give us the ability to act on these insights as never before.

The plan is based on the following assumptions:

- Many of the failings of our education system stem from our failure to engage the hearts and minds of students.
- What students need to learn and what we know about how they learn have changed, and therefore the learning experiences we provide should change.
- How we assess learning focuses too much on what has been learned after the fact and not enough on improving learning in the moment.
- We miss a huge opportunity to improve our entire education system when we gather student-learning data in silos and fail to integrate the information and make it broadly available to decision-makers at all levels of our education system—individual educators, schools, districts, states, and the federal government.
- Learning depends on effective teaching, and we need to focus on extended teams of connected educators with different roles who collaborate within schools and across time and distance and who use technology resources and tools to augment human talent.
- Effective teaching is an outcome of preparing and continually training teachers and leaders to guide the type of learning we want in our schools.
- Making engaging learning experiences and resources available to all learners anytime and anywhere requires state-of-the-art infrastructure, which includes technology, people, and processes that ensure continuous access.
- Education can learn much from such industries as business and entertainment about leveraging technology to continuously improve learning outcomes while increasing the productivity of our education system at all levels.
- Just as in health, energy, and defense, the federal government has an important role to play in funding and coordinating some of the R&D challenges associated with leveraging technology to ensure the maximum opportunity to learn.

The plan also assumes that with technology we can provide engaging and powerful learning content, resources, and experiences and assessment systems that measure student learning in more complete, authentic, and meaningful ways. With technology-based learning and assessment systems, we can improve student learning and generate data that can be used to continuously improve the education system at all levels. With technology, we can execute collaborative teaching strategies combined with professional learning strategies that better prepare and enhance educators' competencies and expertise over the course of their careers. With technology, we can redesign and implement processes to produce better outcomes while achieving ever higher levels of productivity and efficiency across the education system.

Collaboration and Investment for Success

Transforming U.S. education is no small task, and accomplishing it will take leadership throughout our education system—states, districts, schools, and the federal government—as well as partnerships with higher education institutions, private enterprises, and not-for-profit entities.

In the United States, education is primarily a state and local responsibility. State and local public education institutions must ensure equitable access to learning experiences for all students and especially students in underserved populations—low-income and minority students, students with disabilities, English language learners, preschool-aged children, and others. States and districts need to build capacity for transformation. The Department of Education has a role in identifying effective strategies and implementation practices; encouraging, promoting, and actively supporting innovation in states and districts; and nurturing collaborations that help states and districts leverage resources so the best ideas can be scaled up.

Building capacity for transformation also will require investment. But we must resolve to spend investment dollars wisely, with clear expectations about what we expect in terms of learning outcomes and process improvements.

Implementing the plan depends on the broadband initiatives of the *American Recovery and Reinvestment Act of 2009,* which are intended to accelerate deployment of Internet services in unserved, underserved, and rural areas and to strategic institutions that are likely to create jobs or provide significant public benefits. These initiatives are the Broadband Technology Opportunities Program of the Department of Commerce's National Telecommunications and Information Administration, the Rural Development Broadband Program of the Department of Agriculture, and the interagency National Broadband Plan developed by the Federal Communications Commission (FCC).

The plan also draws guidance and inspiration from the report of the National Science Foundation (NSF) Task Force on Cyberlearning, *Fostering Learning in the Networked World: The Cyberlearning Challenge and Opportunity,* published in June 2008, and the work of the President's Council of Advisors on Science and Technology (PCAST).

The plan will be best served if postsecondary education institutions—community colleges and four-year colleges and universities—partner with K–12 schools to remove barriers to postsecondary education and put plans of their own in place to decrease dropout rates. In addition, postsecondary institutions are key players in the transformation of teacher preparation and the national R&D efforts recommended in this plan.

Education has long relied on the contributions of organizations in both the private and not-for-profit sectors, and this will not change.

As we enter the second decade of the 21st century, there has never been a more pressing need to transform American education, and there will never be a better time to act. In keeping with the appropriate role of the federal government, this Nation Education Technology Plan is not a prescription but rather a common definition and a five-year action plan that responds to an urgent national priority and a growing understanding of what the United States needs to do to remain competitive in a global economy.

Accessibility of Web Content

Not all of the websites identified in this plan, at the time of its publication, meet the technical requirements for Web accessibility established by Section 508 of the Rehabilitation Act of 1973, *as amended (see http://www.Section508.gov for these requirements). The Department of Education will take appropriate steps to bring all websites subject to Section 508 into compliance with those accessibility requirements as soon as reasonably possible. Moreover, as Secretary of Education Duncan stated in the cover letter to this plan, the Department is committed to taking a leadership role in ensuring that the benefits of educational technology are accessible to all learners "regardless of background, languages, or disabilities." To meet that goal, the Department will not only exercise its authority under sections 508 and 504 of the* Rehabilitation Act of 1973* *as necessary to achieve compliance, but also will work with and encourage the broader educational community to ensure that individuals with disabilities are not denied the benefits of educational technology due to accessibility issues.*

* *Section 504 provides that:*
No otherwise qualified individual with a disability in the United States, as defined in section 705(2) of this title, shall, solely by reason of her or his disability, be excluded from the participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance or under any program or activity conducted by any Executive agency or by the United States Postal Service.

Learning: Engage and Empower

Goal: All learners will have engaging and empowering learning experiences both in and out of school that prepare them to be active, creative, knowledgeable, and ethical participants in our globally networked society.

Our education system today supports learning, mostly in classrooms and from textbooks, and depends on the relationship between individual educators and their students. The role technology plays in the nation's classrooms varies dramatically depending on the funding priorities of states, districts, and schools and individual educators' understanding of how to leverage it in learning in meaningful ways.

Meanwhile, many students' lives outside school are filled with technology that gives them mobile access to information and resources 24/7, enables them to create multimedia content and share it with the world, and allows them to participate in online social networks and communities where people from all over the world share ideas, collaborate, and learn new things. According to a national survey by the Kaiser Family Foundation, 8- to 18-year-olds today devote an average of seven hours and 38 minutes to using entertainment media in a typical day—more than 53 hours a week (Kaiser Family Foundation 2009). The opportunity to harness this interest and access in the service of learning is huge.

Technology brings similar opportunities to professionals in many fields. Physicians use mobile Internet access devices to download x-rays and test results or to access specialized applications, such as medicine dosage calculators. Earthquake geologists install underground sensors along fault lines, monitor them remotely, and tie them in to early warning systems that signal the approach of seismic waves. Filmmakers use everyday computers and affordable software for every phase of the filmmaking process, from editing and special effects to music and sound mixing. Technology dominates the workplaces of most professionals and managers in business, where working in distributed teams that need to communicate and collaborate is the norm.

The challenge for our education system is to leverage technology to create relevant learning experiences that mirror students' daily lives and the reality of their futures. We live in a highly mobile, globally connected society in which young Americans will have more jobs and more careers in their lifetimes than their parents. Learning can no longer be confined to the years we spend in school or the hours we spend in the classroom: It must be lifelong, lifewide, and available on demand (Bransford et al. 2006).

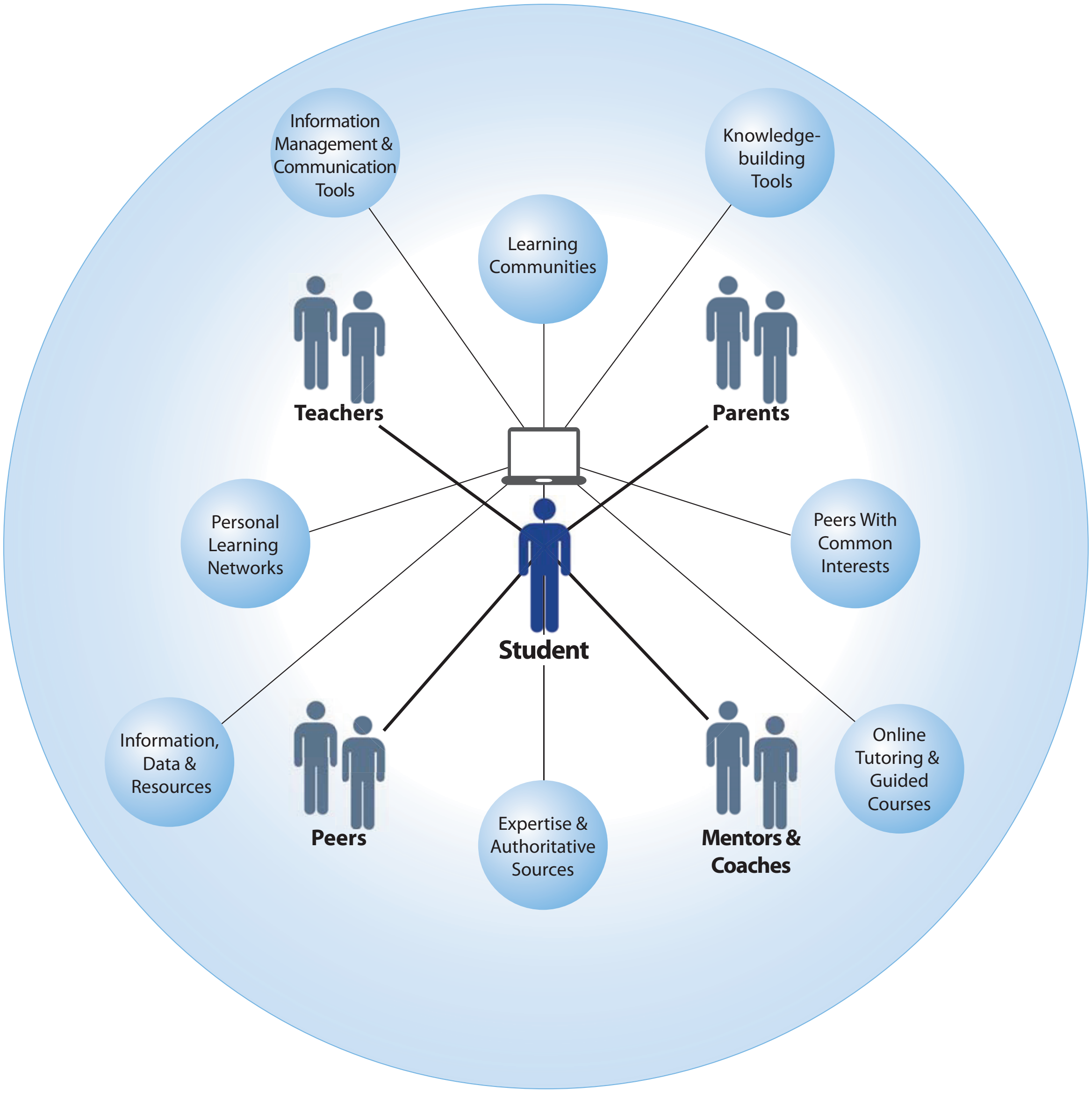
To prepare students to learn throughout their lives and in settings far beyond classrooms, we must change what and how we teach to match what people need to know, how they learn, and where and when they learn and change our perception of who needs to learn. We must bring 21st-century technology into learning in meaningful ways to engage, motivate, and inspire learners of all ages to achieve.

The challenging and rapidly changing demands of our global economy tell us what people need to know and who needs to learn. Advances in learning sciences show us how people learn. Technology makes it possible for us to act on this knowledge and understanding.

What Learning Should Look Like

Figure 1 depicts a model of learning powered by technology. In contrast to traditional classroom instruction, which often consists of a single educator transmitting the same information to all learners in the same way, the model puts students at the center and empowers them to take control of their own learning by providing flexibility on several dimensions. A core set of standards-based concepts and competencies form the basis of what all students should learn, but beyond that students and educators have options for engaging in learning: large groups, small groups, and activities tailored to individual goals, needs, and interests.

Figure 1. A Model of Learning, Powered by Technology



In this model, technology supports learning by providing engaging environments and tools for understanding and remembering content. For example, game-based courses use features familiar to game players to teach core subject content, such as history.

Technology provides access to a much wider and more flexible set of learning resources than is available in classrooms and connections to a wider and more flexible set of "educators," including teachers, parents, experts, and mentors outside the classroom. Engaging and effective learning experiences can be individualized or differentiated for particular learners

Individualized, Personalized, and Differentiated Instruction

Individualization, differentiation, and personalization have become buzzwords in education, but little agreement exists on what exactly they mean beyond the broad concept that each is an alternative to the one-size-fits-all model of teaching and learning. For example, some education professionals use personalization to mean that students are given the choice of what and how they learn according to their interests, and others use it to suggest that instruction is paced differently for different students. Throughout this plan, we use the following definitions:

***Individualization** refers to instruction that is paced to the learning needs of different learners. Learning goals are the same for all students, but students can progress through the material at different speeds according to their learning needs. For example, students might take longer to progress through a given topic, skip topics that cover information they already know, or repeat topics they need more help on.*

***Differentiation** refers to instruction that is tailored to the learning preferences of different learners. Learning goals are the same for all students, but the method or approach of instruction varies according to the preferences of each student or what research has found works best for students like them.*

***Personalization** refers to instruction that is paced to learning needs, tailored to learning preferences, and tailored to the specific interests of different learners. In an environment that is fully personalized, the learning objectives and content as well as the method and pace may all vary (so personalization encompasses differentiation and individualization).*

(either paced or tailored to fit their learning needs) or personalized, which combines paced and tailored learning with flexibility in content or theme to fit the interests and prior experience of each learner. (See sidebar for definitions of individualized, differentiated, and personalized learning.)

An example of individualized and differentiated learning can be found in New York City's School of One pilot, a 2009 summer program that allowed students learning mathematics to learn at their own pace and in a variety of ways. On the basis of its initial success, the School of One concept was expanded in 2010 and is set for further expansion in 2011. (See sidebar on the School of One for more information.)

Personalized learning supports student learning in areas of particular interest to them. For example, a student who learns Russian to read the works of Dostoevsky in their original form and another who orders a surgical kit on eBay to practice sutures on oranges are learning things we would never ask all students to do. But these things are important because they are driven by learners' own passions.

Within specific content areas, although standards exist for what we expect all students to know and be able to do, the model also provides options for how the learning can take place. Among these options is working with others in project-based learning built around challenges with real-world relevance. Well-designed projects help students acquire knowledge in specific content areas and also support the development of more specialized adaptive expertise that can be applied in other areas (Trilling and Fadel 2009). (See sidebar on Winona Middle School for an example of such a project.)

Technology also gives students opportunities for taking ownership of their learning. Student-managed electronic learning portfolios can be part of a persistent learning record and help students develop the self-awareness required to set their own learning goals; express their own views of their strengths, weaknesses, and achievements; and take responsibility for them. Educators can use them to gauge students' development, and they also can be shared with peers, parents, and others who are part of students' extended network.

What People Need to Learn

Education is an enterprise that asks, What's worth knowing and being able to do?

Education experts have proposed answers to this question, and although they differ in the details all recognize that what we need to know goes beyond the traditional three Rs of Reading, 'Riting, and 'Rithmetic. Whether the domain is English language arts, mathematics, sciences, social studies, history, art, or music, 21st-century competencies and expertise such as critical thinking, complex problem solving, collaboration, and multimedia communication should be woven into all content areas.

We are still evolving our understanding of what it means to be a 21st-century learner. For example, what does it mean to be digitally literate in an age of constantly evolving technologies and resources, and how we can teach learners to use new technology in ways that are productive, creative, and responsible? One response to these essential questions is offered by the International Society of Technology in Education (ISTE), which has published the National Educational Technology Standards for Students (NETS–S). (See sidebar on ISTE's standards for students for more information.)

A number of other researchers and organizations also have addressed the issue either in part or whole, and the domain seems to include three categories: information literacy, the ability to identify, retrieve, evaluate, and use information for a variety of purposes; media literacy, the ability to consume and understand media, as well as communicate effectively using a variety of media types; and digital citizenship, the ability to evaluate and use technologies appropriately, behave in socially acceptable ways within online communities, and develop a healthy understanding of issues surrounding online privacy and safety. All this requires a basic understanding of technologies themselves and the ability to make increasingly sound judgments about the use of technology in our daily lives.

Answers to questions about 21st-century learning also must take into account that people no longer can learn everything there is to know in a lifetime, and the economic reality is that most people will change jobs throughout their lives. Therefore, we need adaptive learning skills that blend content knowledge with the ability to learn new things. This requires developing deep understanding within specific domains and the ability to

School of One: Individualizing and Differentiating Learning

During summer 2009, the New York City school system conducted a two-month pilot test of a radically new education concept, the School of One. Conducted at Middle School 131 in New York's Chinatown, the pilot program focused on a single subject, mathematics, and a single grade level (sixth grade). The New York City Department of Education views it as demonstration of a concept that is equally applicable in other subjects and grades.

Instead of organizing the 80 participating students into classes with one of the school's four teachers assigned to each class, the School of One used flexible arrangements of students and teachers and a large collection of alternative ways for students to learn the 77 mathematics skills that were the objectives for the program. The School of One lesson bank included more than 1,000 lessons covering those 77 mathematics skills. Rather than giving every student the same content, the School of One used data from prior assessments to identify which skills each student should work on during the summer. Inputs from teachers and from students provided information about how each student learned best (for example, "likes to learn through games" or "likes to learn alone"). A computer algorithm used information about each student's demonstrated mathematics skills and his or her learning preferences to generate individual "playlists" of appropriate learning activities.

Staff for the summer pilot included teachers whose efforts focused on large-group instruction, college students studying to be teachers who provided small-group instruction and support for online learning, and high school students who focused on tutoring and the grading of assessments.

School of One uses technology to develop a unique learning path for each student and to provide a significant portion of the instruction that is both individualized and differentiated. The New York City Department of Education now operates the School of One program in three middle schools and plans to expand the program to serve over 5,000 students by 2012.

Winona Middle School's Cultural History Project

In 1995, when the Internet was just arriving in schools, students at Winona Middle School in Winona, Minn., began to use it to support and showcase a class project about local history and the changing demographics of their town. Students gathered information about their community by visiting local museums, searching texts, and interviewing local residents. They built a website to share their findings with one another and with their community. The website began to take on a life of its own, attracting the interest of community leaders, professional historians, and individuals living halfway around the world who found they were distant relatives of the town's earliest immigrants. Students expanded the website to include the contributions of the wider community and built a searchable database of genealogical information and other artifacts.

Today, Winona's Cultural History website continues to be a valuable resource for the school and its community, and students continue to interact with others in or outside their local area to evolve an ongoing knowledge base. One of the secrets of this project's success is that it leverages very simple technology so that it can be sustained with minimal funding and maintenance.

ISTE's National Educational Technology Standards for Students

The International Society for Technology in Education has created National Educational Technology Standards for Students (NETS-S) that encompass a full range of technology competencies. The NETS standards include

- ***Creativity and innovation.*** *Students should be able to use technology and their existing knowledge to generate new ideas, products, or processes.*
- ***Communication and collaboration.*** *Students should be able to work collaboratively, both in person and at a distance, and to communicate ideas effectively to multiple audiences using new media.*
- ***Research and information fluency.*** *Students should be able to use a variety of digital media to locate, organize, analyze, and evaluate information from a variety of sources.*
- ***Critical thinking, problem solving, and decision making****. Students should be able to define problems, plan and conduct research, and identify solutions or appropriate decisions using digital tools and resources.*
- ***Digital citizenship.*** *Students should take responsibility for their own lifelong learning and should practice safe, legal, and ethical use of information and digital tools.*
- ***Technology operations and concepts.*** *Students should understand technology systems, select and use technology applications effectively, and be able to troubleshoot systems and applications.*

make connections that cut across domains—learning activities that should replace the broad but shallow exposure to many topics that is the norm in our education system today. We also need to know how to use the same technology in learning that professionals in various disciplines do.

Professionals routinely use Web resources and such participatory technology as wikis, blogs, and user-generated content for the research, collaboration, and communication demanded in their jobs. For students, these tools create new learning activities that allow them to grapple with real-world problems, develop search strategies, evaluate the credibility and authority of websites and authors, and create and communicate with multimedia (Jenkins 2009; Leu et al. 2004). For example,

- In the study of mathematics, professional-level interactive graphing and statistical programs make complex topics more accessible to all learners and help them connect to datasets that are current and relevant to their lives.
- In earth sciences, collecting data with inquiry tools, adding geotags with GPS tools, and interactively analyzing visualizations of data patterns through Web browsers bring professional scientific methods and techniques to learners of all ages and abilities.
- In history, original documents available to historians as digital resources from the Smithsonian and other institutions are available to engage learners in historical thinking and reasoning.

As these examples illustrate, the world's information and sophisticated tools for using it, which are available anytime and anywhere, demand that in addition to knowing content, we become expert learners in at least three ways:

- As skillful and strategic learners who have learned how to learn new things and communicate what we have learned;
- As motivated and engaged learners who identify ourselves as growing in competence and want to learn even more; and

- As networked learners who have the ability to tap expertise anytime and anywhere that can advance our learning.

A crucial step in transforming American education to produce expert learners is creating, revising, and adopting content standards and learning objectives for all content areas that reflect 21st-century expertise and the power of technology to improve learning.

How People Learn

Advances in the learning sciences, including cognitive science, neuroscience, education, and social sciences, give us greater understanding of three connected types of human learning—factual knowledge, procedural knowledge, and motivational engagement. Neuroscience tells us that these three different types of learning are supported by three different brain systems. (See sidebar on the neuroscience of learning.) Social sciences reveal that human expertise integrates all three types of learning. Technology has increased our ability to both study and enhance all three types of learning (National Research Council 2000, 2003, 2007, 2009; National Science Foundation 2008b).

Factual Knowledge

Students are surrounded with information in a variety of forms, and specific features of information design affect how and whether students build usable knowledge from the information they encounter. For example, computers can replicate and integrate a wide variety of media for learning and education: text, video/film, animations, graphics, photos, diagrams, simulations, and more. As a result, technology can be designed to provide much richer learning experiences without sacrificing what traditional learning media offer. Technology can

- Represent information through a much richer mix of media types. This allows the integration of media and representations to illustrate, explain, or explore complex ideas and phenomena, such as interactive visualizations of data in earth and environmental sciences, chemistry, or astronomy. Technology can help learners explore phenomena at extreme spatial or temporal scales through simulation and modeling tools. This opens up many domains and ways of learning that were formerly impossible or impractical. (See sidebar on Chesapeake Bay FieldScope.)

The Neuroscience of Learning

Three broad types of learning—learning that, learning how, and learning why—each correspond to one of three main areas of the human brain.

Learning that *is associated with the posterior brain regions (the parietal, occipital, and temporal lobes within the cerebral cortex). These regions primarily take information in from the senses and transform it into usable knowledge—the patterns, facts, concepts, objects, principles, and regularities of our world. The medial temporal lobe, including the hippocampus, provides a system of anatomically related structures essential to conscious memory for facts and events—what is called declarative knowledge (Squire, Stark, and Clark 2004).*

Learning how *is associated with the anterior parts of the brain (the frontal lobe, from the primary motor cortex to the prefrontal cortex), specialized for learning how to do things, and is expressed through performance (Squire 2004). This also has been called procedural knowledge, implicit memory, and knowing how. This type includes learning "low-level" motor skills but also high-level skills and strategies known as executive functions.*

Learning why *is associated with the interior or central brain regions, including the extended limbic system and amygdale. These evolutionarily primitive brain regions are specialized for affective and emotional learning (LeDoux 2000). They contribute to learning and remembering not what an object is or how to use it but why it is important to us. These structures underlie what attracts our attention and interest, sustains our effort, motivates our behavior, and guides our goal setting and priorities. With these regions, we learn our values and priorities: our image as a person and as a learner and the values and goals that comprise it.*

Chesapeake Bay FieldScope: Analyzing Authentic Scientific Phenomena

Chesapeake Bay FieldScope is a collaborative high school science project that combines traditional hands-on fieldwork with Web-based geospatial technology and other tools to help students build a rich understanding of the ecosystem around them. Students use National Geographic FieldScope, a Web-based mapping, analysis, and collaboration tool, to investigate water quality issues in and around the Chesapeake Bay. In the classroom, students learn about the bay using a multimedia database of scientific information. In the field, students gather their own scientific observations (such as water quality samples, written notes, or digital photos of wildlife) and then upload them to the FieldScope database. All database information is organized as points on a map, providing an intuitive geospatial format to scaffold student learning.

- Facilitate knowledge connections through interactive tools. These include interactive concept maps, data displays, and timelines that provide visual connections between existing knowledge and new ideas.

Procedural Knowledge

Procedural knowledge learning includes both content-related procedures (learning how to do science inquiry, for example) and learning-related strategies (learning how to figure out how to solve a new problem or self-monitor progress on a task). Technology can expand and support a growing repertoire of strategies for individual learners by

- Providing scaffolds to guide learners through the learning process. Many programs use interactive prompts embedded directly into the learning resources, live or virtual modeling of helpful strategies, interactive queries that prompt effective processing, and timely and informative feedback on results. These scaffolds can be designed to respond to differences in individual learning styles and be available on demand when the learner needs help and then evolve or fade as the learner builds stronger skills.

- Providing tools for communicating learning beyond written or spoken language. This can be accomplished through Web-based multimedia, multimedia presentations, or such gestural expressions as those that drive interactions in gaming systems.

- Fostering online communities. Technology can provide platforms for connecting learners in online communities where they can support each other as they explore and develop deeper understanding of new ideas, share resources, work together beyond the walls of a school or home, and gain access to a much wider pool of expertise, guidance, and support (Ito 2009).

Motivational Engagement

The field of affective neuroscience has drawn attention to the critical importance of motivation in how the brain learns. We learn and remember what attracts our interest and attention, and what attracts interest and attention can vary by learner. Therefore, the most effective learning experiences are not only individualized in terms of pacing and differentiated to fit the learning needs of particular learners, but also personalized in the sense that they are flexible in content or theme to fit the interests of particular learners.

To stimulate motivational engagement, technology can

- Engage interest and attention. Digital learning resources enable engaging individual learners' personal interests by connecting Web-learning resources to learning standards, providing options for adjusting the challenge level of learning tasks to avoid boredom or frustration, and bridging informal and formal learning in and out of school (Brown and Adler 2008; Collins and Halverson 2009; National Science Foundation 2008b). Technology also can be used to create learning resources that provide immediate feedback modeled on games to help engage and motivate learners (Gee 2004).

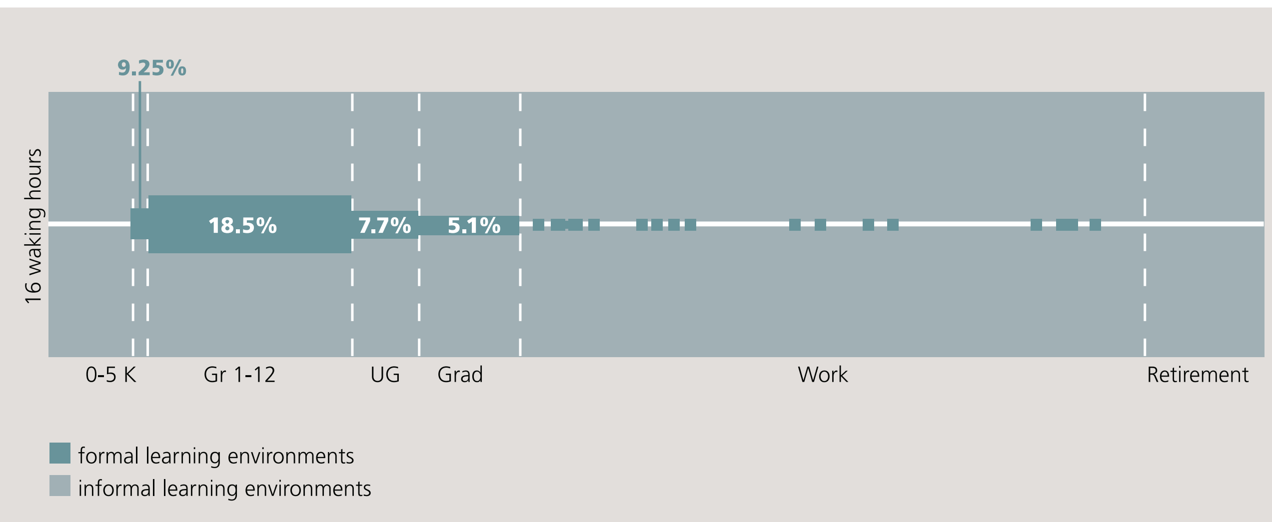
- Sustain effort and academic motivation. Technology-based learning resources can give learners choices that keep them engaged in learning, for example, by providing personally relevant content, a customized interface, options for difficulty level or alternative learning pathways, or choices for support and guidance.

- Develop a positive image as a lifelong learner. Technology can inspire imagination and intellectual curiosity that help people engage actively as learners and open new channels for success or visions of career possibilities. For example, when students use the tools of professionals to engage in real-world problems, they can begin to see themselves in productive professional roles ("I am a graphic artist," "I am a scientist," "I am a teacher"). Technology also provides opportunities for students to express themselves by engaging in online communities and sharing content they have created with the world.

Where and When People Learn

Not that long ago, people expected to learn much of the information and skills they needed for life and work within the confines of a school day and their years in school. Today, learning must be continuous and lifelong. (See Figure 2.)

Figure 2. Lifelong and lifewide learning



Source: Banks et al. 2006.

A key enabler of continuous and lifelong learning is technology. Technology gives learners direct access to learning and to the building blocks of their knowledge—organized, indexed, and available 24/7. This empowers learners to take control of and personalize their learning. Technology also can serve as a bridge across formal (in school) and informal (outside school) learning settings (Barron 2006), creating new opportunities to leverage informal learning by integrating it purposefully into the fabric of formal learning. Technology also provides ways to ensure that as students pursue self-directed and informal learning they are still guided by professional educators.

These are powerful ideas for individual learners but even more so when applied to groups of learners and learning communities—from small groups with different roles and responsibilities in pursuit of a learning project to far larger communities that may be pursuing ambitious design and learning products. Group learning especially is enhanced by social and participatory approaches, such as wikis, in which learners and teachers regardless of their location or the time of day can build knowledge structures or tackle inquiry problems that are posed together. Social media content created by teachers and learners, from blogs to podcasts to YouTube videos or creations and performances in virtual worlds (Jenkins 2009; Johnson, Levine, and Smith 2009; OECD 2008, 2009b), enrich such learning.

Specific examples of individual and collaborative learning with technology include the following:

- Inquiry and adventure environments with games and activities that foster learning.

- Online "collaboratories" (National Science Foundation 2008a) in which scientists establish protocols for collecting data with sensors from local environments across the planet. Learners and teachers learn science by doing science as they capture, upload, and then visualize and analyze geospatial and temporal data patterns from the data contributed by the globally networked community.

- Earth- and sky-mapping Web resources with data from the sciences and other fields of scholarly inquiry that anyone can use to develop virtual travel tours to be applied in learning and teaching activities.

- Augmented reality platforms and games that bring locally relevant learning resources into view for users of mobile devices with a GPS (Johnson et al. 2010).

- Use of the power of collective intelligence and crowdsourcing to tackle complex interdisciplinary problems.

- Powerful learning applications for mobile Internet access devices, such as musical instrument simulators, language-learning tools, and mathematical games.

- Sites and communities that publish academic content, including user-generated content. One notable example is the videotaped lectures of MIT physics professor Walter Lewin, available on MIT's OpenCourseWare site as well as through commercial courseware and video-sharing sites. Lewin's engaging and entertaining lectures have earned him a following of millions worldwide.

Who Needs to Learn

The United States cannot prosper economically, culturally, or politically if major parts of our citizenry lack a strong educational foundation, yet far too many students are not served by our current one-size-fits-all education system. The learning sciences and technology can help us design and provide more effective learning experiences for all learners.

Universal Design for Learning

Making learning experiences accessible to all learners requires universal design, a concept well established in the field of architecture, where all modern public buildings, including schools, are designed to be accessible by everyone. Principles and guidelines have been established for universal design in education based on decades of research and are known as Universal Design for Learning (UDL). The UDL principles reflect the way students take in and process information (Rose and Meyer 2002). Using them to develop goals, instructional methods, classroom materials, and assessments, educators can improve outcomes for diverse learners by providing fair opportunities for learning by improving access to content. The UDL principles are as follows:

- Provide multiple and flexible methods of presentation of information and knowledge. Examples include digital books, specialized software and websites, text-to-speech applications, and screen readers.

- Provide multiple and flexible means of expression with alternatives for students to demonstrate what they have learned. Examples include online concept mapping and speech-to-text programs.

- Provide multiple and flexible means of engagement to tap into diverse learners' interests, challenge them appropriately, and motivate them to learn. Examples include choices among different scenarios or content for learning the same competency and opportunities for increased collaboration or scaffolding.

The definition of UDL that appears in the *Higher Education Opportunity Act* of 2008 (103 U.S.C. § 42) has come to dominate the field because of its broad applicability and its research foundation in the learning sciences, both cognitive and neurosciences.

Serving the Underserved

The goal of UDL is to reach all learners, but some groups are especially underserved. In the past two decades, the disparities in access to and the use of technology have been closely associated with socioeconomic status, ethnicity, geographical location, and gender; primary language; disability; educational level; and generational characteristics (Pew Internet & American Life Project 2007). The FCC now refers to "digital exclusion" as what must be

Universal Design for Textbooks: National Instructional Materials Accessibility Standard—NIMAS

Traditional textbooks, like any standardized learning technology, are much more accessible to some learners than others. For students who are blind, who have physical disabilities, or who have reading disabilities, textbooks impose barriers rather than opportunities for learning. In the past, each classroom teacher or school had to generate some kind of work-around to overcome these barriers—contracting for a Braille version of the book, engaging an aide to help with the physical demands of textbooks, recording or purchasing an audio version for students with dyslexia, and so forth. The costs—in time, resources, learning opportunities—of retrofitting in these ways are high. Most important, the costs of such one-off accommodations are repeated in every classroom and district throughout the country—a staggering waste of money and time.

In 2006, the U.S. Congress mandated a new and more universally designed approach. In that year, regulations for the National Instructional Materials Accessibility Standard (NIMAS) went into effect. That standard stipulates that all U.S. textbooks be available as a "digital source file" (a fully marked up XML source file based on the Daisy international standard). The power of that digital source file is in its flexibility: It can be easily transformed into many different student-ready versions, including a Braille book, a digital talking book, a large-text version, and so forth. The same content can be generated once by a publisher but can be displayed in many different ways to match the different needs of diverse students.

overcome, because job applications, health information, and many other crucial information resources appear only in the digital realm (Federal Communications Commission 2009). As we use technology to reach all learners, the following groups need special attention:

- Low-income and minority learners. Despite significant gains, learners from low-income communities and underserved minority groups still are less likely to have computers and Internet access and have fewer people in their social circles with the skills to support technology-based learning at home (Warschauer and Matuchniak 2010). Some of the solutions to the access problem are capitalizing on existing programs in the public sphere—extended hours for use of networked computers in schools, libraries, community centers, and so on.

- English language learners. English is the predominant language of instruction in most U.S. classrooms and in the vast majority of Web resources. The challenges of learning the content and skills necessary to function as a 21st-century citizen are heightened if English is not a person's first language. Recent advances in language translation technology provide powerful tools for reducing language barriers. With proper design, technology can easily represent information so that there are multiple alternatives for English, multiple options for unfamiliar vocabulary or syntax, and even alternatives to language itself (use of image, video, and audio).

- Learners with disabilities. In public schools, many learners are identified as having special needs. These students need accommodations to have the opportunity to achieve at the same levels as their peers. In addition to UDL for learners with significant physical and sensory disabilities, powerful new assistive technologies are increasingly becoming available to improve access to learning opportunities. These include electronic mobility switches and alternative keyboards for students with physical disabilities, computer-screen enlargers and text-to-speech and screen readers for individuals with visual disabilities, electronic sign-language dictionaries and signing avatars for learners with hearing disabilities, and calculators and spellcheckers for individuals with learning disabilities. Many of these devices are difficult or impossible to use with traditional learning materials, such as printed textbooks. The advantage of digital resources, especially those that are universally designed, is that they can easily be made accessible through assistive technologies. (See the sidebar on universal design for textbooks.)

- Early childhood: For underserved children, learning gaps in literacy begin in early childhood and become increasingly difficult to overcome as their education progresses. Early intervention is crucial if these children are to keep pace with their peers, especially intervention that augments the linguistic, visual, and symbolic worlds that learners experience and seek to emulate. Increasingly, educational television offerings are being complemented with computer-based activities and resources for caregivers that help them engage with young learners around the learning content. A recent rigorous experimental test of such a combination, when used in daycare settings to target early literacy skills, found significant positive effects. (See the sidebar on building early literacy skills through technology.)

- Adult workforce. Many adults in the workforce are underproductive, have no postsecondary credential, and face limited opportunities because they lack fluency in English or other basic literacy skills. Unfortunately, they have little time or opportunity for the sustained learning and development that becoming fluent would require. For these learners, technology expands the opportunities for where and when they can learn, enabling them to catch up and continue to learn. Such resources as Learner Web and USA Learns make it possible for working adults to take online courses anytime and anywhere. While individual adults benefit from more opportunities for advancement, companies and agencies benefit from the increased productivity of a fully literate workforce, one continuously preparing for the future. (See the sidebar on adult learning resources.)

- Seniors. The aging population is rapidly expanding, and elders have specific disabilities—visual, hearing, motor, cognitive—that accompany the neurology of aging. At the same time, seniors have special strengths that come from their accumulated wisdom and experience. Capitalizing on those strengths in supporting lifelong learning for seniors requires careful design of learning environments and the use of technology so that sensory

Building Early Literacy Skills Through Technology-rich Learning Experiences

Although decades of research show that public media can improve literacy skills when young children watch at home (Fisch 2004; Thakkar, Garrison, and Christakis 2006), using digital media in preschools has been more controversial. Now, new research suggests that technology-rich classroom experiences can help build young children's school readiness skills (Penuel et al. 2009).

In a recent study, researchers evaluated the impact of a 10-week literacy intervention built around media-rich materials developed with support from Ready to Learn. The intervention targeted preschool children's literacy skills through a combination of teacher-led video viewings of PBS shows, educational computer games, and hands-on activities. Early childhood educators learned how to use the media as tools to support academic instruction, actively engaging children with technology to teach key learning concepts.

Children who participated in the literacy curriculum outscored the control group children on four important literacy measures that predict later reading success: the ability to name letters, know the sounds associated with those letters, recognize letters in their own names, and understand basic concepts about stories and printed words. Notably, these learning gains were of a magnitude rarely observed in preschool curriculum intervention studies (Preschool Curriculum Evaluation Research Consortium 2008), demonstrating the power of technology-based interventions to help close early learning gaps.

Adult Learning Resources

Learner Web

Developed at Portland State University, Learner Web is a learning support system for adults with a specific goal, such as earning a GED, transitioning to higher education, or gaining skills to qualify for a job. The system is structured around the adult's selected learning plan and offers courseware, work with a tutor or teacher, assessments, and an electronic portfolio. Learners can receive assistance both over the Web and by telephone.

USA Learns

The online multimedia resource USA Learns helps adult learners increase their skills in reading, writing, and speaking English. USA Learns was created for Spanish-speaking adult immigrants by the U.S. Department of Education in collaboration with the Sacramento County Office of Education and the University of Michigan Institute of Social Research. The topics, characters, and simulations in USA Learns reflect the challenges of the immigrant experience. The system is intended for home use but includes a management component that teachers or tutors can use to monitor progress if the adult learner is in a formal program. Users of USA Learns can choose to get instructions in English or Spanish, and immediate feedback and comprehension checks and quizzes help learners gauge their own progress.

weaknesses (in vision or hearing) and mnemonic capacity (in working and associative memory) do not erect insurmountable barriers to continued learning, independence, and socialization.

Enabling All Learners to Excel in STEM

The state of science and engineering in the United States is strong, but U.S. dominance worldwide has eroded significantly in recent years, primarily because of rapidly increasing capability in East Asian nations, particularly China (National Science Board 2010). In addition, new data show that U.S. 15-year-olds are losing ground in science and math achievement compared with their peers around the world (McKinsey & Company 2009).

In November 2009, President Obama launched the Educate to Innovate campaign to improve the participation and performance of America's students in STEM with the goal of enabling all learners to excel in STEM. In January 2010, the President announced a new set of public-private partnerships committing $250 million in private resources to attract, develop, reward, and retain STEM educators.

In addition, the NSF through its cyberlearning initiatives and the President's Council of Advisors on Science and Technology (PCAST) are making recommendations to guide the restructuring of STEM domains for more effective learning with technology, taking into account that technologies for representing, manipulating, and communicating information and ideas have changed professional practices and what students need to learn to be prepared for STEM professions. In particular, technology can be used to support student interaction with STEM content in ways that promote deeper understanding of complex ideas, engage students in solving complex problems, and create new opportunities for STEM learning at all levels of our education system.

Reaching Our Goal

1.0 Learning:

All learners will have engaging and empowering learning experiences both in and out of school that prepare them to be active, creative, knowledgeable, and ethical participants in our globally networked society.

To meet this goal, we recommend the following:

1.1 States should continue to revise, create, and implement standards and learning objectives using technology for all content areas that reflect 21st-century expertise and the power of technology to improve learning.

Our education system relies on core sets of standards-based concepts and competencies that form the basis of what all students should know and should be able to do. Whether the domain is English language arts, mathematics, sciences, social studies, history, art, or music, states should continue to consider the integration of 21st-century competencies and expertise, such as critical thinking, complex problem solving, collaboration, multimedia communication, and technological competencies demonstrated by professionals in various disciplines.

1.2 States, districts, and others should develop and implement learning resources that use technology to embody design principles from the learning sciences.

Advances in learning sciences, including cognitive science, neuroscience, education, and social sciences, give us greater understanding of three connected types of human learning—factual knowledge, procedural knowledge, and motivational engagement. Technology has increased our ability to both study and enhance all three types. Today's learning environments should reflect what we have learned about how people learn and take advantage of technology to optimize learning.

1.3 States, districts, and others should develop and implement learning resources that exploit the flexibility and power of technology to reach all learners anytime and anywhere.

The always-on nature of the Internet and mobile access devices provides our education system with the opportunity to create learning experiences that are available anytime and anywhere. When combined with design principles for personalized learning and UDL, these experiences also can be accessed by learners who have been marginalized in many educational settings: students from low-income communities and minorities, English language learners, students with disabilities, students who are gifted and talented, students from diverse cultures and linguistic backgrounds, and students in rural areas.

1.4 Use advances in learning sciences and technology to enhance STEM learning and develop, adopt, and evaluate new methodologies with the potential to inspire and enable all learners to excel in STEM.

New technologies for representing, manipulating, and communicating data, information, and ideas have changed professional practices in STEM fields and what students need to learn to be prepared for STEM professions. Technology should be used to support student interaction with STEM content in ways that promote deeper understanding of complex ideas, engage students in solving complex problems, and create new opportunities for STEM learning throughout our education system.

Assessment: Measure What Matters

Goal: Our education system at all levels will leverage the power of technology to measure what matters and use assessment data for continuous improvement.

Most of the assessment done in schools today is after the fact and designed to indicate only whether students have learned. Little is done to assess students' thinking during learning so we can help them learn better. Nor do we collect and aggregate student-learning data in ways that make the information valuable to and accessible by educators, schools, districts, states, and the nation to support continuous improvement and innovation. We are not using the full flexibility and power of technology to design, develop, and validate new assessment materials and processes for both formative and summative uses.

Just as learning sciences and technology play an essential role in helping us create more effective learning experiences, when combined with assessment theory they also can provide a foundation for much-needed improvements in assessment (Pellegrino, Chudowsky, and Glaser 2001; Tucker 2009). These improvements include finding new and better ways to assess what matters, doing assessment in the course of learning when there is still time to improve student performance, and involving multiple stakeholders in the process of designing, conducting, and using assessment.

Equally important, we now are acutely aware of the need to make data-driven decisions at every level of our education system on the basis of what is best for each and every student—decisions that in aggregate will lead to better performance and greater efficiency across the entire system.

What We Should Be Assessing

> *"I'm calling on our nation's governors and state education chiefs to develop standards and assessments that don't simply measure whether students can fill in a bubble on a test, but whether they possess 21st century skills like problem-solving and critical thinking and entrepreneurship and creativity."*
>
> *—President Barack Obama,*
> *Address to the Hispanic Chamber of Commerce, March 10, 2009*

President Obama issued this challenge to change our thinking about what we should be assessing. Measuring these complex skills requires designing and developing assessments that address the full range of expertise and competencies implied by the standards. Cognitive research and theory provide rich models and representations of how students understand and think about key concepts in the curriculum and how the knowledge structures we want students to have by the time they reach college develop over time. An illustration of the power of combining research and theory with technology is provided by the work of Jim Minstrell, a former high school physics teacher who developed an approach to teaching and assessment that carefully considers learners' thinking.

Minstrell's work began with a compilation of student ideas about force and motion based on both the research literature and the observations of educators. Some of these student ideas, or "facets" in Minstrell's terminology, are considered scientifically correct to the degree one would expect at the stage of introductory physics. Others are partially incorrect, and still others are seriously flawed. Using these facets as a foundation, Minstrell designed a Web-based assessment program with sets of questions that can be used to inform learning about force and motion rather than simply test how much students have learned (Minstrell and Kraus 2005). Minstrell's facet assessments and instructional materials are available on the Web (http://www.diagnoser.com).

Technology Supports Assessing Complex Competencies

As Minstrell's and others' work shows, through multimedia, interactivity, and connectivity it is possible to assess competencies that we believe are important and that are aspects of thinking highlighted in cognitive research. It also is possible to directly assess problem-solving skills, make visible sequences of actions taken by learners in simulated environments, model complex reasoning tasks, and do it all within the contexts of relevant societal issues and problems that people care about in everyday life (Vendlinski and Stevens 2002).

Other technologies enable us to assess how well students communicate for a variety of purposes and in a variety of ways, including in virtual environments. An example of this is River City, a decade-long effort at Harvard University funded by the NSF. River City is a multiuser virtual environment designed by researchers to study how students learn through using it (Dede 2009). This virtual environment was built as a context in which middle school students could acquire concepts in biology, ecology, and epidemiology while planning and implementing scientific investigations in a virtual world.

River City takes students into an industrial city at the time in the 18th century when scientists were just beginning to discover bacteria. Each student is represented as an avatar and communicates with other student avatars through chat and gestures. Students work in teams of three, moving through River City to collect data and run tests in response to the mayor's challenge to find out why River City residents are falling ill. The student teams form and test hypotheses within the virtual city, analyze data, and write up their research in a report they deliver to the mayor.

Student performance in River City can be assessed by analyzing the reports that are the culmination of their experiences and also by looking at the kinds of information each student and each student team chose to examine and their moment-to-moment movements, actions, and utterances. On the basis of student actions in River City, researchers developed measures of students' science inquiry skills, sense of efficacy as a scientist, and science concept knowledge (Dede 2009; Dieterle 2009). Materials and other resources have been developed to support educators in implementing River City in their classrooms.

As the River City example illustrates, just as technology has changed the nature of inquiry among professionals, it can change how the corresponding academic subjects can be taught and tested. Technology allows representation of domains, systems, models, and data and their manipulation in ways that previously were not possible. Technology enables the use of dynamic models of systems, such as an energy-efficient car, a recycling program, or a molecular structure. Technology makes it possible to assess students by asking them to design products or experiments, to manipulate parameters, run tests, record data, and graph and describe their results.

Technology-based Assessment Using a Hot-air Balloon Simulation

The National Assessment of Educational Progress (NAEP) has been exploring the use of more complex assessment tasks enabled by technology. In one technology-based simulation task, for example, eighth-graders are asked to use a hot air balloon simulation to design and conduct an experiment to determine the relationship between payload mass and balloon altitude. After completing the tutorial about the simulation tool interface, students select values for the independent variable payload mass. They can observe the balloon rise in the flight box and note changes in the values of the dependent variables of altitude, balloon volume, and time to final altitude.

In another problem, the amount of helium, another independent variable, is held constant to reduce the task's difficulty. Students can construct tables and graphs and draw conclusions by clicking on the buttons below the heading Interpret Results. As they work with the simulation, students can get help if they need it: A glossary of science terms, science help about the substance of the problem, and computer help about the buttons and functions of the simulation interface are built in to the technology environment. The simulation task takes 60 minutes to complete, and student performance is used to derive measures of the student's computer skills, scientific inquiry exploration skills, and scientific inquiry synthesis skills within the context of physics.

Another advantage to technology-based assessments is we can use them to assess what students learn outside school walls and hours as well as inside. Assuming that we have standards for the competencies students must have and valid, reliable techniques for measuring these competencies, technology can help us assess (and reward) learning regardless of when and where it takes place.

The National Assessment of Educational Progress (NAEP) has designed and fielded several technology-based assessments involving complex tasks and problem situations (Bennett et al. 2007). (See sidebar on technology-based assessment using a hot-air balloon simulation.)

Growing recognition of the need to assess complex competencies also is demonstrated by the Department's Race to the Top Assessment Competition. The 2010 competition challenged teams of states to develop student assessment systems that assess the full range of standards, including students' ability to analyze and solve complex problems, synthesize information, and apply knowledge to new situations. The Department of Education urged participants in this competition to take advantage of the capabilities of technology to provide students with realistic, complex performance tasks; provide immediate scoring and feedback; and incorporate accommodations that make the assessments usable by a diverse array of students (Weiss 2010)

Using Technology to Assess in Ways That Improve Learning

There is a difference between using assessments to determine what students have learned for grading and accountability purposes (summative uses) and using assessments to diagnose and modify the conditions of learning and instruction (formative uses). Both uses are important, but the latter can improve student learning in the moment (Black and Wiliam 1998). Concepts that are widely misunderstood can be explained and demonstrated in a way that directly addresses students' misconceptions. Strategic pairing of students who think about a concept in different ways can lead to conceptual growth for both of them as a result of experiences trying to communicate and support their ideas.

Assessing in the Classroom

Educators routinely try to gather information about their students' learning on the basis of what students do in class. But for any question posed in the classroom, only a few students respond. Educators' insight into what the remaining students do and do not understand is informed only by selected students' facial expressions of interest, boredom, or puzzlement.

To solve this problem, a number of groups are exploring the use of various technologies to "instrument" the classroom in an attempt to find out what students are thinking. One example is the use of simple response devices designed to work with multiple-choice and true-false questions. Useful information can be gained from answers to these types of questions if they are carefully designed and used in meaningful ways. Physics professor Eric Mazur poses multiple-choice physics problems to his college classes, has the students use response devices to answer questions, and then has them discuss the problem with a peer who gave a different answer. Mazur reports much higher levels of engagement and better student learning from this combination of a classroom response system and peer instruction (Mazur 1997).

Science educators in Singapore have adopted a more sophisticated system that supports peer instruction by capturing more complex kinds of student responses. Called Group Scribbles, the system allows every student to contribute to a classroom discussion by placing and arranging sketches or small notes (drawn with a stylus on a tablet or handheld computer) on an electronic whiteboard. One educator using Group Scribbles asked groups of students to sketch different ways of forming an electric circuit with a light bulb and to share them by placing them on a whiteboard. Students learned by explaining their work to others and through providing and receiving feedback (Looi, Chen, and Ng 2010). (See sidebar on networked graphing calculators for another example of how a technology-based assessment can be used to adjust instruction.)

Using Networked Graphing Calculators for Formative Assessment

Over a wireless network, students can contribute mathematical content to the classroom, such as algebraic functions or graphs—content that is much richer than the answer to a multiple-choice question.

Mrs. J, an experienced science teacher in an urban middle school, participated in a large field trial testing the effectiveness of networked graphing calculators. When district-level tests had revealed that her students struggled to interpret graphs, Mrs. J used the graphing calculator-based wireless system to implement weekly practice on graph interpretations, overcoming her initial feeling that "technology is just overwhelming." She reported, "I have taught for 18 years and I have been in seventh-grade science for about 15 of the 18 … and there are things that I have always been really sure that … kids have understood completely. Now I see what they are thinking. And I am like, whoa, I am just amazed."

Mrs. J used the insights into her students' misunderstandings as revealed by the graphs they constructed to guide her instructional decisions.

Mrs. J also found the classroom network technology beneficial for providing specific help for individual students: "We were doing earth and sun relationships … revolution versus rotation … and … I was able to … see who was making those mistakes still…. So it helped me because I could pinpoint [students' weaknesses] without embarrassing them."

Assessing During Online Learning

When students are learning online, there are multiple opportunities to exploit the power of technology for formative assessment. The same technology that supports learning activities gathers data in the course of learning that can be used for assessment (Lovett, Meyer, and Thille 2008). An online system can collect much more and much more detailed information about how students are learning than manual methods. As students work, the system can capture their inputs and collect evidence of their problem-solving sequences, knowledge, and strategy use, as reflected by the information each student selects or inputs, the number of attempts the student makes, the number of hints and type of feedback given, and the time allocation across parts of the problem.

The ASSISTment system, currently used by more than 4,000 students in Worcester County Public Schools in Massachusetts, is an example of a Web-based tutoring system that combines online learning and assessment activities (Feng, Heffernan, and Koedinger 2009). The name ASSISTment is a blend of tutoring “assistance” with “assessment” reporting to educators. The ASSISTment system was designed by researchers at Worcester Polytechnic Institute and Carnegie Mellon University to teach middle school math concepts and to provide educators with a detailed assessment of students’ developing math skills and their skills as learners. It gives educators detailed reports of students’ mastery of 100 math skills, as well as their accuracy, speed, help-seeking behavior, and number of problem-solving attempts. The ASSISTment system can identify the difficulties that individual students are having and the weaknesses demonstrated by the class as a whole so that educators can tailor the focus of their upcoming instruction.

When students respond to ASSISTment problems, they receive hints and tutoring to the extent they need them. At the same time, how individual students respond to the problems and how much support they need from the system to generate correct responses constitute valuable assessment information. Each week, when students work on the ASSISTment website, the system “learns” more about the students’ abilities and thus can provide increasingly appropriate tutoring and can generate increasingly accurate predictions of how well the students will do on the end-of-year standardized test. In fact, the ASSISTment system has been found to be more accurate at predicting students’ performance on the state examination than the pen-and-paper benchmark tests developed for that purpose (Feng, Heffernan, and Koedinger 2009).

How Technology Supports Better Assessment

Adaptive Assessment Facilitates Differentiated Learning

As we move to a model where learners have options in terms of how they learn, there is a new role for assessment in diagnosing how best to support an individual learner. This new role should not be confused with computerized adaptive testing, which has been used for years to give examinees different assessment items depending on their responses to previous items on the test in order to get more precise estimates of ability using fewer test items.

Adaptive assessment has a different goal. It is designed to identify the next kind of learning experience that will most benefit the particular learner. The School of One demonstration project (see the sidebar on the School of One in the Learning section) used adaptive assessment to differentiate learning by combining information from inventories that students completed on how they like to learn with information on students’ actual learning gains after different types of experiences (working with a tutor, small-group instruction, learning online, learning through games). This information was used to generate individual "playlists" of customized learning activities for every student. (See the sidebar on meshing learning and assessment for an example of adaptive assessment in higher education.)

Universal Design for Learning and Assistive Technology Improve Accessibility

Technology allows the development of assessments using Universal Design for Learning principles that make assessments more accessible, effective, and valid for students with greater diversity in terms of disability and English language capability. (See the sidebar on universal design for textbooks in the Learning section.)

Most traditional tests are written in English and can be taken only by sighted learners who are fluent in English. Technology allows for presentation and assessment using alternative representations of the same concept or skill and can accommodate various student disabilities and strengths. Moreover, having the option of presenting information through multiple modalities enlarges the proportion of the population that can be assessed fairly.

Technology also can support the application of UDL principles to assessment design. For example, the Principled-Assessment Designs for Inquiry (PADI) system developed by Geneva Haertel, Robert Mislevy, and associates (Zhang et al. 2010) is being used to help states develop science assessment items that tap the science concepts the states want to measure and minimize the influence of such extraneous factors as general English vocabulary or vision. Technology can support doing this labor-intensive work more efficiently and provides a record of all the steps taken to make each assessment item accessible and fair for the broadest number of students.

Similarly, assistive technology can make it possible for students who have disabilities that require special interfaces to interact with digital resources to demonstrate what they know and can do in ways that would be impossible with

Meshing Learning and Assessment in Online and Blended Instruction

The online learning systems being developed through the Open Learning Initiative (OLI) at Carnegie Mellon University illustrate the advantages of integrating learning and assessment activities. The OLI R&D team set out to design learning systems incorporating the learning science principle of providing practice with feedback. In the OLI courses, feedback mechanisms are woven into a wide variety of activities. In a biology course, for example, there are

- *Interactive simulations of biological processes that students can manipulate; the student's interaction with the simulation is interspersed with probes to get at his or her understanding of how it works;*
- *"Did I Get This?" quizzes following presentation of new material so that students can check for themselves whether or not they understood, without any risk of hurting their course grade;*
- *Short essay questions embedded throughout the course material that call on students to make connections across concepts; and*
- *"Muddiest Point" requests that ask students what they thought was confusing.*

Tutored problem solving gives students a chance to work through complex problems with the opportunity to get scaffolds and hints to help them. The students receive feedback on their solution success after doing each problem, and the system keeps track of how much assistance students needed for each problem as well as whether or not they successfully solved it.

When OLI courses are implemented in a blended instruction mode that combines online and classroom learning, the instructor can use the data that the learning system collects as students work online to identify the topics students most need help on so that they can focus upcoming classroom activities on those misconceptions and errors (Brown et al. 2006). OLI is now doing R&D on a digital dashboard to give instructors an easy-to-read summary of the online learning data from students taking their course.

The OLI has developed learning systems for engineering statics, statistics, causal reasoning, economics, French, logic and proofs, biology, chemistry, physics, and calculus. A study contrasting the performance of students randomly assigned to the OLI statistics course with those in conventional classroom instruction found that the former led to better student learning outcomes in half the time (Lovett, Meyer, and Thille 2008).

standard print-based assessments. Designing assessments to work with assistive technologies is much more cost-effective than trying to retrofit the assessments after they have been developed.

Technology Speeds Development and Testing of New Assessments

One challenge associated with new technology-based assessments is the time and cost of development, testing for validity and reliability, and implementation. Here, too, technology can help. When an assessment item is developed, it can be field-tested automatically by putting it into a Web-based learning environment with thousands of students responding to it in the course of their online learning. Data collected in this way can help clarify the inferences derived from student performance and can be used to improve features of the assessment task before its large-scale use.

Technology Enables Broader Involvement in Providing Feedback

Some performances are so complex and varied that we do not have automated scoring options at present. In such cases, technology makes it possible for experts located thousands of miles away to provide students with authentic feedback. This is especially useful as educators work to incorporate authentic problems and access to experts into their instruction.

The expectation of having an audience outside the classroom is highly motivating for many students. Students can post their poems to a social networking site or make videotaped public service announcements for posting on video-sharing sites and get comments and critiques. Students who are developing design skills by writing mobile device applications can share their code with others, creating communities of application developers who provide feedback on each other's applications. The number of downloads of their finished applications provides one way of measuring success.

For many academic efforts, the free-for-all of the Internet would not provide a meaningful assessment of student work, but technology can support connections with online communities of individuals who do have the expertise and interest to be judges of students' work. Practicing scientists can respond to student projects in online science fairs. Readers of online literary magazines can review student writing. Professional animators can judge online filmmaking competitions. Especially in contests and competitions, rubrics are useful in communicating expectations to participants and external judges and in helping promote judgment consistency.

Technology also has the potential to make both the assessment process itself and the data resulting from that process more transparent and inclusive. Currently, only average scores and proficiency levels on state assessments are widely available through both public and private systems. Still, parents, policymakers, and the public at large can see schools' and districts' test scores and in some instances test items. This transparency increases public understanding of the current assessment system.

Technology Could Reduce Test Taking for Accountability Only

Many educators, parents, and students are concerned with the amount of class time devoted to taking tests for accountability purposes. Students not only are completing the tests required every year by their states, but they also are taking tests of the same content throughout the year to predict how well they will perform on the end-of-year state assessment (Perie, Marion, and Gong 2009).

When teaching and learning are mediated through technology, it is possible to reduce the number of external assessments needed to audit the education system's quality. Data streams captured by an online learning system can provide the information needed to make judgments about students' competencies. These data-based judgments about individual students could then be aggregated to generate judgments about classes, schools, districts, and states.

West Virginia uses this strategy in its assessment of students' technology skills. (See sidebar on moving assessment data from the classroom to the state.)

Moving Assessment Data From the Classroom to the State

West Virginia's techSteps program is an example of an assessment system coordinated across levels of the education system. techSteps is organized around six technology integration activities per grade level. The activities are sequenced to introduce technology skills developmentally and in a 21st-century context and are largely open-ended and flexible, so they can be integrated into county and school curricula.

Each techSteps activity includes a classroom assessment rubric. After a student completes a techSteps activity, the teacher enters an assessment of his or her performance against the rubric into the techSteps website. techSteps uses the teacher-completed rubric form to identify the target skills demonstrated by that student and uses this information to build the student's Technology Literacy Assessment Profile.

Through techSteps, West Virginia is able to have statewide student data on technology proficiencies at each grade level without requiring a separate "drop-in-from-the-sky" technology test.

Prospects for Electronic Learning Records

Much like electronic medical records in this country, electronic learning records could stay with students throughout their lives, accumulating evidence of growth across courses and across school years. A logical extension of online grade books and other electronic portfolios, electronic learning records would include learning experiences and demonstrated competencies, including samples of student work.

Many schools are using electronic portfolios of students' work as a way to demonstrate what they have learned. (See sidebar on how New Tech High School uses technology to document student accomplishments.) Although students' digital products are often impressive on their face, a portfolio of student work should be linked to an analytic framework if it is to serve assessment purposes. The portfolio reviewer needs to know what competencies the work is intended to demonstrate, what the standard or criteria for competence are in each area, and what aspects of the work provide evidence of meeting those criteria. Definitions of desired outcomes and criteria for levels of accomplishment can be expressed in the form of rubrics.

An advantage of using rubrics is that they can be communicated not only to the people judging students' work, but also to the students themselves. When students receive

New Tech High School: Supporting Student Use of Assessment Results Using Technology

New Tech High School in Napa Valley, Calif., has been using innovative technology-based assessment practices since the school was founded in 1996. Instruction at the school emphasizes project-based learning, with students tackling complex, interdisciplinary problems and typically working in groups. New Tech instructors design these projects around both required content standards and core learning outcomes that cut across academic content areas, including collaboration, critical thinking, oral and written communication, use of technology, and citizenship.

By using this common framework in assessing student's work across classes and grade levels, New Tech teachers provide more useful information than could be obtained from a summary grade alone. Assessments of writing skill, for example, are aggregated across all projects and all courses so that teachers, parents, and the students themselves can get a view of strengths and weaknesses across multiple contexts. In addition, these assessments are made available to students in online grade books that are continually updated so that students can see how they are doing not only in each course, but also on each of the learning outcomes, averaged across all their courses. Electronic learning portfolios contain examples of students' work and associated evaluations also across all classes and grades.

In addition to receiving performance ratings from their teachers and peers, students at New Tech do postproject self-assessments on completion of major projects. These assessments provide feedback for the teacher who designed the project and an opportunity for the student to think about the project experience. The postproject self-assessment template guides the student in reflecting on how successful the project was in terms of the material learned, engagement (interest, relevance), process (for example, how clear project instructions were and whether sufficient scaffolding for student work was available), and self (extent to which the student fulfilled tasks assigned within the group and showed a solid work ethic).

assessment rubrics before doing an assignment—and especially when students participate in developing the rubrics—they can develop an understanding of how quality is judged in the particular field they are working in (for example, an essay of literary criticism, the design of a scientific experiment, or a data analysis).

As with any other kind of assessment score, ratings derived from rubrics should be both valid (demonstrated to measure what they are intended to measure) and reliable (consistent no matter who the rater is). Before rubrics are used on a larger scale for assessments that have consequences for schools and students, their validity and reliability must be established.

Using Assessment Data to Drive Continuous Improvement

Once we have assessments in place that assess the full range of expertise and competencies reflected in standards, we could collect student learning data and use the data to continually improve learning outcomes and productivity. For example, such data could be used to create a system of interconnected feedback for students, educators, parents, school leaders, and district administrators.

The goal of creating an interconnected feedback system would be to ensure that key decisions about learning are informed by data and that data are aggregated and made accessible at all levels of the education system for continuous improvement. The challenge associated with this idea is to make relevant data available to the right people, at the right time, and in the right form.

For example, assessment data should be made available to students so they can play a larger role in directing their own learning, as demonstrated by New Tech High and its use of online grade books. (See the sidebar on New Tech High School).

Assessment data also should be used to support educators' efforts to improve their professional practice. Data from student assessments can enable teachers to become more effective by giving them evidence about the effectiveness of the things they do.

In addition, teams of educators reflecting on student data together can identify colleagues who have the most success teaching particular competencies or types of students, and then all team members can learn from the practices used by their most effective colleagues (Darling-Hammond 2010; U.S. Department of Education Office of Planning, Evaluation, and Policy Development 2010). Using student data in this way also could improve educators' collaboration skills and skills in using data to improve instruction. At times, it might be useful to have educators use common assessments to facilitate this kind of professional learning.

The same student-learning data that guide students and educators in their decision making can inform the work of principals and district administrators. Administrators and policymakers should be able to mine assessment data over time to examine the effectiveness of their programs and interventions.

The need for student data plays out at the district level as well. Districts adopt learning interventions they believe will address specific learning needs, but these interventions often rely on untested assumptions and intuition. In a data-driven continuous improvement process, the district could review data on the intervention's implementation and student-learning outcomes after each cycle of use and then use the data as the basis for refining the learning activities or supports for their implementation to provide a better experience for the next group of students. (See sidebar on using technology to make the link between assessment data and instructional resources in Fairfax County, Va.)

As good as technology-based assessment and data systems might be, educators need support in learning how to use them. An important direction for development and implementation of technology-based assessment systems is the design of technology-based tools that can help educators manage the assessment process, analyze data, and take appropriate action.

Using Technology to Make the Link Between Assessment Data and Instructional Resources

To encourage teachers to make formative use of assessment data, Fairfax County Public Schools (FCPS), Va., developed eCART (Electronic Curriculum Assessment Resource Tool). This Web-based system allows teachers to access everything, from lesson plans to assessment tools, all in one place.

eCART's searchable database provides access to district-approved resources and curriculum correlated to specific standards, benchmarks, and indicators. It allows teachers to create assessments using varied combinations of FCPS common assessment items.

The eCART assessment items were developed by district teachers and designed to provide diagnostic information. The assessments are used to reveal student misconceptions and skills that need to be reinforced.

Using assessment results for their students, Fairfax teachers can follow links to a large library of instructional resources, including supplementary materials, lesson plans, work sheets, and Web links. Students can take eCART assessments online or using pencil and paper.

Student eCART assessment results are stored in the district's data system so that classroom assessment data can be viewed along with benchmark assessment data and results from state tests. Having a common set of formative assessments enables comparisons of student performance across classrooms and schools.

Advancing Technical and Regulatory Practice

Two types of challenges to realizing the vision of sharing data across systems are technical and regulatory. On the technical front, multiple student data systems, the lack of common standards for data formats, and system interoperability pose formidable barriers to the development of multilevel assessment systems. For example, student and program data today are collected at various levels and in various amounts to address different needs in the educational system. State data systems generally provide macro solutions, institution-

FERPA

The Family Educational Rights and Privacy Act *(FERPA) is a federal law that protects student privacy by prohibiting the disclosure of personally identifiable information from education records without prior written consent, except as set forth in 34 CFR § 99.31. FERPA also allows parents and "eligible students" (defined as students who are age 18 or over or who attend post-secondary institutions) to inspect and review their education records and to request that inaccuracies in their records be corrected.*

Advance written consent is generally required to disclose student-level information from education records, such as student grades, if the information would be linked or linkable to a specific student by a reasonable member of the school community. However, schools may non-consensually disclose basic "directory information" such as student names and phone numbers, if schools give public notice to parents and eligible students that they are designating this type of information as "directory information" and provide parents and eligible students a reasonable period of time after such notice has been given to opt out. Another exception to the requirement of prior, written consent permits teachers or administrators within the same school or school district who have a legitimate educational interest in the student's record to access personally identifiable student data.

In 2008, the FERPA regulations were updated to address the conditions under which FERPA permits the non-consensual disclosure of personally identifiable information from education records for research. In this respect, the regulations were amended to permit the release of de-identified records and information, which requires the redaction of all personally identifiable information per 34 CFR § 99.31(b). The 2008 final regulations also specified the conditions under which states or other state educational authorities that have legal authority to enter into agreements for local educational agencies (LEAs) or post-secondary institutions may enter into agreements to non-consensually disclose personally identifiable information from education records to an organization conducting a study for the LEA or institution under 34 CFR § 99.31(a)(6). The updates to the 2008 FERPA regulations also addressed the non-consensual disclosure of personally identifiable information from education records in a health or safety emergency in 34 CFR §§ 99.31(a) (10) and 99.36.

Source: U.S. Department of Education Family Policy Compliance Office 2010

level performance management systems are micro solutions, and student data generated by embedded assessment are nano solutions. Providing meaningful, actionable information that is collected across multiple systems will require building agreement on the technical format for sharing data.

To assist with these efforts, the National Center for Education Statistics at the Department of Education has been leading the Common Data Standards (CDS) Initiative, a national, collaborative effort to develop voluntary, common data standards. The CDS Initiative's objective is to help state and local education agencies and higher education organizations work together to identify a minimal set of key data elements, common across organizations and necessary to meet student, policymaker, and educator needs, and come to agreement on definitions, business rules and technical specifications, when possible, to improve the comparability and share-ability of those elements. (Note: Version 1.0 of CDS was released on Sept. 10, 2010.)

As the reliance on data to inform decisions, the public's demand for transparency and accountability, and the world of technology grow exponentially, we must stay vigilant in our efforts to protect student privacy. On the regulatory front, regulations such as the Family Educational Rights and Privacy Act (FERPA) serve the important purpose of protecting student privacy but also can present challenges, if not properly understood and implemented. Much of the confusion surrounding research and data sharing posed by FERPA in its original form was reduced or eliminated through a 2008 revision of FERPA regulations. Still, varying interpretations of FERPA requirements and differences in district and state policies have made data sharing a complex, time-consuming, and expensive process. (See the sidebar on FERPA.)

Advancing the technical and regulatory practices to ensure privacy is maintained and information is secure while aggregating and sharing data would facilitate efficient use of data that are already being collected to make judgments about students' learning progress and the effectiveness of education programs.

Reaching Our Goal

2.0 Assessment:

Our education system at all levels will leverage the power of technology to measure what matters and use assessment data for continuous improvement.

To meet this goal, we recommend the following actions:

2.1 States, districts, and others should design, develop, and implement assessments that give students, educators, and other stakeholders timely and actionable feedback about student learning to improve achievement and instructional practices.

Learning science and technology combined with assessment theory can provide a foundation for new and better ways to assess students in the course of learning, which is the ideal time to improve performance. This will require involving experts from all three disciplines in the process of designing, developing, and using new technology-based assessments that can increase the quality and quantity of feedback to learners.

2.2 Build the capacity of educators, educational institutions, and developers to use technology to improve assessment materials and processes for both formative and summative uses.

Technology can support measuring performance that cannot be assessed with conventional testing formats, providing our education system with opportunities to design, develop, and validate new and more effective assessment materials. Building this capacity can be accelerated through knowledge exchange, collaboration, and better alignment between educators (practitioners) and the experts.

2.3 Conduct research and development that explores how embedded assessment technologies, such as simulations, collaboration environments, virtual worlds, games and cognitive tutors, can be used to engage and motivate learners while assessing complex skills.

Interactive technologies, especially games, provide immediate performance feedback so that players always know how they are doing. As a result, they are highly engaging to students and have the potential to motivate students to learn. They also enable educators to assess important competencies and aspects of thinking in contexts and through activities that students care about in everyday life. Because interactive technologies hold this promise, assessment and interactive technology experts should collaborate on research to determine ways to use them effectively for assessment.

2.4 Conduct research and development that explores how UDL can enable the best accommodations for all students to ensure we are assessing what we intend to measure rather than extraneous abilities a student needs to respond to the assessment task.

To be valid, an assessment must measure those qualities it is intended to measure, and scores should not be influenced by extraneous factors. An assessment of science, for example, should measure understanding of science concepts and their application, not the ability to see print, to respond to items using a mouse, or to use word processing skills. Test items and tasks should be designed from the outset to measure the knowledge, skills, and abilities that the test intends to assess and not the students' ability to read when assessing mathematics skills or to self-monitor when completing a science task that includes several steps. Assessment and technology experts should collaborate to create assessment design tools and processes that make it possible to develop assessment systems with appropriate features (not just accommodations) so that assessments capture examinees' strengths in terms of the qualities that the assessment is intended to measure.

2.5 Revise practices, policies, and regulations to ensure privacy and information protection while enabling a model of assessment that includes ongoing gathering and sharing of data for continuous improvement.

Every parent of a student under 18 and every student 18 or over should have the right to access the student's own assessment data in the form of an electronic learning record that the student can take with them throughout his or her educational career. At the same time, appropriate safeguards, including stripping records of identifiable information and aggregating data across students, classrooms, and schools, should be used to make it possible to supply education data derived from student records to other legitimate users without compromising student privacy.

Teaching: Prepare and Connect

Goal: Professional educators will be supported individually and in teams by technology that connects them to data, content, resources, expertise, and learning experiences that can empower and inspire them to provide more effective teaching for all learners.

Teaching today is practiced mostly in isolation. Many educators work alone, with little interaction with professional colleagues or experts in the outside world. Professional development typically is provided in short, fragmented, and episodic workshops that offer little opportunity to integrate learning into practice. A classroom educator's primary job is understood to be covering the assigned content and ensuring that students test well. Many educators do not have the information, the time, or the incentives to continuously improve their professional practice from year to year.

Not surprisingly, half of freshly minted teachers leave the profession within the first five years (Ingersoll and Smith 2003). These conditions exist because our education system and the institutions that prepare educators often fail to give educators the tools to do their job well. Our education system holds educators responsible for student achievement but does support them with the latest technology the way professionals in other fields are supported. Although some preservice programs are using technology in innovative ways (Gomez et al. 2008), widespread agreement exists that teachers by and large are not well prepared to use technology in their practice (Kay 2006). As a result, the technology of everyday life has moved well beyond what educators are taught to and regularly use to support student learning.

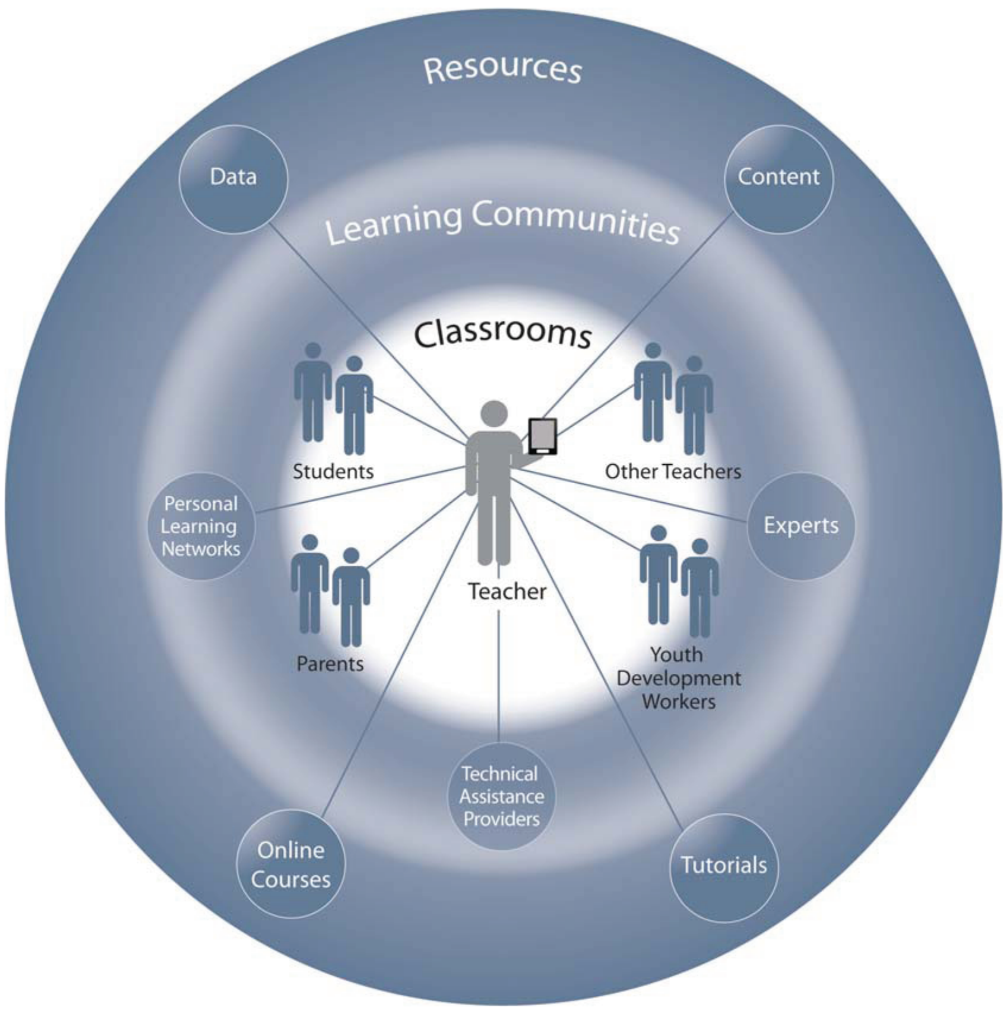
Meanwhile, policymakers and education leaders point to a lack of effective teaching and the need for greater accountability among teachers as the key to fixing education in America. Although the expectation of effective teaching and accountability for professional educators is a critical component of transforming our education system, we also need to recognize that we must strengthen and elevate the teaching profession. This is necessary to attract and retain the most effective educators and achieve the learning outcomes we seek for all learners.

Just as leveraging technology can help us improve learning and assessment, technology can help us better prepare effective educators and increase their competencies throughout their careers while building the capacity of our education system to deliver effective teaching. Technology can do this by enabling a shift to a new model of connected teaching.

The Practice of Connected Teaching

In connected teaching, classroom educators are fully instrumented, with 24/7 access to data about student learning and analytic tools that help them act on the insights the data provide. They are connected to their students and to professional content, resources, and systems that empower them to create, manage, and assess engaging and relevant learning experiences for students both in and out of school. They also are connected to resources and expertise that improve their own instructional practices, continually add to their competencies and expertise, and guide them in becoming facilitators and collaborators in their students' increasingly self-directed learning (Figure 3). Like students in the learning model described earlier, teachers engage in personal learning networks that support their own learning and their ability to serve their students well.

Figure 3. Connected Teaching Builds New Competencies and Expertise



In addition, as learning environments become more complex, connected teaching supports educators in managing the multiple dimensions of curricular instruction. Commercially available and open-source learning management systems are already used widely in universities, and their use is expanding in K–12 settings. Such tools allow educators to coordinate course materials, syllabi, assignments, discussions, and more in a central location for students.

Teachers at George J. Ryan Junior High School in Queens, N.Y., for example, saw improved literacy outcomes in their first year of using an online writing workshop environment. The environment creates virtual classrooms in which educators and students can interact in new ways with course content and with one another. It features a room where students can post writing samples, hold discussions, and find animated content objects linked to quiz data, feedback, and grading. Face-to-face training provided to educators ensured that they could use the environment effectively.

Other online environments also allow broader participation in a student's learning. School administrators can join virtual classrooms for a window on the progress of a given class. Parents or members of other partner institutions can log in for a virtual tour through a class project or contribute materials to the environment.

In connected teaching, individual educators also create their own online learning communities consisting of their students and their students' peers; fellow educators in their schools, libraries, and after-school programs; professional experts in various disciplines around the world; members of community organizations that serve students in the hours they are not in school; and parents who desire greater participation in their children's education.

Episodic and ineffective professional development is replaced by professional learning that is collaborative, coherent, and continuous and that blends more effective in-person courses and workshops with the expanded opportunities, immediacy, and convenience enabled by online learning. For their part, the colleges of education and other institutions that prepare teachers play an ongoing role in the professional growth of their graduates by partnering with schools and organizations that provide engaging and relevant learning experiences throughout the entire course of their careers.

Connected teaching also enables our education system to augment the expertise and competencies of specialized and exceptional educators through online learning systems, online courses, and other self-directed learning opportunities, providing effective teaching where it is not otherwise available.

Connecting With Students to Personalize and Motivate Learning

Connected teaching offers a vast array of opportunities to personalize learning. Many simulations and models for use in science, history, and other subject areas are now available online, including immersive virtual and augmented reality environments that encourage students to explore and make meaning in complex simulated situations (Dede 2009). To deeply engage their students, educators need to know about their students' goals and interests and have knowledge of learning resources and systems that can help students plan sets of learning experiences that are personally meaningful. For a more extensive discussion of personalized learning, see the Learning section of this plan.

Although using technology to personalize learning is a boost to effective teaching, teaching is fundamentally a social and emotional enterprise. The most effective educators connect to young people's developing social and emotional core (Ladson-Billings 2009; Villegas and Lucas 2002) by offering opportunities for creativity and self-expression. Technology provides an assist here as well.

Digital authoring tools for creating multimedia projects and online communities for sharing them with the world offer students outlets for social and emotional connections with educators, peers, communities, and the world at large. Educators can encourage students to do this within the context of learning activities, gaining further insights into what motivates and engages students—information they can use to encourage students to stay in school.

Connecting to Content, Expertise, and Activities Through Online Communities

Many of the technology-based learning resources available today prompt learners to engage with advanced content and authentic activities, which are facilitated when educators orchestrate access to content, experts, and activities of many kinds through online learning communities.

Online learning communities break through educators' traditional isolation, enabling them to collaborate with their peers and leverage world-class experts to improve student learning. Online learning communities also permit the coordination of teams of educators within a school, between a school and homes, and among schools, museums, community centers, and other settings that can support a student's learning. Educators are no longer limited by where they teach or where they lead, nor are they required to deliver teaching as solo practitioners.

For example, through an online learning community, an educator can bring guest speakers located anywhere in the world into student learning. The class can watch the speaker and interact live while the speaker delivers a lecture, demonstrates a scientific experiment or a musical technique, or leads a guided virtual tour of a museum exhibit. A recording of the event can be archived for later viewing or uploaded to a website that hosts free educational content. (For an example of an online learning community built around deep content expertise, see the sidebar on connected teaching in K–12 mathematics.)

Connected Teaching in K–12 Mathematics

The Math Forum (http://mathforum.org) is an online community that supports a connected teaching approach to improving K–12 mathematics education. The Math Forum, based at Drexel University's School of Education, receives between 2 million and 3 million online visits per month.

For educators, the Math Forum website provides valuable instructional resources, including Math Tools, a searchable community library of interactive lessons, activities, and support materials. Educators also can consult a library of articles on current issues in mathematics education and discuss challenges in online forums (Teacher2Teacher). Educators pose questions, which are answered by program associates, who then post the thread for public comment.

Parents can find information about math summer camps and get help explaining concepts. Students can send letters to Dr. Math; between 200 and 300 trained experts are behind the collective identity of Dr. Math.

Problem of the Week, a particularly popular feature on the site, is a subscription-based service. Students around the world submit answers online to the Problem of the Week, annotating their answers with step-by-step explanations. Expert mentors then reply to the submissions, guiding students if necessary to find the right answer.

Math Forum also has been used to support preservice teacher education. In 2004, for example, preservice teachers in two education programs in Oregon used Math Forum's Problem of the Week to practice responding productively to assignments submitted by middle school students. As preservice teachers practiced giving constructive feedback to students, mentors provided guidance and support to improve the feedback. Through this hands-on experience, the preservice teachers learned what kinds of feedback most effectively guided students to the correct answers.

Growth of such online learning communities that foster deep expertise has been limited because they exist outside the formal structure of funding and certifying educator learning. So even though participating in Math Forum may be better for educators than most of the other professional learning experiences they are offered, time spent using online resources like Math Forum does not relieve them of their obligations to attend other programs to meet district and state requirements.

The principle that learning outcomes are more important than where and when the learning takes place should be applied to educator learning just as it should to student learning.

Connecting to Serve the Underserved

Unfortunately, we do not have enough effective educators in many places, including those where we need them most. The shortage of effective educators is especially evident in the STEM areas that are vital to our economic prosperity. A prime example is high school physics: More than 1 million high school students take a physics course each year. Of the educators hired to instruct them, only a third hold a degree in physics or physics education. Many of the other educators who are asked to teach physics (usually in addition to other subjects) have not been trained in how to teach physics concepts and might have limited understanding of those concepts themselves (Hodapp, Hehn, and Hein 2009).

Moreover, the least effective educators are most likely to be teaching in schools serving students from homes that are economically and educationally disadvantaged. Limited access to excellent teaching is a source of inequity in our education system (Darling-Hammond 2010). A recent study found that students in urban and suburban high schools can choose from between three and four times as many advanced mathematics courses (which typically earn extra credit in the college admission process) as students in rural schools (Graham 2009).

Connected teaching can make it possible to extend the reach of specialized and exceptional educators through online learning activities made available to students in every zip code. When a school is unable to attract educators qualified to teach courses that its students need or want, students should be given the option of taking the course online. Many schools have found that K–12 students taking online courses benefit from having an educator on site who keeps track of their progress and provides encouragement, however, that staff member does not need the depth of content expertise of a person solely responsible for teaching a class.

Preparing New Educators and Ongoing Professional Learning

Technology is a powerful enabler of learning, but educators still must teach. They must support their students' engagement with technology resources for learning, highlighting the important subject matter content, pressing students for explanations and higher-order thinking, tracking their students' progress, and encouraging their students to take more responsibility for learning. This requires deep transformations of teaching practices. These transformations must begin in the places where our education system is preparing new professionals: colleges of education and other teacher preparation institutions and organizations.

Young teachers are similar to their students in that they have grown up in a world where laptop computers, cell phones, and handheld gaming devices are commonplace, and homes are filled with computers, TVs, digital video recorders, and game consoles. They are as comfortable interacting with digital devices and accessing the Internet as their students are. Still, this does not mean they understand how to use the technology of their daily lives to improve their teaching practices. Helping them develop this understanding is the job of preservice teacher preparation programs.

The best way to prepare teachers for connected teaching is to have them experience it. All institutions involved in preparing educators should provide technology-supported learning experiences that promote and enable the use of technology to improve learning, assessment, and instructional practices. This will require colleges of education and postsecondary institutions generally to draw from advances in learning science and technology to change what and how they teach when they prepare teachers, keeping in mind that everything we now know about how people learn applies to new teachers as well. (See sidebar on integrating technology into teacher preparation.)

The same imperatives for teacher preparation apply to ongoing professional learning. Professional learning should support and develop educators' identities as fluent users of advanced technology, creative and collaborative problem solvers, and adaptive, socially aware experts throughout their careers.

Research shows that U.S. teachers have less time in their workweek for professional learning than their counterparts in countries where students have the best performance on international examinations (Darling-Hammond 2010). Increasing the time for our educators to engage in professional learning will require processes that cross time and space boundaries.

Educators can be engaged in professional learning not only when attending formal workshops or other activities outside the classroom, but also in the very act of teaching, which can offer a rich source of information to inform professional growth (Ancess 2000; Borko et al. 1997; Kubitskey 2006). When interwoven with daily activities, professional learning allows learning about techniques and materials for teaching that can be directly applied with students. In this process, providing continuous supports for examining, revising, and reflecting on instruction is essential to improving educator practices that affect student outcomes. Technology can help provide continuous supports through models of educator learning that blend face-to-face and online experiences. Technology-supported informal learning communities can connect teachers to university experts in content domains and in pedagogy.

Integrating Technology Into Teacher Preparation

The UTeach program at the University of Texas at Austin is designed to bring more mathematics and science majors into teaching. Participants enter the program in their junior year and graduate with both a bachelor's degree in a STEM field and a teaching certificate. UTeach interweaves technology throughout its course and practicum offerings. Early in their course work, UTeach preservice teachers use technology to find information and to communicate with their professors and with each other. They post lesson plans online and take online assessments. More advanced courses build on these experiences and involve the instructional use of technology within the content areas the preservice teachers will teach. UTeach preservice teachers have multiple opportunities to use technology with students in the field both before and during student teaching.

A different kind of example comes from the alternative teacher certification program at Northwestern University. Northwestern's program uses video and computer technology to capture classroom interactions during interns' summer teaching placements. Peers, mentor teachers, and university faculty review video excerpts with the teaching interns, providing analyses of the teaching and learning and helping to scaffold reflective discourse about classroom practice. In this way, technology helps teaching interns make connections between the language and concepts of the teacher education program and the real practice that occurs in classrooms.

Connecting With Exemplary Practices

Technology can support professional learning by making the practices of exemplary educators accessible to other educators (Fishman 2007; Richardson and Kile 1999). With today's video-sharing tools, for example, outstanding demonstrations of teaching practice can be captured and annotated. Educators can view and analyze their practice and then innovate and customize new ways to refine their craft in light of new insights. Resources such as Teachers.tv can be used to make the act of teaching visible, helping the entire community better understand effective teaching practices. (See sidebar on Teachers.tv.)

Teachers.tv

Teachers.tv is a collection of multimedia resources developed and disseminated in the United Kingdom with the mission of spreading best practices in education as broadly as possible among the entire community involved in student learning—not only those who work in schools, but also parents and district leaders.

The station's programming is available through a variety of media platforms. It is broadcast via Internet all day, everyday and via traditional television for a few hours per day on several stations. Once a program has been broadcast, the content is archived on the site in a searchable library of downloadable videos. Links to the videos can be found on a number of frequently used websites, including that of the Guardian newspaper and both YouTube and iTunes.

Programs ranging in length from 15 minutes to one hour target different members of the educational community. For example, broadcast content in the first week of December 2009 included programs on teaching math, English, and science concepts at the primary or secondary level, a program on effective uses of assessment, a program for district leaders on special needs students, and general-audience programs on Asperger's syndrome, healthy eating, and youth and crime.

Teachers.tv seeks to show, not just tell, how and why best practices work. The regularly scheduled programs "Classroom Observation" and "Great Lesson Ideas" show K–12 teachers' best practice modeled by first-rate teachers in the context of actual classroom instruction. Similarly, a program on special needs students takes viewers inside schools that have been serving that population exceptionally well.

On the Teachers.tv website, users can log in to a community portal where they can find and store the content most relevant for them and discuss their practices with other educators. Teachers also can become "associates" of the station, serving as liaisons between schools and parents and the station. The associates offer suggestions for topics and give first feedback on content.

Connecting With Other Professionals

More than two decades of research has demonstrated the importance of collaboration among teachers. When teachers make their work public and examine each other's work, the quality of their practice and student outcomes improve (Lieberman and Pointer Mace 2010). Social networking technology provides a platform for making teachers' work public, with opportunities for both local and global communities of practice.

Communities of practice provide a strong mechanism for promoting ongoing growth from novice preservice educators through expert master educators and offer opportunities for the engagement of a broad range of participants from outside formal education (Wenger, White, and Smith 2009). Successful learning circles also can bring together educators and students to deepen learning (Riel 1992).

PBS TeacherLine is one example of an online system that engages teachers in collaboration and builds professional community. PBS TeacherLine, long a provider of online courses for teachers, is now focusing on making online courses more interactive to help educators build their own communities of practice. Online courses of 15 or 30 hours are designed as interactive environments in which an expert facilitator communicates best practice approaches and helps educators share ideas. Educators in a course share resources by creating digital portfolios and participating in facilitated discussions.

The Department of Education also is acknowledging the need for communities of practice for educators by funding design research on online communities of practice to learn more about what types of content and interactions will compel people to participate and will provide useful supports for professional educators. This project also includes the development of at least six online communities to leverage the use of educational technology to improve teaching, assessment, learning, and infrastructure in schools. Communities of practice funded by the Department will scaffold best practices, ensuring teachers are highly effective and connected to data, resources, content, and expertise.

Career-long Personal Learning Networks

A transformative idea in the preparation and professional learning of educators and education leaders is to leverage technology to create career-long personal learning networks within and across schools, preservice preparation and in-service educational institutions, and professional organizations. The goal of these career-long personal learning networks would be to make professional learning timely and relevant as well as an ongoing activity that continually improves practices. These networks and other resources would enable educators to take online courses, tap into experts and best practices for just-in-time learning and problem solving, and provide platforms and tools for educators to design and develop resources and share them with their colleagues.

As we move into an era when colleges of education will be held accountable for the effectiveness of their graduates, these institutions can use personal learning networks to provide ongoing support once their graduates enter the workforce. An example of this is TFANet, a website provided by Teach for America (TFA) for all its new educators. TFANet offers valuable resources for educators and opportunities for TFA teachers to connect and share ideas. This resource exchange also enables TFA teachers and alumni to share, rate, and download successful lesson and unit plans, data-tracking tools, and classroom management strategies.

Using technology in these ways for ongoing professional learning for educators will require rethinking the use of time-based measures of attainment rather than competency-based measures. Strictly time-based measures do not allow professional educators to take advantage of the many new opportunities that online learning offers by being able to transcend time and space.

Growing Demand for Skilled Online Instruction

As online learning becomes an increasingly important part of our education system at all levels, this creates both the need and opportunity for educators who are skilled in online instruction and the demand for greater knowledge of the most effective practices. As we implement online learning, we should make sure that students' learning experiences address the full range of expertise and competencies as reflected in standards and use meaningful assessments of the target competencies. Crucial to filling this need while ensuring effective teaching are appropriate standards for online courses and teaching, and a new way of approaching online teacher certification that functions across state lines.

Closing the Technology Gap in Teaching

The technology that enables connected teaching is available now, but not all the conditions necessary to leverage it are. Many of our existing educators do not have the same understanding of and ease with using technology that is part of the daily lives of professionals in other sectors and with this generation of students. The same can be said of many of the education leaders and policymakers in schools, districts, and states and of the higher education institutions that prepare new educators for the field.

This gap in technology understanding influences program and curriculum development, funding and purchase decisions about educational and information technology in schools, and preservice and in-service professional learning. Too often, this gap prevents technology from being used in ways that would improve instructional practices and learning outcomes.

Still, we must introduce connected teaching into our education system rapidly, and for that we must rely on the organizations that support educators in their profession—schools and districts, colleges of education, professional learning providers, librarians and media specialists, and professional organizations. We also must call on education leaders and policymakers to remove barriers to connected teaching and provide incentives and recognition for educators who demonstrate effective teaching in a connected model.

Reaching our Goal

3.0 Teaching:

Professional educators will be supported individually and in teams by technology that connects them to data, content, resources, expertise, and learning experiences that enable and inspire more effective teaching for all learners.

To meet this goal, we recommend the following actions:

3.1 Expand opportunities for educators to have access to technology-based content, resources, and tools where and when they need them.

Today's technology enables educators to tap into resources and orchestrate expertise across a school district or university, a state, the nation, and even around the world. Educators can discuss solutions to problems and exchange information about best practices in minutes, not weeks or months. Today's educators should have access to technology-based resources that inspire them to provide more engaging and effective learning opportunities for each and every student.

3.2 Leverage social networking technologies and platforms to create communities of practice that provide career-long personal learning opportunities for educators within and across schools, preservice preparation and in-service educational institutions, and professional organizations.

Social networks can be used to provide educators with career-long personal learning tools and resources that make professional learning timely and relevant as well as an ongoing activity that continually improves practice and evolves their skills over time. Online communities should enable educators to take online courses, tap into experts and best practices for just-in-time problem solving, and provide platforms and tools for educators to design and develop resources with and for their colleagues.

3.3 Use technology to provide all learners with online access to effective teaching and better learning opportunities and options in places where they are not otherwise available and in blended (online and offline) learning environments.

Many education institutions, particularly those serving the most vulnerable students and those in rural areas, lack educators with competencies in reaching students with special needs and educators with content knowledge and expertise in specialized areas, including STEM. Even in areas where effective teaching is available, students often lack options for high-quality courses in particular disciplines or opportunities for learning that prepare them for the modern world. Online learning options should be provided to enable leveraging the best teaching and make high-quality course options available to all learners.

3.4 Provide preservice and in-service educators with professional learning experiences powered by technology to increase their digital literacy and enable them to create compelling assignments for students that improve learning, assessment, and instructional practices.

Just as technology helps us engage and motivate students to learn, technology should be used in the preparation and ongoing learning of educators to engage and motivate them in what and how they teach. This will require synthesizing core principles and adopting best practices for the use of technology in preparing educators. Technology also should be an integral component of teaching methods courses, and field experiences rather than treated as a discrete skill distinct from pedagogical application.

3.5 Develop a teaching force skilled in online instruction.

As online learning becomes an increasingly important part of our education system, we need to provide online and blended learning experiences that are more participatory and personalized and that embody best practices for engaging all students. This creates both the need and opportunity for educators who are skilled in instructional design combined with knowledge of emerging technologies. Crucial to filling this need while ensuring effective teaching are appropriate standards for online courses and teaching and a new way of approaching online teacher certification.

Infrastructure: Access and Enable

Goal: All students and educators will have access to a comprehensive infrastructure for learning when and where they need it.

Although we have adopted technology in many aspects of education today, a comprehensive infrastructure for learning is necessary to move us beyond the traditional model of educators and students in classrooms to a learning model that brings together teaching teams and students in classrooms, labs, libraries, museums, workplaces, and homes—anywhere in the world where people have access devices and an adequate Internet connection. An infrastructure for learning is necessary to support a learning society in which learning is lifelong and lifewide.

Our infrastructure for learning is modeled on the cyberinfrastructure envisioned and deployed by the National Science Foundation to encourage collaboration among scientists and researchers, which was subsequently broadened to apply to learning in all domains (National Science Foundation 2008b). The term “cyber” tells us that the time and distance barriers of the physical world are reduced by virtual connections between people and between people and technology resources and tools. “Infrastructure” reminds us that even in virtual worlds, physical and organizational structures are needed to run a system.

The essential underlying principle is that the infrastructure includes people, processes, learning resources, and policies and sustainable models for continuous improvement in addition to broadband connectivity, servers, software, management systems, and administrative tools.

Building an infrastructure for learning is a far-reaching project that will require the participation and collaboration of individuals from all disciplines and types of institutions across the entire spectrum of education. It also will require education, business, and government as partners. And it will take leadership and a commitment to a shared understanding of its importance to transforming U.S. education.

Revolutionary Opportunity for Change

Over the past 40 years, we have seen unprecedented advances in computing and communications that have led to powerful technology resources and tools for learning. Today, low-cost Internet access devices, easy-to-use digital authoring tools, and the Web facilitate access to information and multimedia learning content, communication, and collaboration. They also provide the ability to participate in online learning communities that cross disciplines, organizations, international boundaries, and cultures.

Many of these technology resources and tools already are being used within our public education system. We are now, however, at an inflection point for a much bolder transformation of education powered by technology. This revolutionary opportunity for change is driven by the continuing push of emerging technology and the pull of the critical national need for new strategies to turn around a P–12 system that is failing to adequately prepare young Americans for postsecondary education and the workforce and a postsecondary system that is failing to prepare its graduates for success in life and work in a changing world.

Our model of an infrastructure for learning is always on and makes learning opportunities available to learners, educators, and administrators regardless of their location, the time of day, or the type of access devices. It supports not just access to information, but also the creation of content and access to people and participation in online learning communities.

An infrastructure for learning unleashes new ways of capturing and sharing knowledge based on multimedia that integrate text, still and moving images, audio, and applications that run on a variety of devices. It enables seamless integration of in-school and out-of-school learning. It frees learning from a rigid information-transfer model (from book or educator to students) and enables a much more motivating intertwine of learning about, learning to do, and learning to be.

On a more operational level, an infrastructure for learning brings together and enables access to data from multiple sources while ensuring appropriate levels of security and privacy. The infrastructure integrates computer hardware, data and networks, information resources, interoperable software, middleware services and tools, and devices, and it also connects and supports interdisciplinary teams of professionals responsible for its development, maintenance, and management, and its use in transformative approaches to teaching and learning.

Unpacking the Challenge

Given the enormity of the challenge of building an infrastructure for learning, we should approach it step-by-step, designing and implementing individual elements so we can take advantage of their incremental benefits along the way.

Broadband Everywhere

A crucial element of an infrastructure for learning is a broadband network of adequate performance and reach, including abundant wireless coverage in and out of school buildings. “Adequate” means enough bandwidth to support simultaneous use by all students and educators anywhere in the building and the surrounding campus to routinely use the Web, multimedia, and collaboration software. The activities of the FCC (http://www.fcc.gov/broadband) and the Department of Commerce National Telecommunications and Information Administration (NTIA) Broadband Technology Opportunities Program (http://www2.ntia.doc.gov) to bolster the nation's broadband provisioning are essential to learning lifelong and lifewide.

In March 2010, the FCC released the National Broadband Plan to provide a blueprint for connecting all Americans to broadband capability. The National Broadband Plan recognizes the crucial task of improving high-speed Internet access for learners in schools and homes and calls for a number of changes to the E-Rate that would dramatically improve learners' access to broadband-enabled learning experiences. (See the sidebar on the National Broadband Plan. For background information on the E-Rate, see the sidebar on balancing connectivity and student safety on the Internet on p. 56.)

The National Broadband Plan and Education

The National Broadband Plan deals with many aspects of the nation's technology infrastructure, including the infrastructure for education. In the education arena, the plan calls for specific actions in three areas:

Supporting and promoting online learning. *The plan calls for expanded access to educational digital content, increased recognition of credits earned through online learning, refinements of digital data and interoperability standards, digital literacy promotion, and research and development of new broadband-enabled online learning systems.*

Unlocking the value of data and improving transparency. *The plan advocates the adoption of electronic learning records and the modernization of privacy laws to protect student data while allowing its use to improve learning outcomes. The FCC also calls for improved financial data transparency in education, supported by online tools that make school systems' spending visible and connect local education agencies with product and service providers that meet their technology needs more efficiently.*

Modernizing educational broadband infrastructure. *Most critically, the plan calls for several changes to the E-Rate that would increase learners' access to broadband-enabled learning experiences. Proposed changes to the E-Rate include the following:*

- *Raising the E-Rate cap to account for inflation, providing much-needed additional funding to schools and libraries;*
- *Funding wireless connectivity to portable learning devices, allowing students and teachers to continue learning beyond the school day;*
- *Providing more support for internal network connections, allowing greater student and teacher access to high-speed connectivity in the classroom;*
- *Allowing community members to make use of E-Rate-funded connections outside school hours, creating new opportunities for job training and extended learning opportunities for adults;*
- *Encouraging schools and libraries to partner with state, regional, local, and tribal entities to establish networks that increase broadband purchasing power;*
- *Streamlining the E-Rate application process to reduce the burden on schools and libraries that seek funding;*
- *Increasing E-Rate recipients' flexibility to purchase the most cost-effective broadband solutions available in their geographic area;*
- *Setting new minimum service goals for broadband connectivity that take into account the numbers and needs of E-rate network users, providing sufficient bandwidth for learners to take advantage of engaging multimedia tools; and*
- *Awarding some E-Rate funds competitively to promote innovation in technology-supported learning.*

The full text of the National Broadband Plan's recommendations and vision for education are available online at http://www.broadband.gov/plan/11-education.

Building a Statewide Infrastructure for Learning

In 2001, Maine kicked off the Maine Learning Technology Initiative (MLTI), the first statewide effort to provide students and educators across multiple grades with 24/7 access to personal learning devices. A joint task force convened by the governor and the state legislature assessed Maine's education needs and the infrastructure that would be required for implementation of one-to-one computing, including hardware, software, internal and external school networks and servers, technical support, and educator professional development.

To be able to provide all aspects of the infrastructure to support worthwhile uses of technology for learning while staying within Maine's budget parameters, the decision was made to focus the first phase of MLTI on middle school students.

After pilot testing and training at "exploration sites" in each of the state's nine regions, Maine's one-to-one program was extended to seventh-graders in all state middle schools in 2002 and to all eighth-graders in 2003. MLTI now equips each of Maine's 243 middle schools with wireless Internet access and provides each school with enough laptops for every seventh- and eighth-grade student and educator to use both in and outside school. Since MLTI's inception, more than 37,000 laptops provided by the program have been used by over 100,000 educators and learners throughout the state. MLTI also provides intensive professional development, implementation assistance, and technical support to educators to ensure that the technology is fully leveraged to support student learning.

Maine believes that its investment in technology for its middle school students has paid off: The state's eighth-grade writing proficiency jumped 12 percent after statewide one-to-one implementation (Silvernail and Gritter 2007). Laptop use also has been linked to gains on statewide mathematics tests and improved retention of science course material (Berry and Wintle 2009; Silvernail and Bluffington 2009).

Inspired by this success, Maine has expanded its laptop initiative to all students in grades 9–12. The state is committed to funding wireless Internet access in all Maine secondary schools and has negotiated discounts for districts to provide their students with laptops.

Access Devices for Every Student and Educator

Because an infrastructure for learning should support learning in and out of the classroom, students and educators need Internet access devices for around-the-clock use from any location. Internet access devices are continually evolving and today include desktop computers, laptops, netbooks, public access kiosks, mobile phones, portable digital players, and wireless readers.

Many districts say they face major challenges in providing access devices for every student and educator. Even with the rise of relatively low-cost mobile devices and netbooks, most devices cost at least several hundred dollars and need to be replaced every few years. In 2002, however, Maine became the first state in the country to give every seventh- and eighth-grade student and educator a laptop for use both at school and at home. Research on the effectiveness of the program shows that student learning has improved (Berry and Wintle 2009; Silvernail and Bluffington 2009; Silvernail and Gritter 2007), and the program is now being expanded to high schools. (See sidebar on building a statewide infrastructure for learning.) Many K–12 students already carry mobile devices for personal use with greater computing power than the supercomputers of a generation ago. K–12 educators routinely own access devices for use in their daily lives. Students at our nation's colleges and universities increasingly are arriving on campus with powerful laptops and mobile devices of their own. The presence of so many access devices and the precedent that has been established at colleges and universities are prompting some K–12 school districts to explore having their students and educators use their own personal access devices as an alternative to purchasing them.

In the past, districts were reluctant to allow students to use their own devices in school because of concerns about the unfair advantage of affluent students who are more likely to have the latest devices and the risk of students accessing inappropriate Internet content or using their connectivity to cheat on tests. However, districts are finding that a combination of acceptable use policies and staff training makes student use of personal digital devices both feasible and safe.

Middletown Public Schools in New Jersey, for example, brought together elementary, middle, and high school educators to forge an acceptable-use policy that would allow students to use personal cell phones and other computing devices in school. Students then created videos to illustrate acceptable and unacceptable uses for their peers. At Passage Middle School in Newport News, Va., a host of student and educator uses of cell phones to support learning was unleashed when the principal decided to allow the use of cell phones for instructional purposes during class. (See sidebar on using cell phones to support teaching and learning.)

Schools also can solve the equity issue—concern that affluent students will have devices and others will not—by purchasing devices just for the students who need such financial support. This is more cost-effective than purchasing devices for every student. Districts can think about providing an access device and Internet access at home for those students who need them in the same way they provide a free or reduced-price hot lunch for students who could not otherwise afford it. In choosing the devices to provide for students who otherwise would not have them, districts need to make sure that all their students have devices that support writing, analysis, and the creation of digital content related to their courses, not just consumption of content created by others.

Allowing students to bring their own access devices to school has been limited, however, by provisions within the E-Rate, a federal program that supports connectivity in elementary and secondary schools and libraries by providing discounts on Internet access, telecommunications services, internal network connections, and basic maintenance to support them. Schools' eligibility for E-Rate money is contingent on compliance with several federal laws designed to ensure student privacy and safety on the Internet. These include the Children's Internet Protection Act (CIPA), which requires the use of electronic filtering on school networks. In some cases, lack of full understanding of this requirement creates unnecessary barriers to the rich learning experiences that in-school Internet access should afford students.

E-Rate provisions and CIPA requirements should be clarified, and schools and districts should explore the ways that student-owned devices can aid in learning. (See the sidebar on balancing connectivity and student safety on the Internet.)

Using Cell Phones to Support Teaching and Learning

After letting two students use the calculator functions on their cell phones to solve the crisis of being two calculators short for a schoolwide math exam, the principal at Passage Middle School, Va., decided that he might be on to something. Hoping to capitalize on students' excitement when allowed to use their cell phones in school, he instituted Phone Fridays in math class and challenged students to come up with ways to use their phones to enhance learning. Students started using the phones' calendar function to keep track of homework schedules and the camera function to take pictures of the notes on the classroom's whiteboards. They created blogs and podcasts related to their homework and supported their math work both with the phone's calculator and by using the stopwatch function to time their speed at doing calculations.

Positive student reactions led the principal to invite other interested educators to join in the cell phone experiment. Before allowing cell phone usage on a broader scale, each educator had a discussion with his or her students to set ground rules for usage. All the classes came up with similar rules, and a school policy was developed: Cell phones could be used in class only for working on assignments. Text or video could be sent only with the educator's permission. No photographing or video- or audio-recording of people was allowed without their permission, no posting to websites was allowed without permission, and online safety precautions were to be taken when publishing from a mobile phone.

Teachers began using cell phone applications for polling and to set up an online text messaging board to discuss homework. One educator used the cell phones while teaching, asking students to answer questions via text messaging rather than out loud. As student answers came in, they were displayed on a screen at the front of the class, identified by the student's cell phone screen name. English teachers, in particular, found the cell phones useful as they started using blogs to engage students in writing. One class used Twitter to collaborate in generating stories in class.

Balancing Connectivity and Student Safety on the Internet

E-Rate is a federal program that supports connectivity in elementary and secondary schools and libraries by providing discounts on Internet access, telecommunications services, internal network connections, and basic maintenance. Schools, school districts, and consortia can receive discounts on these services ranging from 20 to 90 percent depending on their level of poverty and geographic location.

Schools' eligibility for E-Rate money is contingent on compliance with several federal laws designed to ensure student privacy and safety on the Internet. The Children's Internet Protection Act (CIPA) *requires any school that funds Internet access or internal network connections with E-Rate money to implement filters that block students' access to content that may be harmful to minors, including obscenity and pornography.* CIPA *also requires schools receiving E-Rate discounts to teach online safety to students and to monitor their online activities.*

Ensuring student safety on the Internet is a critical concern, but many filters designed to protect students also block access to legitimate learning content and such tools as blogs, wikis, and social networks that have the potential to support student learning and engagement. More flexible, intelligent filtering systems can give teachers (to whom CIPA *restrictions do not apply) access to educationally valuable content. On the other end of the spectrum, some schools and districts filter students' online activities with proxy servers that meet* CIPA *requirements but are easy to get around, minimizing their utility for managing and monitoring students' online activity.*

CIPA *also has posed challenges to accessing school networks through students' own cell phones, laptop computers, and other Internet access devices to support learning activities when schools cannot afford to purchase devices for each student. Applying* CIPA*-required network filters to a variety of student-owned devices is a technical challenge that may take schools months or years to implement. However, districts such as Florida's Escambia County Schools have created technical solutions and accompanying acceptable use policies (AUPs) that comply with* CIPA *regulations, allowing Web-based learning on student devices to run on networks supported by federal E-Rate funding.*

Source: Universal Service Administrative Company 2008.

Open Educational Resources

Open educational resources (OER) are teaching, learning, and research resources that reside in the public domain or have been released under an intellectual property license that permits sharing, accessing, repurposing—including for commercial purposes—and collaborating with others. These resources are an important element of an infrastructure for learning. Originating in higher education, OER forms range from podcasts to digital libraries to textbooks, games, and courses, and they are freely available to anyone over the Web.

MIT's decision to launch the OpenCourseWare (OCW) initiative to make the core content from all its courses available online in 2000 gave the OER movement a credible start (Smith 2009). Other universities joined the OCW Consortium, and today there are more than 200 members, each of which has agreed to make at least 10 courses available in open form.

Equally important to the OER movement was the emergence of the Creative Commons, an organization that developed a set of easy-to-use licenses whereby individuals or institutions could maintain ownership of their creative products while giving others selected rights for using OER for noncommercial purposes.

Advances in our understanding of how to design good OER are coming out of the work of the Open Learning Initiative (OLI) at Carnegie Mellon University. OLI has been developing state-of-the-art, high-quality online learning environments that are implemented as part of courses taught not only at Carnegie Mellon, but also at other universities and at community colleges. The OLI learning systems are submitted to rigorous ongoing evaluation and refinement as part of each implementation.

Many OER materials are available not just to individuals enrolled in courses, but to anyone who wants to use them. Nearly half of downloads of MIT's OpenCourseWare, for example, are by individual self-directed learners (Maxwell 2009).

Because OER materials are online, their development, publishing, and consumption have crossed geographic boundaries, enabling the movement to support a global education community. For example, the OER Commons is a well-known global membership network providing access to content that is free to use or share and, in some cases, change and share again. In many cases, these materials also are licensed so they can be incorporated into new courses and in new ways, even within a product that can be sold commercially.

The OER movement could be leveraged more fully throughout the education system and across types of learners. Students in the P–16 systems and adults who are changing careers or who simply have an interest could make use of these materials. Further, as we transition from the static print-based textbook to a more dynamic digital resource network, assets that are published as OER could be integrated into a new kind of “open textbook.” For example, the development of a high-quality algebra textbook could be funded by a consortium and then the textbook could made freely available for use, reuse, and continuous improvement. A company could leverage these materials within an even better product for schools to use. Traditionally, textbooks have been a significant portion of the K–12 budget as well as the student-borne cost of higher education, and in budget-conscious times this is one strategy that could be considered.

Interoperability Standards

Not all high-quality technology-based learning resources are open, and ideally individual learners, teachers, schools, districts, and states could bring together an array of digital learning resources from many sources—both open and fee based—to meet their needs. Combining resources in this way, however, requires standards for interoperability so the resources can be catalogued and work together. A number of efforts to develop specifications for learning applications (SIF, SCORM, and IMS) have been underway for years, but no single approach has become the standard.

Next-generation Computing

To help build out an infrastructure for learning, districts and schools should begin a transition to the next generation of computing system architectures. Districts should consider options for reducing the number of servers they run through consolidation using virtualization. Virtualization allows a single server to run multiple applications safely and reliably, so that districts can reduce the number of servers on their networks dramatically, cutting costs and making the networks less complex and easier to manage.

Districts also can consider moving to cloud computing, which involves shifting from the procurement and maintenance of servers in local datacenters to purchasing software as a service (SaaS) and Web applications from datacenters running in the cloud.

Cloud computing is a catchy new name, but its principal outcome—utility computing—is not new. Utility computing is the packaging of computing resources as a metered service similar to how public utilities package and sell electricity through our nation’s power grid. What makes cloud computing more desirable and possible is that we are nearing an inflection point driven by technology advances and the need for more powerful and collaborative platforms at lower cost.

Cloud computing can support both the academic and administrative services required for learning and education. It can enable students and educators to access the same learning resources using different Internet devices anytime and anywhere, both in and out of school. This will not happen automatically, however. School systems and other youth-serving organizations—public libraries, public broadcasting, after-school clubs, and so on—will need to engage each other and seek common platforms or at least technical interoperability.

Cloud computing is still in a nascent stage with obstacles to overcome to fully realize its potential. Still, now is the time to move forward with investments that contribute to the shift to cloud computing, with the primary benefits being cost savings and an ability for education institutions to refocus on their core mission, educating students. (See sidebar on North Carolina State University.)

North Carolina State University Cloud Computing Services

The Virtual Computing Laboratory (VCL) at North Carolina State University has been a pioneer in delivering secure on-demand computing services for education institutions. VCL was using cloud computing before the term came into popular use: It has been doing research on virtual computing since 2003 and began offering cloud services in 2004.

The VCL academic cloud is based on open-source technology and offers infrastructure as a service, platform as a service, and software as a service, including support of high-performance computing services. The advantages of VCL's cloud computing approach include consolidation of computing resources and technical support services, delivery of applications that would be difficult to install on student computers, and the extension of computing services to education institutions that otherwise would have only limited technology infrastructures.

As of 2009 VCL was serving more than 30,000 faculty and staff members. A typical user accesses VCL through a Web interface, going through a set of authentication and authorization steps and then choosing the desired kind of computing environment and time period from a set of pull-down menus.

VCL can dynamically move resources from one application to another, producing increased efficiency and lower costs. During semester breaks, for example, when most students are not using computing resources, the system assigns those resources to researchers with heavy computing requirements for activities, such as running complex models and simulations.

VCL now offers services on a pilot basis to seven other North Carolina public universities, the North Carolina Community College System, and several out-of-state universities including three in India. Possible extension of these academic cloud services to K-12 schools is being considered.

Services Delivered From the Cloud

Figure 4 illustrates the comprehensive nature of integrated software services needed for learning experiences and that can be delivered from the cloud.

At the top are the users of the services—students, educators, administrators, and parents—with a variety of Internet access devices. With these devices, users can find a large and diverse set of digital educational resources from both proprietary and open providers.

Education resources and services could be used directly in a variety of educator- or learner-directed ways. They also could be used as ingredients for derivative products that are authored, built, edited, disseminated, and managed as student projects or educator-author curriculum modules through services indicated in the adjacent cluster. In this model, students and educators are both consumers and producers of educational content, with the role of student and educator sometimes interchanged. The framework of services also includes the administrative services for operating the school and school systems.

Figure 4: Framework for software services in a technology-empowered learning environment

Users of Services: Students, Teachers, Administrators, Parents		
Internet Access Devices		
Resources and Applications		
Education resources & services (open & proprietary)	**Authoring, editing, disseminating & content management**	**Administrative**
digital textbooks • digital libraries • tutoring systems • simulations • augmented reality • interactive visualization • educational	text processing • audio/video capture/edit • programming platforms • blogs• wikis • instructional/course management	scheduling • personnel/HR • plant/facilities management • procurement • attendance • student records
Assessment and Reporting		
Social Networking and Collaboration		
Public and Private Network-connected Clouds – software services, data libraries & repositories		

Below the three types of services are cross-cutting integrated capabilities to support data-driven assessment of individual students, individual educators, and the resources (content) and processes serving teaching and learning. Included here are assessments for formative and summative uses at time scales ranging from real time to decades. Also included are rating, ranking, and recommender services for educational resources.

The resources, authoring, and administrative services all can be used by individuals for solo work and also by teams of people working in various configurations of same and different place and time, perhaps internationally, through social networking and collaboration services. All the above rest critically on networking and middleware, with public and private cloud computing as the underlying platform for computation, data, and digital object management.

Human Talent and Scaling Expertise

Building and nurturing an infrastructure for learning requires providers and users who have knowledge and expertise in emerging technologies and a shared commitment to standards and specialists with experience integrating technology into curriculum development and assessment in meaningful ways.

The challenge of providing this level of expertise on the scale our education system requires should not be underestimated. Already, for example, the number of computers per computer technician in K–12 education is estimated at 612 compared with 150 computers per technician in private industry (CoSN 2009). To an increasing extent, students and educators are handling routine maintenance and troubleshooting of computer equipment themselves.

Using Students as Technical Resources

Generation YES

Generation YES started in 1995 as one of the first 100 federally funded Technology Innovation Challenge Grants. Its founder, Dennis Harper, believed that there was a better way than trying to train teachers in using technology with the expectation that they would then pass these skills to students. His insight was to use students as the technology experts, with each student assigned to a teacher as the technology consultant responsible for helping him or her develop and implement technology-based classroom activities. The learning goals for the student center on such real-world skills as project planning, collaboration, and communication. Since its inception, 1,200 schools and 75,000 students have participated in Generation YES.

MOUSE

Since its start in New York City in 1997, MOUSE has had the dual purpose of providing technical support to help teachers integrate technology into instruction and helping students (Mouse Squad volunteers) acquire the skills and attitudes they need for college. Now operating in more than 200 locations, MOUSE provides student-run technical help desks. MOUSE Corps is a career readiness program that offers professional internships, mentoring, and skill-building workshops to high school students. Citigroup has estimated that MOUSE volunteer labor saves the average school $19,000 a year in technical support costs.

Programs have been developed to make the technical support and troubleshooting a learning experience for students as well as a cost-saving measure. Students can also develop both technical and leadership skills through this experience. (See sidebar on using students as technical resources.)

Another level of support required is a professional educator who can engage with educators on leveraging technology for improving their professional practice. Studies have found that educators are more likely to incorporate technology into their instruction when they have access to this kind of coaching and mentoring (Strudler and Hearrington 2009). School technology coordinators, librarians, and media specialists may play this important role. Innovative approaches to staffing in schools that take advantage of online learning resources may free resources that can be applied to fund on-site mentors and coaches who can help educators make good use of technology resources.

Over time, districts have evolved instructional technology departments concerned with the use of technology in teaching and learning in addition to traditional information technology departments. Some districts have both kinds of IT departments (under any variety of names), and some have combined the two functions under a single leadership.

Even in the latter case, those in charge of IT for a district or state may find they are left out of deliberations on key decisions in such areas as instruction, personnel assignment, or assessment. Those responsible for instruction, personnel, and assessment, on the other hand, are often frustrated by technology that does not meet their needs. Building an infrastructure for learning will require close coordination among all these functions.

Reaching Our Goal

4.0 Infrastructure:

All students and educators will have access to a comprehensive infrastructure for learning when and where they need it.

To meet this goal, we recommend the following actions:

4.1 Ensure students and educators have broadband access to the Internet and adequate wireless connectivity both in and out of school.

Students and educators need adequate broadband bandwidth for accessing the Internet and technology-based learning resources. Adequate should be defined as the ability to use the Internet in school, in the surrounding campus, throughout the community, and at home. It should also include simultaneous use of high-bandwidth resources, such as multimedia, communication and collaboration environments, and communities. Crucial to providing such access are the broadband initiatives being individually and jointly managed by various federal agencies.

4.2 Ensure that every student and educator has at least one Internet access device and appropriate software and resources for research, communication, multimedia content creation, and collaboration for use in and out of school.

Only with 24/7 access to the Internet via devices and technology-based software and resources can we achieve the kind of engagement, student-centered learning, and assessments that can improve learning in the ways this plan proposes. The form of these devices, software, and resources may or may not be standardized and will evolve over time. In addition, these devices may be owned by the student or family, owned by the school, or some combination of the two. The use of devices owned by students will require advances in network filtering and improved support systems.

4.3 Support the development and use of open educational resources to promote innovative and creative opportunities for all learners and accelerate the development and adoption of new open technology-based learning tools and courses.

The value of open educational resources is now recognized around the world, leading to the availability of a vast array of learning, teaching, and research resources that learners of any age can use across all content areas. Realizing this value will require new policies concerning the evaluation and selection of instructional materials so that digital resources are considered and processes are established for keeping educational resource content up to date, appropriate, and tagged according to identified content interoperability standards.

4.4 Build state and local education agency capacity for evolving an infrastructure for learning.

Building an infrastructure for learning is a far-reaching project that will demand concerted and coordinated effort. The effort should start with implementing the next generation of computing system architectures and include transitioning computer systems, software, and services from in-house datacenters to professionally managed datacenters in the cloud for greater efficiency and flexibility. This will require leveraging and scaling up the human talent to build such an infrastructure, which should ultimately save money and enable education IT professionals to focus more on maintaining the local infrastructure and supporting teachers, students, and administrators.

4.5 Develop and use interoperability standards for content and student-learning data to enable collecting and sharing resources and collecting, sharing, and analyzing data to improve decision making at all levels of our education system.

Fragmented content, resources, and student-learning data siloed in different proprietary platforms and systems, along with a lack of common standards for collecting and sharing data, are formidable barriers to leveraging resources for teaching and learning. These barriers exist because we lack common content interoperability standards and tools to enable use of such standards. The lack of common standards affects the quality of tools because developers limit their R&D investments into narrow markets and are not able to leverage overall market advancements in research and development. Interoperability standards are essential to resolving these issues.

4.6 Develop and use interoperability standards for financial data to enable data-driven decision making, productivity advances, and continuous improvement at all levels of our education system.

Just as content, resources, and student-learning data are fragmented in disconnected technology systems and throughout our education system, the same is true for financial data. Therefore, we also need financial data interoperability standards and tools that enable the use of these standards.

Productivity: Redesign and Transform

Goal: Our education system at all levels will redesign processes and structures to take advantage of the power of technology to improve learning outcomes while making more efficient use of time, money, and staff.

To reach the president's goal of regaining global leadership in college graduation rates by 2020, the United States must increase the percentage of citizens holding college degrees from the current level of just under 40 percent to 60 percent. That is a sizable increase and, considering that college graduation rates in our country have held steady for more than three decades (OECD 2009a), a sizable challenge.

Add to this challenge the projections of most states and the federal government of reduced revenues for the foreseeable future, and it is clear that we will not reach this goal simply by spending more money on education.

In fact, over the last 30 years, the United States has increased its real dollar K–12 education spending per student by more than 70 percent without a commensurate improvement in outcomes (National Center for Education Statistics 2005; 2008). In higher education, tuition costs are on the rise, yet just 21 percent of the increased revenue goes to instruction (Vedder 2004) and spending changes have not resulted in higher degree completion rates (Bound, Lovenheim, and Turner 2009).

More money for education is important, but we must spend education dollars wisely, starting with being clear about the learning outcomes we expect from the investments we make. We also must leverage technology to plan, manage, monitor, and report spending so that we can provide decision-makers with a reliable, accurate, and complete view of the financial performance of our education system at all levels. Such visibility is essential to improving productivity and accountability.

At the same time, we must make a commitment to continuous improvement by continually measuring and improving the productivity of our education system to meet our goals for educational attainment within the budgets we can afford.

The Productivity Paradox

Improving productivity is a daily focus of most American organizations in all sectors—both for-profit and nonprofit—and especially in tight economic times. Education has not, however, incorporated many of the practices other sectors regularly use to improve outcomes and manage costs, nor has it leveraged technology to enable or enhance them. We can learn much from the experience in other sectors.

During the 1970s and 1980s, economists puzzled over what they called the “productivity paradox.” Businesses were rapidly deploying technology in the belief that it would help them perform better and more efficiently. But when economists looked for hard data to demonstrate that U.S. economic output per unit of investment was increasing, they turned up empty-handed.

In the 1990s, economists were finally able to find evidence of substantial improvements in productivity related to technology (Brynjolfsson and Hitt 1998). They discovered that when businesses first introduced technology, they tended to use it to automate existing processes and procedures, without regard to whether they might be flawed or inefficient. Such uses may have had some benefit in terms of accuracy or speed, but the cost and complexity of acquiring technology, implementing it, and training staff in its use far outweighed its contributions.

Later still, in the 2000s, economists concluded that dramatic improvements in productivity were the result of structural innovations and a thorough redesign of business processes made possible by technology (Black and Lynch 2003).

What education can learn from the experience of business is that we need to make the fundamental structural changes that technology enables if we are to see dramatic improvements in productivity. As we do so, we should recognize that although the fundamental purpose of our public education system is the same, the roles and processes of schools, educators, and the system itself should change to reflect the times we live in and our goals as a world leader. Such rethinking applies not just to learning, assessment, and teaching processes, but also to the infrastructure and operational and financial sides of running schools and school systems.

A Call to Action for Education Leaders

Redesigning education in America is a complex challenge that will require all 50 states, the thousands of districts and schools across the country, the federal government, and other education stakeholders in the public and private sector to come together to design and implement solutions. It is a challenge for education leaders and policymakers, technologists in both the public and private sectors, and for educators throughout our education system.

An appropriate role for the Department of Education is to identify strategies for improving productivity in education and to work with states and districts to increase their capacity to implement them. This will include encouraging states and local education agencies to make changes to practices, policies, and regulations that prevent or inhibit education from using technology to improve productivity.

In addition, when learning is powered by technology, the role of education leadership changes dramatically. Having leaders throughout our education system who understand the role of technology is essential. For example, every state should assign responsibility for educational technology to a senior-level individual who can provide a new kind of education leadership by ensuring that planning for educational and information technology is connected with the core functions of curriculum and instruction, assessment, professional learning, and administration. A senior-level leader equally knowledgeable about education and technology also would ensure that educational technology purchases are efficient and effective, both in terms of what is purchased and how purchases are made. (For an example of one state that has learned a new way to lead, see sidebar.)

Embracing Continuous Improvement

The underlying principle of continuous improvement is that we are unlikely to improve productivity until we can define and measure it. This starts with identifying what we seek in learning outcomes. It also requires getting a handle on the costs associated with components of our education system and with individual resources and activities so that the ratio of outcomes to costs can be tracked over time.

This plan devotes considerable space to the learning outcomes we seek and measuring what matters in learning. It also considers pragmatic such outcomes as successful high school graduation, readiness for postsecondary education, and college degree completion.

As we establish new and more complete measures of learning and pragmatic outcomes, however, quality matters. A student who successfully completes algebra in one high school may learn more, be better prepared for college-level mathematics, and be more inspired to pursue a career in mathematics than a student who successfully completes algebra at another high school. Even if we cannot accurately measure or easily remedy these qualitative differences, we must consider them as we determine what to measure for continuous improvement.

Leading for Learning

Taking advantage of technology to make transformative changes in learning opportunities requires leadership. The number of aspects of the existing system that need to change make the effort both daunting and complex, but examples of leaders working together to address this challenge are starting to emerge.

In Michigan, Mike Flanagan, the state superintendent of instruction, was motivated to take on educational transformation by the high dropout rate in many school districts. Superintendent Flanagan issued a Dropout Challenge, calling on districts to lower the number of students who leave school without a diploma. One of the first steps in the Dropout Challenge work was to get accurate data on the number of students who had started ninth grade who actually graduated four years later so that Michigan districts knew where they really stood with respect to dropouts. This understanding was hard to come by with the old practice of merely looking at the number of students starting 12th grade who do not earn a diploma.

Next, Superintendent Flanagan reasoned that schools need to measure and use indicators known to predict dropping out—such as poor attendance, earning few course credits in ninth and 10th grades, and failure to progress to the next grade. These data were not part of the state's data system, and many districts did not keep track of them. Michigan used $11.5 million in funding from the American Recovery and Reinvestment Act of 2009 *to fund a Regional Data Initiatives grant program to make these kinds of data available at the school level. More than 97 percent of the states' school districts signed on to the initiative. In addition, an online professional learning community is focusing on best practices in using data for dropout prevention.*

The state legislature supported Superintendent Flanagan's Dropout Challenge initiative by raising the age at which a student can leave school without parental permission from 16 to 18. To provide alternatives for students who have dropped out or who are considering doing so, Michigan also has begun expanding alternative programs, including options for online instruction. Superintendent Flanagan has given waivers to the state's seat time requirements to 21 programs, some of which allow students to take all their instruction online.

Measuring and Managing Costs

The United States spends an average of about $10,000 per student per year on K–12 education. But for too many education leaders and decision-makers, visibility into the costs of specific services our education system delivers to students is nonexistent. This is because education accounting and reporting typically are done across large programs and broad categories, such as instruction or instructional support. These accounting practices are insufficient for tracking, benchmarking, and analyzing the costs of various services individually or compared with one another—all of which are essential to making decisions that lead to better outcomes and productivity.

A better approach to accounting for these purposes is cost accounting, which focuses on recording, tracking, and reporting costs associated with specific functions or services. Cost accounting can provide a complete picture of actual costs today and also serve as the basis for projecting costs in the future. As part of a commitment to continuous improvement, states and districts should adopt common cost-accounting standards for benchmarking and analyzing costs.

Using Data in Decision Making

An essential component of continuous improvement is making decisions based on data, which will require fundamental changes in how we collect and use data and in the processes we currently use for decision making.

For many years, school districts have been developing and using multiple data systems for different purposes. As a result, many districts today have separate systems for finance data, personnel data, required accountability information for special education students, school lunch data, enrollment and attendance, and assessment data. Historically, linking data from these different systems has been cumbersome or impossible.

Advances in technology and a recent policy emphasis on using data in decision making have resulted in much improved data in many districts. Still, although almost all districts have electronic access to such data as student demographics, attendance, grades, and test scores, less than half have the ability to combine data from different types of systems so as to link student outcome data to data about specific instructional programs, teacher characteristics, or school finances (Gray and Lewis 2009; U.S. Department of Education Office of Planning, Evaluation, and Policy Development 2010). Combining data from these different types of systems will require at a minimum the development and use of content, student-learning, and financial data interoperability standards. Over time, it will require designing, developing, and adopting integrated systems for collecting the complex forms of data we need and for deriving meaningful interpretations relative to what we want to measure.

In addition to fragmented data systems, the silos created by funding programs, tradition, and interest groups present a major barrier to improving the productivity of our education system. When those responsible for a given function are isolated from others within the same organization, they tend to develop practices and procedures that are optimal only from their own perspective. In addition, decisions made in one portion of an organization may create tension with decisions made in another.

To ensure better alignment in decision making, states and districts should develop process-redesign teams that cut across functions and follow the process rather than looking at work flow only within a given office (CoSN 2009). In addition, federal and state policies and regulations should be reviewed to identify and remove barriers to more efficient use of resources within schools and districts. Policies also should be reviewed to remove practices that keep technology functions isolated from the functions of teaching, learning, and assessment. These include separate funding streams and restrictions on the use of funds that reinforce the isolation of the educational technology function. (See sidebar on using data to drive improvement.)

Employing Iterative Design and Development

As we embrace continuous improvement, we must respect the complexity of our system and invest the effort needed to evaluate educational practices in different contexts over time. Rather than expecting to find an ideal turnkey solution, states and districts should define, test, and refine new ideas on a trial basis and measure their implementation effectiveness and results. New educational practices should be adopted with the expectation that there will be multiple cycles of implementation and refinement. States and districts also should partner with each other on process redesign pilots and programs to leverage resources and scale up the best ideas.

Moving to Useful Metrics on the Use of Technology

Current data on the use of educational and information technology in our system consist of records of purchases and numbers of computers and Internet connections. Very little information on how technology is actually used to support teaching, learning, and assessment is collected and communicated systematically. Only by shifting our focus to collecting data on how and when technology is used will we be able determine the difference it makes and use that knowledge to improve learning outcomes and the productivity of our education system.

Using Data to Drive Improvement

During the 1980s and 1990s, Maryland's Montgomery County Public Schools (MCPS) saw dramatic changes in their student bodies, with increasing numbers of students living in poverty and coming from immigrant families or historically underserved ethnic groups. When Jerry Weast became superintendent in 1999, he initiated an Integrated Quality Management System (IQMS) as a strategy for identifying and closing achievement gaps. IQMS combines student information, such as enrollment, attendance, grades, scheduling, and test performance, with data on professional development, finances, and human resources. An Instructional Management System (IMS) was added to give teachers online access to curriculum resources, student performance on formative and summative assessments and various screenings, and curriculum guides and lesson plans.

A joint venture with a technology developer produced software for a handheld computing device that allowed teachers to do individual assessments of a student's literacy skills and capture the data for the student's electronic file. The electronic records enabled reading coaches to look at data for individual students, identify students who were not making the expected progress, and seek out the relevant teachers to offer suggestions and support. The result was that district reading achievement rose overall, with especially large gains for African-American, Hispanic, and low-income students (Childress, Doyle, and Thomas 2009).

More recently, MCPS has implemented a collaborative data-focused process it calls M-STAT. Community superintendents come together and use data to examine such issues as differential advanced course enrollment rates within their high schools. The district had long recognized the lower participation of Hispanic and African-American students in advanced courses and had switched from using teacher recommendations to using PSAT scores and other objective indicators to counsel students into honors and AP courses. The M-STAT process revealed that Hispanic and African-American students were less likely than other students to participate in the PSAT. The community superintendents started working with their principals on such actions as meeting with African-American and Hispanic parents to talk about the importance of the PSAT and making the examination more enjoyable by providing snacks. By 2008, 88 percent of African-American and 84 percent of Hispanic students in MCPS took the PSAT; more than 60 percent of African-American and Hispanic high school students were enrolled in at least one honors or AP course (Childress, Doyle, and Thomas 2009).

Employing technology on the scale proposed in this plan is new to education. Findings from evaluations of technological adaptations demonstrate a range of effectiveness, from low to high, depending on not just the specific technology but also the way in which it is used, the training associated with it, and the effort applied to on-going refinement and further development (Campuzano et al. 2009; Kulik 2003). The lessons learned from previous efforts emphasize that the introduction of new or adapted technologies must be accompanied, at a minimum, by a deliberate, often repeating cycle of implementation, observation and assessment, and improvement. To truly build a knowledge base and ensure that we are using our scarce resources wisely, formative research, which might often be quite local in focus, should be accompanied by a more broadly coordinated program of summative research that measures both effectiveness and cost-effectiveness.

Reorganizing Teaching and Learning

We have long known that whatever it is we are trying to teach, whether drawing or quantum mechanics, individual students will vary in how much they know already, how they like to learn, and the speed at which they can learn more. In a time when we have the capability to support learning 24/7 and personalize the way a student interacts with digital content, it no longer makes sense to give every 13-year-old the same set of 45-minute American history lessons.

How much could we save if students who are ready and interested in moving ahead in their studies were allowed to do so instead of marking time until their classmates catch up? How much more efficient would our system be if students who need extra support in reading comprehension strategies had that support at their fingertips whenever they were reading in the content areas? How many more students would pass their courses and not have to repeat them? These are essential questions we must ask as we redesign education, and answering them will require rethinking basic assumptions about how our education system meets our goals.

One of the most basic assumptions in our education system is time-based or seat-time measures of educational attainment. These measures were created in the late 1800s and early 1900s to smooth transitions from K–12 into higher education by translating high school work to college admissions offices (Shedd 2003) and made their way into higher education when institutions began moving away from standardized curricula.

Time-based measures were appropriate in their day, but they are not now when we know more about how people learn and we have access to technology that can help us accommodate different styles and paces of learning. As we move to online learning and learning that combines classroom and online learning, time-based measures will increasingly frustrate our attempts to provide learning experiences that lead to achievement and the pursuit of postsecondary education that our modern world requires.

Another basic assumption is the inflexible way we organize students into age-determined groups, structure separate academic disciplines, organize learning into classes of roughly equal size with all the students in a particular class receiving the same content at the same pace, and keep these groups in place all year. (See sidebar on making a school "not school.")

The last decade has seen the emergence of some radically redesigned schools, demonstrating the range of possibilities for structuring education. For example, organizing education around the demonstration of competence rather than seat time opens up a wide range of possibilities. The first school district to win the Baldrige National Quality Award, Chugach School District in Alaska, achieved remarkable gains in student outcomes after mobilizing its community to identify the competencies it wanted to see in high school graduates and shifting to a performance-based system in which diplomas were awarded on the basis of performance on the district's assessment of those competencies (NIST, Baldrige 2001). Since that time, 15 districts and 200 schools have signed up to replicate this systemic reform (Re-Inventing Schools Coalition n.d.).

New Hampshire is now moving to a competency-based approach to secondary education across the entire state. The state's governor asked his school board to come up with the education reforms needed to meet the goal of having zero dropouts by 2012. The board focused on the issue of unproductive requirements that impede student progress: Why, for example, can a student earn a high school credit by attending gym class but not for the hours spent practicing and performing as part of a gymnastics team? Subsequently, the board changed state regulations to give students the option of earning credit for graduation by demonstrating their competence with respect to the standards stipulated by their school districts. New Hampshire districts are still determining how to implement this system, including its implications for funding, teacher training, and assessment practices. But a new high school position—the extended learning opportunity coordinator—is emerging in schools across the state.

Technology can facilitate implementation of such a competency-based approach to education. At the Young Women's Leadership Charter School in Chicago, teachers use a specially designed database to keep track of the proficiency ratings each student has earned. Proficiency ratings are updated daily so that everyone—the student, the parent, teachers, and the school leader—knows exactly where each student stands relative to the competencies required for graduation. (See sidebar on competency-based assessment at the Young Women's Leadership Charter School.)

Making a School "Not School"

The kind of radical rethinking of the nature of schooling that technology makes possible is illustrated by Westwood Cyber School, located just outside Detroit, Mich. Launched two years ago as a dropout recovery and prevention program, the Cyber School is the first location in the country to implement a British model known as the "Not School."

Like its British prototype, Westwood Cyber does not have traditional classrooms, academic departments, courses, or tests. Students use the Internet to work almost entirely from home, reporting to the brick-and-mortar school building for just two hours a week to check in with school staff. The rest of the time they work interactively with school personnel and the school's learning management system. Learning activities emphasize project-based learning and incorporate multiple subject areas. Student projects result in an individualized portfolio of creative work that is tailored to each student's interests. Experts (state-certified teachers) grade students' portfolio work products using grading rubrics closely tied to state learning standards to ensure that students achieve mastery of required material within their individualized learning programs.

The Westwood school district, which had been losing enrollment, has increased enrollment by 33 percent since starting the Cyber School. The school itself has retained 90 percent of its students.

Competency-based Assessment at Young Women's Leadership Charter School

In 2002, the Young Women's Leadership Charter School (YWLCS) in Chicago instituted a radically new system for awarding course credit that is helping its students master course material, graduate from high school, and enroll in higher education at rates far exceeding those of demographically similar schools. A nonselective public school that serves primarily low-income minority students, YWLCS graduated 79 percent of its students in 2005, a figure 1.5 times higher than Chicago Public Schools' overall 52 percent graduation rate that year.

School leaders have implemented a system for student assessment that moves away from tying credit to seat time. Instead, the school recognizes the continuous nature of student learning by awarding credit for specific competencies demonstrated at any point in a student's high school career.

With a commercial partner, the school developed a data system designed specifically for use in a competency-based program. Throughout the year, YWLCS teachers evaluate student work and go to the system to assign each student a proficiency rating of High Performance, Proficient, or Not Yet Proficient for each key learning objective associated with the class. Students earn credit for classes in which they demonstrate proficiency on at least 70 percent of academic course outcomes.

The data system uses the proficiency data that teachers enter to create a dynamic record of each student's progress that is updated daily and is accessible to teachers, parents, and students. Teachers can use the data system to target their instruction and remediation strategies for current students. In addition, students can use their own data to identify the courses they are not yet proficient in and work with their teachers to develop a plan for mastering unmet standards.

If students demonstrate a competency after the end of the year has passed, future teachers can update students' proficiency ratings in the data system to reflect what they have learned since the conclusion of a course.

YWLCS compiles information from the data system into formal reports of student achievement, converting proficiency ratings into grade point average equivalents, to ensure that its graduates' competencies are recognized by colleges, sources of financial aid, and other external parties. This competency-based approach is producing results: 90 percent of YWLCS students who graduated in 2009 were accepted to college or another postsecondary option.

Another way technology can support the reorganization of teaching and learning is by enabling more flexible student-centered scheduling. At the Huyton Arts and Sports Centre for Learning, a secondary school in the United Kingdom, for example, learning activities are selected and scheduled to fit individual students' needs rather than traditional academic periods and lockstep curriculum pacing.

Extending Learning Time

Another strategy for rethinking how teaching and learning are organized involves extending the learning day, week, or year. American students spend significantly less time in the classroom than students in many other countries, and students—especially low-income students—show a marked drop in their mathematics and reading proficiencies over the summer break. President Obama and other policymakers have questioned the logic of maintaining a three-month summer hiatus originally instituted so that students could provide needed farm labor during the critical summer months.

Since 2006, Massachusetts has had an Expanded Learning Time Initiative under which schools in lower income districts are adding 300 or more instructional hours to the school year. A number of charter school networks share the belief that extending learning time is key to preparing students from low-income communities for college, and they are instituting longer school days and weeks. Yes Prep schools, for example, run from 7:30 in the morning until 4:30 each day with additional sessions every other Saturday. Yes Prep educators also support extending learning time by giving students their cell phone numbers so that students can call them during the evening to ask questions about homework.

As we seek ways to extend learning time, in addition to considering the amount of time students spend in school, we should also look at whether we can provide engaging and powerful learning experiences through other means. For example, we know that students' lives outside school are filled with technology that gives them 24/7 mobile access to information and resources and allows them to participate in online social networks and communities where people from all over the world share ideas, collaborate, and learn new things. Our education system should leverage students' interest in technology and the time they currently spend learning informally outside the regular school hours to extend learning time in a way that motivates them even more.

One way to do that is through online learning, which allows schools to extend learning time by providing students with learning on demand anytime and anywhere, dramatically expanding educational opportunities without increasing time spent in school. With online learning, students can gain access to resources regardless of time of day, geography, or ability; receive personalized instruction from educators and experts anywhere in the world; and learn at their own pace and in ways tailored to their own styles and interests. Moreover, it enables our education system to leverage the talents and expertise of our best educators by making their knowledge and skills available to many more learners.

In addition, all these benefits can be realized through online learning at considerably less cost than providing students with additional in-person, classroom-based instruction by extending the school day or year.

As schools implement online learning, they should ensure that students' learning experiences address the full range of expertise and competencies as reflected in standards and use meaningful assessments of the target competencies. For example, online collaborative environments or virtual worlds can facilitate the participatory nature of learning in addition to providing opportunities for content knowledge. State education agencies can provide leadership and technical assistance in this area, and educators also should look to their peers for best practices.

Removing Barriers to Secondary and Postsecondary Graduation

The United States has a long way to go if we are to see every student complete at least a year of higher education or postsecondary career training. There is no way to achieve this target unless we can dramatically reduce the number of students who leave high school without getting a diploma and/or who are unprepared for postsecondary education. A complex set of personal and academic factors underlie students' decision to leave school or to disengage from learning, and no one strategy will prevent every separation from the education system.

Many students report that dropping out of school is a gradual process of disengagement that can be reversed with more relevant learning experiences and social and emotional interactions at school (Bridgeland, Dilulio, and Morrison 2006; Rumberger and Lim 2008). Technology-based programs and resources, including online learning, tutoring and mentoring, and social networks and participatory communities within and across educational institutions, can provide both. They also can give students guidance and information about their own learning progress and opportunities for the future. Specifically, students need to know what is expected of them as they move from middle school to high school and from high school to postsecondary education. Other practices supported with technology also can help address the problem.

First, there is the issue of identifying students' difficulties early and providing extra support where needed. Support should start as early as possible, before children enter school, and should become intensified for those students who need it as they move through school. From the point of high school entry, every student could have a learning dashboard indicating whether or not his or her course enrollments and performance are on track for high school graduation and qualification for college entry. Such a system could make "smart" suggestions about options for fulfilling requirements, including the possibility of earning credits for courses taken during the summer, in alternative programs, at community colleges, or online.

When prevention fails and students quit attending school for a period of time, we must have multiple options for reconnecting them with the education system. Such students often become discouraged about their prospects for being able to earn the credits needed for graduation or have an aversion to returning to a school where they will be in classes with younger students rather than their original cohort. (See sidebar on adult learning resources in the Learning chapter.)

Increasingly, secondary students are taking courses online to earn credit for courses they initially failed or missed because they were not attending school. Such courses can be taken under any number of arrangements—independently in the evening, during summer sessions, in a night school, or during the school day with a member of the teaching staff, who provides encouragement and support as the student works with the online material.

In Walled Lake Consolidated School District in Michigan, for example, students can recover course credits through online summer school courses. The summer credit recovery program has worked so well that the district is developing a plan that will allow students to stay in high school while working by attending class in their brick-and-mortar school for four hours a day and taking their other two required courses online at their convenience. (See sidebar on expanding learning opportunities through blended learning.)

Expanding Opportunities Through Blended Learning

Walled Lake Consolidated School District in Oakland County, Mich., is turning to online learning to offer students a wider range of educational opportunities very cost-effectively.

In 2008, Walled Lake began offering its summer school credit recovery classes online. The district enlisted the help of its teachers to review various offerings and selected an online learning provider whose curriculum was comparable to that of district courses. Walled Lake enrolled 300 students in these online courses and also provided face-to-face meetings with district teachers twice a week to help students with course material and track their progress. This blended strategy lowered the district's costs of providing each summer school course by nearly 50 percent, reducing the cost per student from $194 to about $102.

Inspired by this success and students' positive experiences with online learning, Walled Lake plans to begin allowing high school students to take both online and classroom-based courses during the school year. Students will continue to attend school at least four hours per day, but they may elect to enroll in up to two online courses each semester. As with its summer school courses, Walled Lake students' online learning experiences will be supported by biweekly interactions with local teachers. This blended learning arrangement will accommodate students' diverse learning styles and desire to work before or after school in ways that were not possible with full-time conventional instruction.

Walled Lake is also partnering with a local community college to make postsecondary education a reality for more of its high school students. Under the experimental agreement, 11th- and 12th-grade students may choose to enroll concurrently in high school and college, completing some college coursework online and some on the college campus, facilitated by the flexible scheduling system described above. The district will continue to claim full-time-equivalent funding for each student and will pay students' tuition for courses taken at the community college during their high school years. This arrangement will enable Walled Lake students to complete an associate degree just one year after high school graduation.

Another example is provided by Tarrant High School in Alabama. Tarrant students are taking advantage of ACCESS (Alabama Connecting Classrooms, Educators, & Students Statewide), the state's online learning program, to take courses before or after school or in the summer in order to recover credits for courses they failed or to graduate earlier. The school's principal believes that ACCESS has been a significant factor in raising her school's graduation rate from 66 percent in 2006 to 80 percent in 2008. Research conducted in the state of Washington has concluded similarly that online credit recovery can help increase graduation rates (Baker et al. 2006).

Reaching Our Goal

5.0 Productivity:

Our education system at all levels will redesign processes and structures to take advantage of the power of technology to improve learning outcomes while making more efficient use of time, money, and staff.

To meet this goal, we recommend the following actions:

5.1 Develop and adopt a common definition of productivity in education and more relevant and meaningful measures of outcomes, along with improved policies and technologies for managing costs, including those for procurement.

Education has not incorporated many of the practices other sectors regularly use to measure outcomes, manage costs, and improve productivity, a number of which are enabled or enhanced by technology. As other sectors have learned, we are unlikely to improve outcomes and productivity until we define and start measuring them. This starts with identifying what we seek to measure. It also requires identifying costs associated with components of our education system and with individual resources and activities so that the ratio of outcomes to costs can be tracked over time.

5.2 Rethink basic assumptions in our education system that inhibit leveraging technology to improve learning, starting with our current practice of organizing student and educator learning around seat time instead of the demonstration of competencies.

To realize the full potential of technology for improving performance and increasing productivity, we must remove the process and structural barriers to broad adoption. The education system must work to identify and rethink basic assumptions of the education system. Some of these include measurement of educational attainment through seat time, organization of students into age-determined groups, the structure of separate academic disciplines, the organization of learning into classes of roughly equal size, and the use of time blocks.

5.3 Develop useful metrics for the educational use of technology in states and districts.

Current data on the use of educational and information technology in our system consist of records of purchases and numbers of computers and Internet connections. Very little information on how technology is actually used to support teaching, learning, and assessment is collected and communicated systematically. Only by shifting our focus to collecting data on how and when technology is used will we be able to determine the difference it makes and use that knowledge to improve outcomes and the productivity of our education system.

5.4 Design, implement, and evaluate technology-powered programs and interventions to ensure that students progress seamlessly through our P–16 education system and emerge prepared for college and careers.

The United States has a long way to go if we are to see every student complete at least a year of higher education or postsecondary career training. Achieving this target will require dramatically reducing the number of students who leave high school without getting a diploma and/or who are unprepared for postsecondary education. A complex set of personal and academic factors underlie students' decision to leave school or to disengage from learning, and no one strategy will prevent every separation from the education system. Collaboration between P–12 and higher education institutions and practices supported with technology are crucial to addressing the problem.

R&D: Innovate and Scale

The model for learning presented in this plan assumes that we will develop, adopt, and ensure equitable access to a technology-based education system that provides effective learning experiences, assessments, and teaching and a comprehensive infrastructure for learning to support both formal education and all other aspects of learning. It also assumes we will incorporate many of the practices other sectors regularly use to improve productivity and manage costs and will leverage technology to enable or enhance them.

In the past, we have relied on public education entities and private companies to develop technology resources and tools for learning. In both these sectors, however, incentives are provided for developing discrete products and services without regard for how they work as parts of a system or for research on their effectiveness. Public education entities can mandate use of their products and services. Commercial enterprises gain market share through compelling value propositions, effective marketing, and broad distribution channels. But research on the effectiveness of learning technology typically comes after products and services have been deployed—when it is too late to result in major improvements—if it comes at all.

If we are to achieve our goal of leading the world in education, we must be leaders in the design and implementation of a more effective education system. To that end, this plan calls for a new approach to R&D for education that focuses on four areas:

- Continuing to provide competitive grants for scaling up innovative and evidence-based practices through the Department of Education's Investing in Innovation Fund (i3).

The i3 program provides funding for grants that are awarded to schools and nonprofit organizations for scaling innovations that improve K–12 education. There is a particular focus on the identification of evidence and increasing the level of understanding of what strategies and innovations work for what students under what circumstances.

- Transferring existing and emerging technology innovations from such sectors as consumer, business, and entertainment into education.

The Department of Education will promote the inclusion of innovative thinkers in consumer, business, and entertainment technology in federally funded convenings and collaborations with educational technology specialists.

- Supporting and sustaining the education R&D that is currently happening at the National Science Foundation, especially through its cyberlearning initiatives.

In June 2008, the NSF Task Force on Cyberlearning published *Fostering Learning in the Networked World: The Cyberlearning Opportunity and Challenge*, a comprehensive report on the role technology can and should play in STEM learning. For 2011, the NSF has established a new multidisciplinary research program to fully capture the transformative potential of advanced learning technologies across the education system. The Cyberlearning Transforming Education (CTE) program's investments will focus on anytime, anywhere learning, personalized learning, and using technology to advance our fundamental knowledge of how technology and learning sciences can come together in learning and assessment.

- Creating a new organization with the mission of serving the public good through R&D at the intersection of learning sciences, technology, and education (Pea and Lazowska 2003).

The *Higher Education Opportunity Act* (P.L. 110-315), passed in August 2008, authorizes establishment of the National Center for Research in Advanced Information and Digital Technologies (also called the Digital Promise). The center is authorized as a 501(c)3 that would be able to accept contributions from the public and private sectors to support the R&D needed to transform learning in America.

The National Center for Research in Advanced Information and Digital Technologies would support research at scale, facilitating the participation of educators, schools, and districts as partners in design and research. It would also promote transparency and collaboration, encouraging multiple researchers to work with the same data and interoperable software components and services. Its unique charter is to identify the key research and development challenges in the education field and coordinate the best combination of expertise for addressing them. These characteristics, along with an emphasis on public-private collaboration, distinguish the National Center for Research in Advanced Information and Digital Technologies from existing centers that help state and local education entities identify and implement established best practices in learning technology. The center's work would also be distinct from field-initiated research on the effectiveness of technology-based interventions.

The Defense Advanced Research Projects Agency (DARPA) offers an example of how such a research agency can promote work that builds basic understanding and addresses practical problems. DARPA sponsors high-risk/high-gain research on behalf of Department of Defense agencies, but it is managed and staffed by individuals from both industry and academia who are experts in the relevant research areas. DARPA program officers are given considerable discretion, both in defining the research agenda and making decisions about the funding and structuring of research.

In a similar manner, the National Center for Research in Advanced Information and Digital Technologies should identify key emerging trends and priorities and recruit and bring together the best minds and organizations to collaborate on high-risk/high-gain education R&D projects. It should aim for radical, orders-of-magnitude improvements by envisioning the impact of innovations and then working backward to identify the fundamental breakthroughs required to make them possible.

Through the funding of rapid and iterative cycles of design and trial implementation in educational settings, the national center can demonstrate the feasibility and early-stage potential of innovative tools, content, and pedagogies that leverage knowledge, information, and technology advances at the cutting edge.

The center should also ensure that teams working on each individual project share developments, progress, best practices, and outcomes with each other to take advantage of key findings and economies of scale and to ensure integration and interoperability between projects when desirable. The national center will need to work closely with representatives of private industry to develop clear memoranda of understanding concerning the terms for precompetitive fundamental research.

The national research center can focus on grand challenge problems in education research and development. “Grand challenge problems” are important problems that require establishing a community of scientists and researchers to work toward their solution.

American computer science was advanced by a grand challenge problems strategy when its research community articulated a set of science and social problems whose solutions required a thousand-fold increase in the power and speed of supercomputers and their supporting networks, storage systems, and software. Since that time, grand challenge problems have been used to catalyze advances in genetics (the Human Genome Project), environmental science, and world health.

To qualify as grand challenge problems suitable for this organization, research problems should be

- Understandable and significant, with a clearly stated compelling case for contributing to long-term benefits for society
- Challenging, timely, and achievable with concerted, coordinated efforts
- Clearly useful in terms of impact and scale, if solved, with long-term benefits for many people and international in scope
- Measurable and incremental, with interim milestones that produce useful benefits as they are reached.

This kind of grand challenge problem strategy has driven innovation and knowledge building in science, engineering, and mathematics. The time is right to undertake it to improve our education system (Pea 2007).

The following grand challenge problems illustrate the kinds of ambitious R&D efforts this organization could lead. Notably, although each of these problems is a grand challenge in its own right, they all combine to form the ultimate grand challenge problem in education: establishing an integrated, end-to-end real-time system for managing learning outcomes and costs across our entire education system at all levels.

1.0: Design and validate an integrated system that provides real-time access to learning experiences tuned to the levels of difficulty and assistance that optimize learning for all learners and that incorporates self-improving features that enable it to become increasingly effective through interaction with learners.

Today, we have examples of systems that can recommend learning resources a person might like, learning materials with embedded tutoring functions, software that can provide UDL supports for any technology-based learning materials, and learning management systems that move individuals through sets of learning materials and keep track of their progress and activity. What we do not have is an integrated system that can perform all these functions dynamically while optimizing engagement and learning for all learners. Such an integrated system is essential for implementing the individualized, differentiated, and personalized learning called for in this plan. Specifically, the integrated system should be able to

- Discover appropriate learning resources;
- Configure the resources with forms of representation and expression that are appropriate for the learner's age, language, reading ability, and prior knowledge; and
- Select appropriate paths and scaffolds for moving the learner through the learning resources with the ideal level of challenge and support.

As part of the validation of this system, we need to examine how much leverage is gained by giving learners control over the pace of their learning and whether certain knowledge domains or competencies require educators to retain that control. We also need to better understand where and when we can substitute learner judgment, online peer interactivity and coaching, and technological advances, such as smart tutors and avatars for the educator-led classroom model.

2.0: Design and validate an integrated system for designing and implementing valid, reliable, and cost-effective assessments of complex aspects of 21st-century expertise and competencies across academic disciplines.

The multiple-choice tests used in nearly all large-scale assessment programs fail to meet the challenge of capturing some of the most important aspects of 21st-century expertise and competencies. Past attempts to measure these areas have been expensive and of limited reliability. Technology offers new options for addressing the multiple components of this challenge. For example, technology can support

- Systematic analysis of the claims about student competence (including competence with respect to complex aspects of inquiry, reasoning, design, and communication) intended by academic standards and the kinds of evidence needed to judge whether or not a student has each of those aspects of competence;
- Specifying assessment tasks and situations that would provide the desired evidence;
- Administering complex assessment tasks capable of capturing complex aspects of 21st-century expertise through the use of technology; and

- Developing and applying rules and statistical models for generating reliable inferences about the learner's competencies based on performance on the assessment tasks.

Promising R&D applying technology to each of these components of the grand challenge is ongoing, but the pieces have yet to be integrated into a single system that is applicable across content domains and that is cost-effective to implement. In addition to system development, solving this grand challenge problem will require studies to demonstrate the validity of the new assessments and their usefulness for both making formative instructional decisions to improve learning and summative evaluative decisions for purposes of establishing competency and accountability.

3.0: Design and validate an integrated approach for capturing, aggregating, mining, and sharing content, student-learning, and financial data cost-effectively for multiple purposes across many learning platforms and data systems in near real time.

To meet the education and productivity goals articulated in this plan, learners and their parents, educators, school and district leaders, and state and federal policymakers must use timely information about student-learning and financial data to inform their decisions. Today, these data are maintained in a variety of digital formats in multiple systems at local and state levels. As the processes of learning, assessment, and financial management and accounting move into the digital realm, education data systems and education research have become exceedingly complex in terms of scale, heterogeneity, and requirements for privacy. Still, we must create systems that capture, curate, maintain, and analyze education and financial data in all scales and shapes, in near real time, from all areas where learning occurs: school, home, and community. This must be done in a manner fully consistent with privacy regulations.

Although underlying technologies for exchanging data sets exist, education does not yet have the kind of integrated Web-enabled data-sharing system that has been developed for the health-care, telecommunications, and financial sectors. Such a system must be capable of dealing with both fine-grained data derived from specific interactions with a learning system and global measures built up from that data, and it must be able to collect, back up, archive, and secure data coming from many different systems throughout a state. It must also be capable of integrating the financial data essential for managing costs. Addressing this challenge will require:

- A data format to represent learning and financial data;
- A service to discover and exchange data;
- A data security standard for the service;
- A specification, test suite, and reference implementation of the service to ensure vendor compliance; and
- Best practices to guide the deployment of such services.

4.0: Identify and validate design principles for efficient and effective online learning systems and combined online and offline learning systems that produce content expertise and competencies equal to or better than those produced by the best conventional instruction in half the time at half the cost.

Research labs and commercial entities are hard at work developing online learning systems and combined online and offline learning systems that support the development of expertise within and across academic disciplines. Although we have isolated examples of systems producing improved learning outcomes in half the time, we have yet to see this kind of outcome achieved within the K–12 system and particularly in those schools where students need help the most. In addition, in both K–12 and higher education, we have yet to see highly effective systems that can be brought to scale.

We have evidence that learning can be accelerated through online tutoring, restructuring curricula, and by providing guiding feedback for improvement throughout the learning process. Further, we know that the current "packages" of learning that define semester and yearlong courses are generally arbitrary and a result of long-standing tradition rather than of careful studies. Achieving twice the content expertise and competencies in half the time at half the cost through online learning systems seems very possible, but it will require careful design, development, and testing.

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Appendix A. How This Plan Was Developed

The U.S. Department of Education initiated the development of *Transforming American Education* in spring 2009 to capitalize on the opportunities created by technological advancements and new research on learning that have emerged since the publication of the last national education technology plan in 2004. The Department's goal was to create a vision for the strategic application of technology throughout the education system in support of student learning and achievement and consistent with the administration's broader education and economic priorities.

In accordance with the White House's Open Government Directive, public participation, transparency, and collaboration were key considerations in developing this plan. Web 2.0 technology greatly accelerated the plan development process and enabled tens of thousands of individuals to learn about and contribute to it through webinars, online forums, and an interactive public website through which all interested parties could contribute resources, statements, and comments.

Plan development began with interviews with a dozen leaders across the Department of Education and at the White House Office of Science & Technology Policy to build a deep understanding of policymakers' priorities, goals, and insights into how to make the next national education technology plan most effective.

Outreach began with an extensive series of events built around the National Educational Computing Conference (NECC) in June 2009. The National Education Technology Plan development team led by SRI International conducted five focus groups with teachers, school administrators, and members of the Consortium on School Networking (CoSN) and the Software & Information Industry Association (SIIA). Fifty chief technology officers and chief information officers from school districts across the country participated in a forum on the new plan.

In addition, more than 300 leading educators and educational technology experts participated in the ISTE Leadership Symposium. Leadership Symposium participants drafted vision statements and action steps that became the basis for the initial Web-based outreach event that generated 263 public comments over a two-week period from June 29 to July 12, 2009, on the National Education Technology Plan temporary website.

The input gathered was presented to a technical working group of educators, researchers, and state and local policymakers who contributed an extraordinary range of expertise to the vision, research, and writing of *Transforming American Education*. The Technical Working Group convened in person at three two-day meetings to craft the plan's vision and recommendations. In addition, technical working group members participated in discussions with guest experts during five two-hour webinars to incorporate additional expertise in critical issue areas for inclusion in the plan.

A second version of the National Education Technology Plan website was launched on Aug. 29, 2009, to give the public a sense of the themes being considered by the technical working group and to allow a wide range of stakeholders to contribute their own resources for consideration. During the three-month input period, 22,876 individuals visited the site and contributed 572 reports, technology tool examples, case studies, and personal or group statements on the plan. The site's 2,582 registered users included classroom teachers (235), students (48), school administrators (48), other school staff (117), district administrators (13), professors and other higher education staff (123), educational technology organization and nonprofit professionals (118), researchers (52), education consultants (116), technology tool and service providers (153), and state and national policymakers (2).

Hundreds of other stakeholders provided valuable input to the national education technology plan team throughout the summer and fall. The plan development team held webinar discussions with the members of educational technology organizations SETDA, CoSN, and NCTET, as well as with education philanthropy leaders. The plan development team presented at several education forums and conferences including iNACOL's Virtual School Symposium, NCTET's Policy Forum, the National Center for Technology Innovation Conference, and the Redefining Teacher Education for Digital Age Learners Invitational Summit. In addition, two technical working group members led a face-to-face open forum at the University of Michigan and a virtual public forum in Second Life.

Finally, to gather perspectives and insights from industry into ways to promote unprecedented innovation in education research and development, Assistant Deputy Secretary for Innovation and Improvement Jim Shelton and the plan development team convened top thinkers from 24 leading technology and educational content providers in a day-long summit in Menlo Park, Calif., on Sept. 21, 2009.

A draft plan was released on March 5, 2010, and posted for online feedback on http://www.ed.gov/technology. After two months of public comment, all input was reviewed by the plan development team and used to inform the final revision of *Transforming American Education*.

The Department extends its thanks to the thousands of individuals who shared their expertise in developing this vision for transforming the future of American education with technology.

Appendix B. Contributors

We extend our deepest thanks to the members of the National Education Technology Plan technical working group for their extensive contributions to the plan's vision for the future of education:

Daniel E. Atkins, University of Michigan
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Plan development was directed by Barbara Means of SRI International with the support of Marianne Bakia, Kate Borelli, Judy Brooks, Ed Dieterle, Austin Lasseter, Hannah Lesk, Jeremy Roschelle, Linda Shear, Susan Thomas, and Andrew Trotter. Linda G. Roberts served as a senior advisor to the plan development team.

Appendix C. Acknowledgments

We extend our appreciation to the thousands of individuals who participated in the numerous discussions, focus groups, presentations, webinars, public forums, and Web-based comment events that were held throughout the plan development process. A summary of the activities through which stakeholders contributed input is provided below. Our special thanks go to those who organized outreach efforts that helped gather valuable insights from across the field.

Policy Interviews

U.S. Department of Education

Joseph Conaty, Director, Academic Improvement and Teacher Quality Programs

Tom Corwin, Director, Division of Elementary, Secondary, and Vocational Analysis Budget Service

John Easton, Director, Institute of Education Sciences

Cheryl Garnette, Director, Technology in Education Programs, Office of Innovation and Improvement

Alan Ginsburg, Director, Policy and Program Studies Service

Laura Johns, Office of Educational Technology

Jenelle Leonard, Director of School Support & Technology Programs

Martha Kanter, Under Secretary

Ray Myers, Office of Educational Technology

Hugh Walkup, Office of Educational Technology

Joanne Weiss, Director, Race to the Top Fund

White House

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Tom Kalil, Deputy Director for Policy, White House Office of Science and Technology Policy

National Organizations

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Michael Cohen, President, Achieve

Dane Linn, Education Division Director, National Governors Association

Gene Wilhoit, Executive Director, Council of Chief State School Officers

Technical Working Group Webinar Discussants

Equity Issues in Technology-supported Learning

Mark Warschauer, University of California, Irvine

Open Educational Resources and System Redesign

Michael Horn, Innosight Institute

Elliot Maxwell, Consultant to the Committee for Economic Development

Reconceptualizing Assessment

Robert Kozma, Kozmalone Consulting

Jim Pellegrino, University of Illinois, Chicago

Enhancing Productivity

Rich Kaestner, Consortium on School Networking (CoSN)

Supporting Teachers with Technology

Barry Fishman, University of Michigan

Bill Penuel, SRI International

Ann Renninger, Swarthmore College

Steve Weimar, Math Forum

Outreach Events

State Educational Technology Directors Grantee Meeting

May 5, 2009

142 registered participants

ISTE Leadership Symposium at the National Educational Computing Conference

June 28, 2009

207 registered participants

ISTE CIO/CTO Forum at the National Educational Computing Conference

June 29, 2009

50 participants

Focus Groups at the National Educational Computing Conference

June 29-July 1

59 participants

SETDA Member Webinar

Aug. 24, 2009

Silicon Valley Industry Summit

Sept. 21, 2009

Agile Mind, Linda Chaput
Apple, John Couch
Blackboard, Jessie Woolley-Wilson
Carnegie Learning, Steve Ritter
Cisco, Ned Hooper
Dell, Mark Horan
George Lucas Educational Foundation, Steve Arnold
Google, Maggie Johnson
IBM, James Spohrer
Hewlett-Packard, Phil McKinney
Intel, Eileen Lento
KC Distance Learning, Caprice Young
McGraw-Hill, Randall Reina
Microsoft, Stephen Coller
NeXtAdvisors, Michael Moe
Teachscape, Mark Atkinson
Oracle, Clare Dolan
Pearson, Doug Kubach
Scholastic, Margery Mayer
SMART Technologies, Nancy Knowlton
Sun Microsystems, Scott McNealy
Texas Instruments, Melendy Lovett
VIP Tone, Robert Iskander
Wireless Generation, Larry Berger

NCTET Policy Forum

Sept. 25, 2009
30 participants

CoSN Member Webinar

Oct. 6, 2009
72 registered participants

Webinar with Philanthropy Leaders

Oct. 6, 2009

Cisco 21st Century Schools Initiative, Bill Fowler
HP Global Social Investment, Jim Vanides
Intel Foundation, Wendy Hawkins
MacArthur Foundation, Craig Wacker and Connie Yowell
Microsoft Partners in Learning, James Bernard and Mary Cullinane
National Geographic JASON Project, Caleb Schutz
New Tech Network, Monica Martinez
Oracle Education Foundation, Bernie Trilling
Pearson Foundation, Kathy Hurley and Mark Nieker

Public Forum at the University of Michigan

Oct. 21, 2009

75 participants

NCTET Member Webinar

Oct. 26, 2009

Exploring New Modalities for Learning Conference

Oct. 30, 2009

SETDA Leadership Conference

Nov. 1, 2009

Second Life Public Forum

Nov. 5, 2009

200 participants

ISTE100 Meeting

Nov. 9, 2009

25 participants

iNACOL Virtual School Symposium

Nov. 16, 2009

National Center for Technology Innovation Conference

Nov. 17, 2009

Summit on Redefining Teacher Education for Digital Age Learners

Dec. 8, 2009

Technical working group members Daniel E. Atkins, Barry Fishman, Roy Pea, and Brenda Williams played an important role in reaching out to various stakeholders. We also extend our deep thanks to those who helped convene and gather input from the community, including Patricia Anderson, Karen Billings, Leslie Connery, Christine Fox, Tracy Gray, Jenelle Leonard, Don Knezek, Keith Krueger, Susan Patrick, Paul Resta, Mark Schneiderman, Irene Spero, and Mary Ann Wolf.

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COMMUNITY COLLEGE DISTRICT

Education Master Plan
Information Submission Form

The GCCCD is starting a year-long process to develop an Educational Master Plan that will serve as the blueprint for our future. The Educational Master Plan is a long-range, comprehensive document intended to guide institutional and program development at both the college and district levels. The priorities established in the Educational Master Plan will serve to guide College and District decisions about growth, development and resource allocation.

As the first step in this planning process, everyone in the GCCCD community (faculty, staff, students and community members) are invited to identify and submit information sources to be reviewed for the trend analysis in one of six taxonomy areas - society, technology, economy, environment, politics, and education. We are not asking you to do new research - only to identify information you already have or that you encounter during the search period (March 21 - April 25) and bring it to the attention of the Scan Teams for review.

Please feel free to submit as many of these forms as you would like. Please answer the following questions for each submission:

1) What is the document we should review? : Digital Marketing: The Time for a New "Academic Major" Has Arrived

2) Author: Cliff Wymbs

3) Source: Journal of Marketing Education 2011 33: 93 originally published online 20 February 2011

4) Which of the following taxonomy areas does it fit into? (Please select only one):

- ☐ Society
- ☐ Technology
- ☐ Economy
- ☐ Environment
- ☐ Politics and Legal Issues
- ☒ Education
- ☐ Other:

5) Relevance: Academic program development

6) Page / Section: 93-106

7) **Add Attachment/Hyperlink Here**:

To attach a document: ***Reader 9:*****Tools-Comments and Markups-Attach A File As A Comment**
Reader X: Comment (upper right), select paper clip icon under Annotations

Questions: lynne.davidson@gcccd.edu *Research, Planning and Institutional Effectiveness*

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Digital Marketing: The Time for a New "Academic Major" Has Arrived

Cliff Wymbs[1]

Abstract

The rapidly emerging digital economy is challenging the relevance of existing marketing practices, and a radical redesign of the marketing curriculum consistent with the emerging student and business needs of the 21st century is required. To remain relevant to our students and to the ultimate consumers of our output, businesses, the marketing curriculum must evolve with both the changing technological environment and the way marketing is perceived by its own academic architects. After an overview of recent marketing trends, this article describes the need for a fundamental change in the teaching of marketing in today's environment, performs a curriculum audit of existing digital marketing initiatives, and then details a new curriculum reflective of marketing in a digital age and an approach to implement it. Finally, the new major is discussed in the context of specific challenges associated with the new age of marketing. The approach developed here provides other universities a target to serve as one measure of progress toward a curriculum more in tune with the emerging digital environment.

Keywords

digital marketing, Internet marketing, curriculum development, marketing education, marketing curriculum

In this article, I assert that new Internet and other digital technologies are not only transforming the practice of marketing but also the way we think about it, for example, mass markets are being replaced by markets of one, push marketing is being transformed into interactive permission marketing, fixed products are being replaced by inexpensive customized ones, fixed prices are often being replaced with auctions. There is still a hybrid of old and new; however, I concur with Wind and Mahajan (2001) who say the changes are real and irreversible. In response to these changes, I believe that to remain relevant universities need to offer a program, or at a minimum a course, in "Digital Marketing." Technology has caused the marketing environment to dramatically change, with the end result that customers have gained, and begun to use, significant market power. Our students, the first digitally literate generation, are experiencing these changes firsthand and will likely be the generation to integrate marketing theory and practice in this area. Our mission as educators is to provide them the necessary tools, vocabulary, and expertise to embark on this journey. They must learn traditional marketing skills in this new context and create new mental models associated with the coevolution of consumers and business in a more socially mediated world.

Offering a Digital Marketing major presents significant challenges in course creation and teaching in this dynamically changing area. I have seen the majority of our internships and an increasing number of students' full-time jobs coming in the digital marketing area. The only way to remain relevant and ensure the academic rigor associated with this emerging discipline is to experience and learn about the new environment as quickly as we can, use industry practitioner input where possible, and create a pedagogical plan that is flexible and can be modified when it seems appropriate.

This article demonstrates that the rapidly emerging digital economy is challenging the relevance of existing marketing practices and then proposes a model to radically redesign the marketing curriculum consistent with the emerging student and business needs of the 21st century. The model focuses on producing a well thought-out design of an ideal program. The complete redesign of the marketing curriculum has the benefit of producing clearly conceived and structured learning outcomes associated with the purposeful pursuit of knowledge rather than disjointed and fractured educational experiences associated with stand-alone courses that are often viewed as cash (and publicity) cows (Boyer, 1987; Gardiner, 1996; Underwood, 2009). Given the dramatic change in the environment, others, including Borin, Metcalf, and Tietje (2007), also see the need for a comprehensive

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redesign of the marketing curriculum, but their approach focuses on product and service innovation aspects.

I begin the curriculum redesign effort with a situational analysis of what is changing in the business and marketing environments since the introduction of the Internet. This sets the stage to discuss existing marketing programs and the difficulties they are facing in dealing with the rapidly emerging digital environment. Next, I present a proven model for curriculum change, followed by the design and implementation components of our new Digital Marketing major. This is followed by suggestions for what others in slightly different situations may do to increase relevance in their marketing curriculum and keep ahead of the technology curve.

The Emergence of Digital Marketing as an Area of Inquiry

This section begins with a discussion of the evolution of marketing in the 21st century. I then define digital marketing. Next, I discuss its emerging role in business and demonstrate the need for it to be an area of academic inquiry.

Marketing Evolution

What we commonly think of as "marketing" has gone through fundamental change over the past decade, shifting from a narrow managerial/organizational focus to a much broader definition that acknowledges marketing's role in other institutional contexts and in society in general (Petkus, 2010). The American Marketing Association (AMA) has changed its definition of marketing twice, in 2004 and 2007, with its most recent definition positioning marketing as an "activity" rather than a "function," as a broader activity within the company or organization rather than just a department, and as creating long-term value rather than just an exchange of money. The new 2007 definition states, "Marketing is the activity, set of institutions, and processes for creating, communicating, delivering, and exchanging offerings that have value for customers, clients, partners, and society at large" (AMA, 2007).

With the emergence of the Internet, technology-specific definitions of marketing have also been put forth, for example, "Internet marketing is a process of building and maintaining customer relationships through online activities to facilitate the exchange of ideas, products, and services that satisfy the customer" (Mohammed, Fisher, Jaworski, & Paddison, 2004, p. 4). The key differences between this definition and the 2007 AMA definition are the focus on building and maintaining customer relationships through online activities, the empowerment of customers.

Wind (2008) provides insight to the transition that is taking place when he states that our present thinking about marketing is bound by a set of core concepts, that is, marketing as exchange, the four Ps (product, price, place, and promotion), the three Cs (company, customers, and competitors), customer satisfaction, relationship marketing, permission marketing, and collaborative marketing. Each of these concepts is being challenged and changed by a world of empowered consumers, heightened competition, globalization, advances in technologies, and the interdependencies of these forces. Rethinking these core concepts is required if marketing is to have a seat at the corporate table in the coming years. Kelley and Bridges (2005) highlight the importance of quickly factoring these changes into the marketing curriculum when they assert that the requirements of the 21st century workforce directly affect what marketing educators teach their students. For example, in the area of market research, experimentation is rapidly replacing traditional survey and focus groups because it permits companies to test new ideas—and prices—in minutes and hours rather than weeks and months (Brynjolfsson & Schrage, 2009). Similarly, the Association to Advance Collegiate Schools of Business in 2005 and in 2007 revised its skill development standard to ensure that the marketing curriculum more closely reflected the realities of the employment marketplace (Teer, Teer, & Kruck, 2007). Increasingly, firms require marketers to analyze and interpret the vast quantity of data generated from digitally recorded customer conversations (Baruch College, 2010). Spiller and Scovotti (2008) find that today major Internet companies lack qualified people to meet their employment demands and they assert that as applications using the Internet evolve, a new type of digitally savvy graduate will be required to meet the needs of the business.

Digital Marketing Defined

Digital marketing is an evolving concept; however, it is important to provide a clear and consistent definition of it here to serve as a foundation for the remaining analysis. The Digital Marketing Institute defines digital marketing as "the use of digital technologies to create an integrated, targeted and measurable communication which helps to acquire and retain customers while building deeper relationships with them" (Smith, 2007). Digital marketing includes both direct marketing, which treats customers as individuals and defines them not only by their individual characteristics but also by how they behave, and interactive marketing, which has the ability to address an individual and the ability to gather and remember the response of that individual (Deighton, 1996). Digital marketing also involves applying digital technologies, that is, web, e-mail, databases, mobile/wireless, and digital TV, to support interactive and noninteractive marketing activities aimed at achieving profitable acquisition and retention of customers within a multichannel buying process and customer lifecycle (Chaffey, 2010). Because the Internet is only one technology and marketing is increasingly using other digital forms to serve customers, the term *digital marketing* seems to be more appropriate than the more limited term defined earlier, *Internet marketing.*

The first part of the digital marketing definition demonstrates the range of access platforms and communications tools that form the online channels that e-marketers use to build and develop relationships with customers. The access platforms deliver content and enable interaction through different online communication tools such as organizational websites, portals, search engines, blogs, e-mail, instant messaging, and text messaging. Some also include traditional voice telephone as part of digital marketing. The second part of the description indicates that the main driver of digital marketing is the business returns from gaining new customers and maintaining relationships with existing customers, not the technology that drives digital marketing. The definition also emphasizes that digital marketing does not occur in isolation but is most effective when it is integrated with other communications channels such as phone, direct mail, or face-to-face. In fact, online channels could also be used to support the whole buying process from presale to sale to postsale and further development of customer relationships.

A key difference between digital marketing and traditional marketing is that the former uses digital technologies that are inherently measurable, permit conversations to be targeted, and facilitate the creation of relationships between customers and firms, whereas the latter is much more mass communication oriented. The number and ways of creating digital relationships and conversations with customers is growing exponentially, limited only by the imagination and entrepreneurial spirit of their creators (Alkhateeb, Clausen, Khanfar, & Latif, 2008).

The main uses of digital marketing to date have been Internet-based search marketing and digital advertising, banner ads. The former has been so successful because of its relevance to consumer inquiry, whereas the latter has been viewed as a necessary annoyance because it interrupts consumer conversations. The future of digital marketing will simply follow the customers wherever they may go. Today's trends seem to indicate that customers are increasingly mobile and social. Thus, the key to future marketing success is rather simple to articulate but much more difficult to implement: Get the customer the desired information when they want it and where they need it and avoid providing irrelevant informational clutter and violating their privacy concerns.

Digital marketing provides the critical bridge between customer digital touch points and digital conversation interfaces that firms use to provide relevant content to the customer. (See Figure 1 that displays these relationships.) The new Digital Marketing major has individual courses that focus on specific firm and customer dimensions associated with how these new digital touch points and interfaces can be used to provide the desired information to customers when and where they demand it.

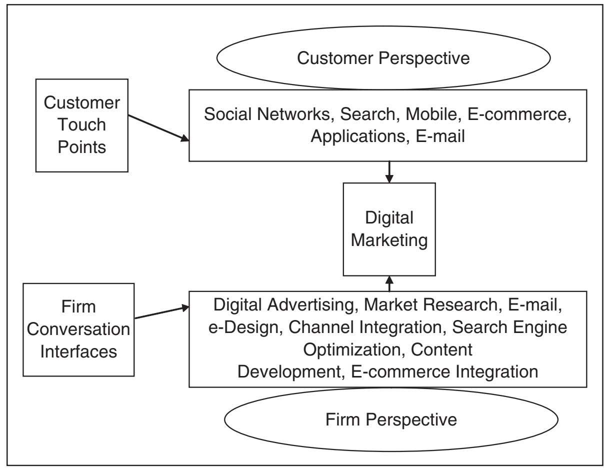

Figure 1. Digital marketing

The Reality of Digital Marketing in Business

As Wind and Mahajan (2001) said almost a decade ago, digital marketing is not traditional marketing on steroids, nor is it just a faster or newer channel but rather a new approach to marketing, that is, the digital revolution has fundamentally changed marketing at the core. Most certainly digital technology has opened new channels for selling products and services, but it also has put customers in charge, creating a fundamental shift in the dynamics of marketing. Digital marketing is about how best to communicate with customers, how to meet their changing needs, and how to build sustainable relationships and loyalty.

Marsey (2010) states,

> It's hard to deny the power of digital marketing, with 190 million Americans now online and 58 percent of cell phones built with web capabilities. . . . Digital marketing is literally everywhere, all the time. When the Internet first emerged, it was all about the latest and greatest technologies and how to push products in the digital space.

Now, however, the focus is entirely back on the consumer.

In Levy (2010), "The State of Digital Marketing," Emily Reily of Forrester Research states that the heart of digital marketing is

> where the conversation is happening with the consumer. That's where the consumer does its product

> research, that's where they confide in each other and ask questions and make brand decisions. And so it's a very, very key part. Even if it doesn't command the highest dollar amount, it really should require the most critical thinking, because this is again where you're really going to make or break your relationship with your customer. . . . Everything is going to really become digital to some degree. Most people are going to have smart phones; most people are going to be able to access the Web from their TV. So the digital buy is going to kind of be the everything buy, (p. 1).

David Thomas of the SAS Institute states that

> we may not yet have enough people dedicated to this (digital marketing) full-time, but I think we're doing a pretty good job of spreading the idea across the marketing organization to say this is something that everybody needs to be aware of and it needs to be part of the way that you do your job. (Levy, 2010, p. 5)

Pete Stein of Razorfish observed that "this was the year that the CEO wanted a special report on digital" (Levy, 2010, p. 2). Customers are spending increasing amounts of time in digital spaces, firms are sensing the need to increase knowledge of digital marketing throughout their organizations to respond to consumers' demands, and CEOs are becoming increasingly aware of the effects of digital marketing.

Need Justification for Digital Marketing in Academia

The justification for digital marketing as an academic area is predicated on three conjectures: (a) The traditional marketing curriculum does not provide students the necessary skills to analyze—buying behavior implications associated with the changing power relationships between customers and the firms, the exponential growth of recorded customer/firm interactions, and the use of experiments instead of market research to gain customer insight. (b) The digital economy is real and not a passing fad—in 2008, online consumer sales totaled $250 billion, B2B e-commerce was $3.5 trillion (Laudon & Traver, 2009); in 2010, Facebook had more than 500 million registered users and more than 30 billion pieces of content shared monthly for its social networking site (Facebook, 2010; Halkias, 2010), and the spending on online advertising in the United Kingdom had for the first time surpassed spending on TV advertising, that is, spending is the ultimate litmus test of where an industry is in embracing a particular channel (DMI [Digital Marketing Institute], 2010). (c) Marketing as a discipline has become less relevant to business. With regard to the last conjecture, it is helpful to ask and answer three related questions: (a) Does the emerging, connected, digital economy have fundamental implications on how firms create and maintain customer relationships, interact with marketing partners, and satisfy customers' needs? (b) Has the marketing curriculum of our universities kept up with the relevance and vigor associated with the ambiguous, uncertain, rapidly changing marketspace faced by marketing executives? (c) Can our students articulate the marketing implications of the proliferation of new media and channels, empowered customers, and fragmentation of markets? If you believe that the answer to the first question is yes and the next two are no, as I do, then as marketing educators we have both the responsibility and the charge to do something about it.

One such educator, Wind (2008), who has followed marketing trends for more than 40 years, incorporates many of the above-mentioned dynamics when he asserts that the world in which marketing operates has fundamentally changed, that is, marketing research and practice has not kept up, and at the heart of the current trouble is a severance of academic rigor from managerial relevance. He proposed seven strategies that can increase both rigor and relevance of marketing: (a) bridge the disciplinary silos, for example, work with finance to better define customer lifetime value; (b) shift from traditional management to network orchestration, for example, the need to connect with markets, customers, and resources across boundaries of enterprises and nations; (c) change the focus from customer relationship management to customer managed relationships and cocreate solutions with customers; (d) shift from company-branded products to customer-branded solutions, for example, offer integrated solutions such as Nike did with Apple, with music for runners; (e) use analytics and metrics as glue, for example, increase the rigor of marketing and create business intelligence; (f) adopt an experimentation philosophy in all activities and strive for empirical generalization, for example, adaptive experimentation; and (g) challenge and change your mental models, for example, think of new ways to empower customers. These areas are quite far reaching and serve as good measuring sticks to evaluate the relevance and rigor of any new curriculum. To gain a better understanding of the state of digital marketing in today's economy and to serve as basis for our analysis, I conducted an audit of digital marketing academic activity among other colleges and universities (Tippins, 2004).

Digital Marketing Curriculum Audit—2010

A review of the top 10 marketing undergraduate programs in the United States reveals some interest in the digital marketing area, with 7 of the 10 programs having at least one related course ("Best colleges' specialty rankings: Undergraduate business specialties: Marketing," 2010). (See Table 1 that

Table 1. Top 10 Undergraduate Marketing Programs and Digital Marketing–Related Courses

Courses	No Course	Digital Marketing	Law of E-Commerce	Data Mining	Design of E-Business Systems	Electronic Commerce	Direct Response and Internet Marketing	Digital Advertising	Social Media
Wharton—University of Pennsylvania			X						
University of Michigan		X							
University of Texas				X					
University of California Berkeley					X				
University of North Carolina	X								
University of Indiana		X							
University of Wisconsin	X								
New York University		X							
University of Virginia						X			
University of Southern California							X		

lists course areas of digital marketing classes at these institutions.) The course has many different names but usually contains one or more of the following terms (*Internet*, *web design*, *digital*) coupled with the term *marketing*. A review of the course descriptions obtained from the schools' websites revealed the main topic areas to be a general overview of digital marketing, web design, and/or web analytics. However, the creation of a given digital marketing course within a university appeared to be opportunistic. It seemed that wherever a university had a faculty member with an interest and related area of expertise, a digital marketing course was created; for example, if the related expertise was in Computer Information Systems, then a web design course was created; if it was in Advertising, then a digital advertising course was created, and so on. To increase the breadth of digital marketing audit, I took a random sample of small, large, and private business schools listed in the *Fiske Guide to Colleges 2010* (Fiske, 2010) and compared these programs. I was not surprised to find that large and private business schools have slightly more digital marketing offerings than small counterparts, but none have what I would call an extensive cluster of courses. In 2008, the Direct Marketing Educational Foundation performed an analysis of schools that had Internet marketing programs and found that there were 5 undergraduate programs (only 1 offered a BBA degree, Dowling College in Oakdale, New York); 17 masters programs, of which 3 were MBA and 33 certificate/specialization undergraduate programs; and 131 offered Internet-related course programs (DMEF, 2008).

Many of the top marketing universities have more extensive digital marketing offerings at the MBA level. One possible explanation is that there is greater demand by students for course relevance when they are looking to augment their business career than when they are first starting out. Similarly, executive education has a greater variety of digital marketing courses. Columbia University had an Internet Marketing and Global Business course in its executive MBA a decade ago, whereas Harvard now offers a course titled "Taking Marketing Digital" that "explores social networking, mobile marketing, online communities, viral marketing, wikis, and blogs, you will learn how to build brands in a highly networked world" (Harvard Business School, 2010). NYU School for Continuing and Professional Studies offers a concentration in "Digital Marketing" and "Marketing Analytics" in its MS program.

In general, it appears that urban universities in 2010 tend to offer more digital marketing courses than their rural counterparts. For example, New York City academic institutions, possibly because of their closeness to Silicon Alley (new media center carved out during the dot.com boom), as well as the established midtown Manhattan media cluster, have shown the greatest interest in the digital marketing area. Both demand and supply factors come into play; the media center provides a fertile ground for adjuncts to teach new courses and students are more aware of emerging trends and populate these courses. In addition to the NYU and Columbia initiatives, Pace University has an undergraduate program in "E-Business and Interactive Media Concentration" that has two specific Internet-related courses, "Strategic Internet Marketing" and "Multimedia Applications for the Computer." Baruch College/CUNY has a "Digital Marketing" track with eight distinct Internet-related courses (that cover each category in Table 1), five of which focus in the marketing discipline. The Direct Marketing Association, also located in New York City, is an industry trade group that has dozens of seminars and online courses for a fee. Not surprising, there are also several for-profit universities offering a complete array of online digital marketing courses. Two of the most well known are Full Sail University and DeVry University. It can be noted that these offerings have to be in tune with the marketplace and offer relevant courses, because that is their sole selling point and main source of revenue. The above audit indicates that many schools have a limited number of stand-alone digital marketing courses. If the desire is to create a new, ideal program from scratch, one would be prudent to create a formal procedure and curriculum model to guide the process.

Curriculum Model

A review of literature indicated that there is no shortage of models that could be used for curriculum redesign (Borin & Metcalf, 2010; Cheng, 1994; Cook, 1993; Koohang, Riley, Smith, & Floyd, 2010; Tippins, 2004). I chose to use the Association of the Computer Machinery/Institute of Electrical and Electronic Engineers–Information Technology (ACM/IEEE-IT) undergraduate curriculum model as our guide because of its proven track record and because of the similarities of the fields of information technology and digital marketing (ACM/IEEE, 2008). Both require an understanding of technologies and the manipulation of information to serve a business purpose (Morello, 2005; Rubel, 1996).

This model is simple in design and consists of two phases. Phase I involves the design of the framework that encompasses formulating the program mission, program accreditation, establishing career goals, and establishing program competencies. Phase II focuses on the design of specific courses in the curriculum and includes the design of foundation and advanced courses (Koohang et al., 2010).

Curriculum Design

The process used for curriculum design for the Digital Marketing major follows the two-phased ACM/IEEE-IT model.

Phase I

The mission of the Marketing Department at our university is to educate students for fulfilling careers in marketing, that is, helping the organization acquire customers and creating value for them. The Digital Marketing major is consistent with the Department's mission and became a stand-alone "accredited" program after it was approved by the school and college curriculum committees, thus fulfilling the accreditation phase.

If marketing is to lead in the development of customer insight in the new digital environment, it must reexamine all concepts, methods, and practices for appropriateness and relevance (Wind & Mahajan, 2001). As I demonstrated in the "The Reality of Digital Marketing in Business" section, the changed business environment has created a need for digital marketing education. One example, market research, can highlight this change. Historically, market research studies were designed and executed and firms would get customer intention results in about 6 months. Firms such as Amazon can now place features on websites and tell within hours how customers respond. Experiments are becoming far more pervasive and persuasive as information technology improves and testing grows faster and cheaper, resulting in huge changes for corporate cultures that will embrace speed. I assert that market research courses must incorporate these new techniques to remain relevant. But this is just one course that is illustrative of the fundamental change that is occurring, I suggest that much greater, widespread design change is necessary for marketing to remain relevant to students and firms employing those students.

In many ways, we can use business organizational responses to the evolving digital environment as a curriculum guide. New career areas and new categories of jobs in digital marketing indicate where firms have already made resource commitments. If we as academics want to remain relevant to business, it would behoove us to create courses that provide our students with basic levels of knowledge to address many of these critical areas of business. See Appendix A for a list of where digital marketing careers exist and the new categories of jobs specific to digital marketing. In April 2010 at a Baruch Digital Marketing Conference in New York City (Baruch College, 2010), the two largest advertising agencies in the world, the largest software manufacturer, and the most profitable Internet firm all indicated that they had done significant hiring in the digital marketing area during the recession of 2008/2009 and still had hundreds of unfilled jobs. Experienced talent, not economics, appears to be the constraining factor in the digital marketing area.

The last area associated with Phase I is establishing program goals and competencies, that is, the knowledge and skills students should have by the time they complete the program. Our goal for the Digital Marketing major is to provide students with a relevant educational experience consistent with the emerging environment that promotes competence in the emerging field of digital marketing and the capacity for career success. As indicated previously, the basic need driving the above goal revolves around the rapidly changing, technology-mediated consumer experience that places greater emphasis on digital data and firm/customer relationships.

Because I am introducing a new discipline, a learning sequence could be developed that moved the students along Bloom's cognitive goals hierarchy (Bloom, 1956), that is, introductory courses have to provide basic knowledge facts of the digital environment; students next have to comprehend how traditional marketing differs from digital marketing, particularly in the area of gaining customer insight; then new data reduction techniques have to be understood and then applied in new ways to analyze consumer behavior. This is then followed by new research techniques and data models being combined and synthesized to solve marketing problems. Ultimately, the new digital marketing approaches have to prove to be more responsive to customers' demands than previous methods. After completing the program, I expect students to have the competencies associated with the learning goals in Appendix B.

Phase II

For about 4 months, I discussed core and specialized digital marketing topics with industry trade organizations, major digital advertising firms, software firms, academics from other universities, and officers from several digital start-ups and each provided thoughts on what was required. A core group of four to six industry people and two to three academic people refined the proposal and eventually produced a draft curriculum in about 5 months.

Most of the earlier discussions of our group involved what core courses should be part of the new Digital Marketing major. The "existing" marketing core was typical of many marketing programs around the country and had a market research course, a consumer behavior course, an international business course, and a marketing strategy course. The industry representatives strongly lobbied for a web analytics course in the digital marketing core. They argued that the explosion of marketing data demanded that students who graduated with a Digital Marketing degree had to have the ability to analyze the rapidly growing quantity of data generated by digital technologies. (See learning goals associated with Web Analytics and Intelligence in Appendix B.) We in the academic community felt that there was a need for an introductory course in digital marketing to set the stage for the more advanced courses as well as to provide all majors with a common understanding of the discipline's domain. (See learning goals associated with Internet Marketing in Appendix B.) A major at our university requires eight classes in the functional area, so the addition of two more required courses to the existing four-course core was not feasible because we wanted our students to have some flexibility to specialize in areas of their interest. We chose to eliminate from the core the International Business course because it did not relate directly to digital marketing and there was a precedent—several years earlier International Business was eliminated from the Advertising track. After taking the required course, Principles of Marketing, the Digital Marketing major has four required core courses that cover the basics of both traditional and digital marketing. The four courses are Market Research, modified to include coverage of Internet experimentation; Internet Marketing, an overview course reflective of the Internet Marketing paradigm; Web Analytics and Intelligence, a quantitative course to interpret data and create market intelligence for decision makers; and Marketing Strategy, an information intensive capstone course that will address a digital marketing problem and create a professional marketing plan. Next, students must choose, based on their interest, whether to learn basics of buying behavior from a consumer or business perspective. To complete the major, students then must choose three specialized digital marketing electives that can be tailored to their interests. A complete list of courses is provided in Appendix C.

Students can take three specialized digital marketing courses to carve out an area of expertise in the rapidly emerging digital marketing area. The areas, careers, and associated courses are as following:

- Area: Consumer Behavior in Digital Marketing
  - Careers: Direct and Interactive Marketing, Digital Advertising
    - Courses: Direct and Interactive Marketing, Digital Advertising, e-Business Technologies
- Area: International Supply Chain Management
  - Careers: Supply Chain Management and B-2-B Marketing
    - Courses: Internet Law, Innovation, Technology, and the Global Enterprise (B-2-B), Business Buying Behavior
- Area: Digital Entrepreneurship
  - Career: Entrepreneurs
    - Courses: Social Media Marketing and New Ventures, Direct and Interactive Marketing, Digital Advertising, Consumer Behavior or Business Buying Behavior

Curriculum design is necessary and must occur before implementation; however, implementation can be problematic if not properly sequenced.

Curriculum Implementation

According to Diamond (1997), the implementation of the proposed curriculum change requires many factors to be aligned, most notable, a solid base of instructional talent must be available, and the current curriculum must fill a knowledge gap.

For illustrative purposes, I share how we addressed each of these factors as they occurred at our school. A full-time faculty member, who created three courses for an Electronic Commerce concentration at the MBA level a decade earlier, led the effort and we had adjunct faculty who continued to teach these Internet-related courses. The knowledge gap was most obvious to the students who grew up with digital technology and had oversubscribed our single Internet marketing course, the marketing internship coordinator who placed over half of all his marketing internships in digital marketing areas, and the local companies who were seeking better trained digital marketing undergraduates to employ.

In addition to the necessary conditions for curriculum change identified above, there have to be sufficient conditions to create a tipping point for change (Gladwell, 2000). At our school, the two main internal forces driving curriculum change process were market dynamics and strong leadership (Borin et al., 2007). Our college is one of the largest business schools in the nation and we are located in the media capital of the world, New York City. After we created a proposal, one of the largest advertising agencies, The Interpublic Group, decided to partner with our college to increase the depth and breadth of international and Internet marketing graduates. We had documented the need and aligned many key factors required for the program to be a success: student interest and industry need, a willing industry coparticipant, a potential leader with curriculum experience and digital marketing experience, and support from upper management. Even after we executed the aforementioned implementation plan, we still faced two additional constraints involving the uneasy tension between the broader academic community and industry.

Reibstein, Day, and Wind (2009) highlight the growing gap between the interests, standards, and priorities of academic marketers and the needs of marketing executives. Executives and their business problems seem to be centered on the rapidly evolving digital marketing world; however, academics appear not to be listening to marketers' needs and on occasion have been accused of talking to themselves and engaging in research driven by the tenure process (Underwood, 2009). Here, I encourage marketing academics to expand their focus, to seek out important problems in the evolving digital marketspace, and to have an impact on the practice of marketing. If we are to remain good marketers ourselves, we must understand that employers are the clients to whom we must ultimately provide value.

Teer et al. (2007) found that there is a need for academic and practitioner partnerships to determine what knowledge and skills our students need and what level of expertise is desired for entry-level employees. However, they observed (particular to database marketing, but likely to be present in all of digital marketing) as a major problem in this area the difficulty in finding individuals with appropriate skills needed to teach these courses. Even if industry professionals are available to be hired as adjuncts, members of the marketing department must perform the critical leadership role of guiding the creation of courses and course content and ensuring that the program meshes from a rigor (theory) and relevance (practice) perspective. The teaching of these digital courses has some pluses and minuses, for example, it is hard to play the traditional professor "sage on the stage" role when the course content is rapidly evolving, but it is much easier to be relevant with the students when you are helping them learn about something that they use on a daily basis for fun. Both teachers and students must engage in continuous learning.

Curriculum Evaluation

As indicated above, the basic marketing education structure seems to remain the same; however, the content of what we teach in it must change to reflect the current environment and changes in relative power between consumers and businesses. I now compare and test whether our new Digital Marketing major addresses Wind's seven specific design elements associated with the new age of customer empowered marketing. The detailed results of this analysis provided in Appendix D indicate that the new Digital Marketing major is quite responsive to each of Wind's seven strategies. This tight fit indicates that the new major is both relevant to business coping in the new digital age and exhibits vigor in the breadth and depth of the areas covered.

Strategy and Tactics for Marketing Educators: Curriculum Recommendations

A major contribution of this article is to provide a template for marketing educators on how to create and structure a digital marketing offering that is both responsive to needs of the business community and positions students with requisite skills to take advantage of these opportunities. This journey was not without challenges that many of you will likely encounter if you choose a similar path. For that reason, we briefly state them and then provide strategic and/or tactic responses to each.

Challenge 1: Is the Area of Marketing Experiencing a Fundamental Change?

This first challenge, in many ways, is most important because if it is not adequately addressed the others are moot. I have shown support for the statement that digital marketing is not traditional marketing on steroids, nor is it just a faster or newer channel but rather a new approach to marketing, that is, the digital revolution has fundamentally changed marketing at the core. A key difference between digital marketing and traditional marketing is that the former uses digital technologies that are inherently measurable, permits conversations to be targeted, and facilitates the creation of relationships between customers and firms, whereas the latter is much more mass communication oriented. The number and ways of creating digital relationships and conversations with customers is growing exponentially, limited only by the imagination and entrepreneurial spirit of their creators. Digital marketing is literally everywhere, all the time, it is where the conversation is happening with the consumer and as such represents a fundamental and irreversible change in marketing.

Challenge 2: Is There a Business Need for a Digital Marketing Offering?

I have highlighted several key trends that address this challenge. The traditional marketing curriculum does not provide students the necessary skills to analyze: buying behavior implications associated with the changing power relationships between customers and the firms, the exponential growth of recorded customer/firm interactions, and the use of experiments instead of market research to gain customer insight. Nor does the curriculum have courses that take into account the way firms in the new digital economy create and maintain customer relationships, interact with marketing partners, and satisfy customers' needs. These voids are compounded by the fact that the digital economy is quite large and growing, for example, more than 3.0 trillion dollars in commerce in 2008 and in 2010 more than 500 million people sharing 30 billion pieces of content monthly on just one social networking site. In 2008, there were only 5 undergraduate programs, 17 master programs, 33 certificate programs, and 131 academic institutions that offered digital marketing courses attempting to fill this void (DMEF, 2008).

Challenge 3: Has Business Input Influenced the Curriculum Development?

We have met with industry representatives throughout the development process and they have provided invaluable feedback. After we created the program in spring 2010, we held a conference where major technology companies, Google and Microsoft, and advertising firms GroupM of the WPP group, R/GA of the Interpublic Group, and Incisive Media, provided their assessment of our digital marketing offering. What we heard was a consistent message: Their clients were increasingly spending a greater portion of their advertising budget on digital advertising and they demanded better web analytics and greater measurement of return on their expenditures. The conference can be viewed at http://www.baruch.cuny.edu/dml/engine.php?action=viewAsset&mediaIndex=1138.

Challenge 4: Is There an Evolution Path to Introduce Digital Marketing Into a School's Curriculum, That Is, What Courses Should Be Offered and When?

The complete redesign of the marketing curriculum has the benefit of producing clearly conceived and structured learning outcomes associated with the purposeful pursuit of knowledge rather than disjointed and fractured educational experiences associated with stand-alone courses; however, few institutions will likely have the resources and/or the organizational capabilities to do this all at once. I believe that the next best approach is to use the curriculum redesign discussed in this article as a final product and for each institution to create its own evolutionary path. Many institutions may choose to replicate the learning sequence we used that starts with an introductory course to provide basic knowledge of the digital environment, followed by a course describing how traditional marketing differs from digital marketing particularly in the area of gaining customer insight and market research, and then offers a course in new data reduction techniques and how they can be understood and applied in new ways to analyze consumer behavior. This is then followed by elective courses that address specific applications of digital marketing to the business world, for example, Digital Advertising, Social Media and Small Business Entrepreneurship, Direct and Interactive Marketing, Law and the Internet, and so on.

Challenge 5: What Happens If Existing Faculty Do Not Possess the Needed Skill Set to Teach These New Digital Marketing Courses?

One effective approach involves creating technology champions within your department to enhance the technology diffusion process and using faculty mentoring and workshops. These technology diffusion leaders would likely be the ones to create the first digital marketing courses and eventually create a curriculum of related courses. This is what happened in our university. The AMA has recognized the need for education in this area and has put together a training series to address this very problem. For the first half of 2010, they had seven live presentations and interactive forums, for example, Marketing Metrics and Dashboards, 2.0—the next generation in marketing, measurement, analytics, and resource allocation (AMA, 2010). Another option is to attend AMA and Direct and Interactive Marketing Association annual meetings where digital marketing topics are widely discussed. A third option is to read journals on this subject such as the *Journal of Interactive Marketing*. An increasing number of traditional marketing journals such as *Journal of Marketing Education* and magazines such as *Marketing Management* are including more digital marketing articles in them, and a large number of podcasts and web seminars are increasingly available. A fourth option is to become tech savvy and play with the new technology as it becomes available. A fifth option is to put together and teach a digital marketing course; learning by doing is a great educational experience.

Challenge 6: What Should I Look For in Hiring Someone To Teach a Digital Marketing Course?

The understanding and teaching of digital marketing requires the combination of several skill sets. First, faculty must understand the digital technology and how that is creating an array of new media forms that facilitate customer communication. Second, he or she must be able to translate digital technology potential into marketing and psychological concepts and be able to compare and contrast what is new and what is similar with existing marketing concepts. Third, he or she must have or develop (or read about) established interfaces with practitioners to fully understand what is happening in the market among marketing executives, advertising agencies, and consultants and how they are attempting to reach customers in new and interesting ways. The hiring of industry professionals as adjuncts has proven successful for our university; members of the marketing department, however, must perform the critical leadership role of guiding the creation of courses and course content and ensuring that the program meshes from a rigor (theory) and relevance (practice) perspective.

Challenge 7: What Forms of Assessment Are Taking Place With the New Curriculum?

The assessment of success or failure of the program is first whether the digital marketing courses fill and then whether our students successfully find employment. Over the past couple of years, I have seen over half to almost two thirds of our marketing students getting internships in the digital marketing space even though most had little or no digital marketing classes. We have had success at the MBA level in placing students (who either took digital marketing courses or obtained our digital marketing certificate) in digital marketing jobs, with a dozen graduates placed with Microsoft alone. With regard to relevance, we plan to create an industry advisory group, and we will solicit feedback each year from our students with an end-of-semester evaluation for all our courses.

Conclusion

This article demonstrates that the rapidly emerging digital economy is challenging the relevance of existing marketing practices and a radical redesign of the marketing curriculum consistent with the emerging student and business needs of the 21st century is required. To remain relevant to our students and to the ultimate consumers of our output, businesses, the marketing curriculum must evolve with both the changing technological environment and the way marketing is perceived by its own academic architects. Reibstein et al. (2009) highlight the growing gap between the interests, standards, and priorities of academic marketers and the needs of marketing executives.

The digital marketing major discussed here is my attempt to bridge this relevancy gap. I believe that the courses created and our curriculum approach meet the needs of business, our students, and the marketing academic community. I think the approach is appropriate and suitable for other universities; however, I realize that many may choose an evolutionary path toward digital marketing, so I outlined a phased implementation approach to the Digital Marketing major. Our approach provides other universities a target, end state, to serve as one measure of progress toward a curriculum more in tune with the emerging digital environment. Another such measure that they could use to evaluate progress in the digital marketing area is to see how their current curriculum offering maps into the seven strategies that Wind (2008) identifies as critical in increasing both rigor and relevance of marketing in the fundamentally changed digital world. As indicated in Appendix D, our digital marketing curriculum appears to be quite responsive and addressed each of Wind's seven strategies.

The digital marketing curriculum audit reported earlier seems to indicate that many universities, more than 130 in 2008, are beginning to offer a limited number of digital marketing courses. I hope that they, and many more of the nonadopters, can use what I have shared to guide their offering and, as such, increase the business relevance of marketing in the digital age.

Appendix A

Business Identified Careers and Jobs

Digital marketing—Career areas
- New media and digital media agencies
- Advertising agencies
- E-business and e-commerce companies
- Companies providing online marketing–related products and services
- Corporate employers recruiting for in-house online marketing–related jobs
- Search engine marketing and search engine optimization (SEO)
- Digital public relations

Digital marketing—Specific jobs
- Advanced analytics
- Application development
- Client services
- Creative
- Digital media services
- Rich media
- Strategy

Note. Adapted from "Digital marketing jobs" (2010).

Appendix B

Learning Goals and Proficiency Exercises for Substantially New Digital Marketing Courses

Course	Learning Goals	Task/Exercise
Internet Marketing	• Demonstrate how the Internet affects the breadth and depth of a firm's overall marketing strategy. • Identify strategic and operational aspects of information-based marketing programs on the Internet: a. For a variety of products and services b. In both consumer and business markets c. In countries around the globe • Recognize how the Internet has affected and created key Internet marketing levers (product, pricing, communication, community, distribution, and branding) and demonstrate how online and offline levers can be combined to achieve marketing goals. • Gain Internet marketing skills through written and oral assignments.	Create a marketing plan using the marketspace matrix and show how marketing levers are used to build customer relationships for a particular product.
Social Media Marketing and New Ventures	• Identify the emerging social media "ecosystem" and how the social media phenomenon relates to business. • Define and categorize how social networking transforms personal and professional relationships. • Identify a social media opportunity that can be turned into a new venture.	Create a business plan for a social media new venture opportunity.
Marketing Web Analytics and Intelligence	• Identify how Web analytics can affect the breadth and depth of a firm's overall marketing strategy. • Recognize strategic and operational aspects of Web analytics' tools and technologies: a. For a variety of products and services b. In both consumer and business markets c. In countries around the globe • Discuss examples of how Web analytics can influence and create new marketing levers. • Interpret how new marketing levers influence customer relationships, brand response, and, potentially, sales. • Relate web analytic knowledge and skills through written and oral assignments.	Analyze the data from a website, identify appropriate analytics, and create a report that provides a market strategy recommendation.
Digital Advertising	• Reach customers with relevant digital advertising. • Design effective online ads. • Budget online advertising and the risks of underallocating. • Integrate online advertising with the "traditional' parts of a campaign; achieve marketing objectives—from lead generation to retention and loyalty. • Measure the effectiveness of Internet ads and campaigns. • Leverage consumer behavior in digital channels to construct advertising objectives. • Prepare campaign tracking and analysis for a digital advertising campaign.	Apply best practices to create compelling digital advertising campaigns from both creative and media perspectives.
Direct and Interactive Marketing	• Identify the strategic objectives that can be met with direct and interactive marketing. • Identify the media used to deliver direct and interactive marketing campaigns. • Describe best practices for direct and interactive marketing. • Identify the sources of information used in direct and interactive marketing. • Describe the analytic techniques and tools used in direct and interactive marketing. • Evaluate direct and interactive marketing campaigns.	Create a direct and interactive market plan to accomplish a strategic objective and then use analytics to evaluate that plan.
Social Media Technologies in Business	• Identify, describe, and explain today's Web 2.0–based social media technologies in the interconnected corporate environment. • Identify, describe, and explain the impact of these social media technologies on corporate and nonprofit organizations. • Recognize the ways in which social media can be incorporated into the corporate structure and provide an organization with competitive advantage. • Recognize the ways in which advances in information technology must be informed by considerations of privacy, confidentiality, and professional ethics. • Conduct online and library research, present the results of this research to the class, and demonstrate an ability to work effectively in a group.	Generate a plan that shows how a firm can use social media to enhance a particular strategic objective without violating privacy concerns.

Appendix C

Listing and Description of Courses

Core courses	
MKT 3600	Marketing Research
MKT 4123	Marketing Web Analytics and Intelligence[a]
MKT 4555	Internet Marketing
MKT 5750	Marketing Strategy
Additional required course (3 credits)	
MKT 3605	Consumer Behavior
or	
MKT 4700	Business Marketing Management
Elective courses—Choose three courses (9 credits) from the following, two of which must be marketing (MKT) or international business (IBS) courses.	
MKT 4151	Direct and Interactive Marketing[a]
MKT 4557	Digital Advertising[a]
MKT 4460	International Supply Chain Management
MKT 4966	Social Media Marketing and New Ventures[a]
IBS 3000	Innovation, Technology, and the Global Enterprise
CIS 3444	e-Business Technologies
CIS 3630	Principles of Web Design
LAW 3108	Law and the Internet
LAW 3118	Law of Unfair Competition and Intellectual Property
MGT 4967	Technology, Innovation, and Design in Entrepreneurship

a. New or substantially modified courses for the major.

Appendix D

Curriculum Evaluation Based on Wind's Seven Criteria

1. Bridge the disciplinary silos.
   a. The design of the Digital Marketing major is interdisciplinary in nature. Depending on their interest, students can take courses in law, entrepreneurship, or computer and information science to complement their marketing knowledge.
   b. If students, via coursework, understand the language and basic principles of the traditional business silo areas, they will more likely seek them as partners, rather than avoid them, when they enter the business world.
   c. The major, particularly in the core courses, stresses both behavioral and quantitative approaches to addressing marketing questions. The major also strongly encourages the student to take internships so that they can see firsthand how academic training and practitioner experience mesh in the real world.
2. Shift from traditional management to network orchestration.
   a. Our students increasingly understand the power of networking each time they log in to their Facebook accounts.
   b. The importance and power of networks is addressed in several of our courses, for example, Social Media Marketing and New Ventures and the Supply Chain Management course. Most of the courses have group projects, where students must learn to work in small, networked groups.
3. Change in focus from customer relationship management to customer managed relations.
   a. A key facet of the digital marketing definition, and its major difference from the AMA definition, is the importance of the creation of relationships with customers.
   b. Companies have wasted much money in failed attempts to manage customer relations. Relationships are not to be managed by one party but rather relationships must codevelop with both parties adding mutual value.
   c. The coevolving of relationships is the main focus of the core Internet Marketing course as well as the Digital Advertising and Direct and Interactive Marketing classes.
4. Shift from company-branded products to customer-branded solutions.
   a. Unlike in the pre-Internet world where companies sold products to customers, now customers have more power and choices. Drucker (2003) notes that "the customer has the information" and "whoever has the information has the power."
   b. Rather than treating customers as an exogenous group, they are increasingly looked on as a part of the firm and participants in the value creation process. Now customers do their banking online, find information with search engines, assemble their furniture, and participate in the new product development processes.
   c. Two of the most successful online businesses, EBay and Google, have experienced huge growth because they empower the consumer.
   d. These concepts come through clearly in the core Internet Marketing class and are re-enforced in the Digital Advertising class.
5. Use analytics and metrics as glue.
   a. The Forrester Research Group estimated that the market for Web analytics would be roughly $431 million in the United States in 2009, growing at a rate of 17% between now and 2014 (Lovett, 2009).
   b. Today, a majority of companies are dramatically underinvested in analyzing data flowing from

digital channels. Even when business managers have committed money to measurement technology, they usually fail to apply commensurate resources and effort to make the technology work for their business.
   c. Today, most organizations focus too much on generating reports and too little on producing true insights and recommendations, opting for what is easy, not for what is valuable to the business.
   d. In the Web Analytics and Intelligence course, we investigate how digital analytics can play a greater role in future business decision making.
6. Adopt the adaptive experimentation philosophy.
   a. The Internet has fundamentally changed the economics of market research. No longer is it a laborious and costly activity, studies can be designed in days and carried out overnight.
   b. Experiments, such as A/B (inclusion/exclusion of an item) tests, can be done without consumers knowing that an experiment is being conducted.
   c. Also, large Internet panels permit the researchers to look at customer buying behavior over time and look at very precise target segments.
   d. The market research core courses coupled with the Internet marketing courses directly address the dramatic move toward experimentation in the new marketing arena.
7. Challenge (and change) your mental model.
   a. Marketers of the 21st century must challenge conventional wisdom by using creativity and innovation. They need to rethink their mental models of how to empower customers, understand their behaviors, collect and analyze the data, and design strategies that affect customer behavior consistent with company objectives (Wind, 2008).
   b. Who better to challenge these mental models of existing marketing professionals than students who have grown up using these new technologies to do new and creative applications?
   c. The courses in the major give students the vocabulary and basic knowledge of existing marketing professionals as well as digital marketing knowledge.

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Educational Master Plan

Information Submission Form

1) Title: Raising CCC & CSU Grad Rates

2) Author: Chancellor Bruce Baron

3) Source: The Sun, San Bernardino, CA (Jan. 5, 2011)

4) Taxonomy Area:

- [ ] Society
- [ ] Technology
- [ ] Economy
- [ ] Environment
- [ ] Politics and Legal Issues
- [x] Education
- [ ] Other: ______

5) Relevance: Success Rates

6) Page / Section: ______

7) Link to document: ______

or

8) Attach Document Here: [ ]

Newspaper

Raising CCC and CSU success rates

Article from: **The Sun, San Bernardino, Calif.** Article date: **January 5, 2011**
Author: **Chancellor Bruce Baron**

California Community Colleges (CCCs) have three missions under the California Educational Master Plan: vocational training, economic development and transfer preparation.

The 112 colleges in the system educate about 2.7million students per year, down from their peak enrollment of 2.9million in 2008, a result of the drastic cuts in class offerings required by the lack of state funding. Those 2.7million include 200,000 for which the educating institution did not receive funding, but not the 140,000 estimated to have been turned away because we did not have room for them in our classrooms.

In 2009-10, we transferred 52,341 students to California State Universities (CSUs) and the University of California institutions (UCs), and in 2008-09 awarded 127,099 certificates and associate's degrees, and (most current statistics available) transferred another 35,884 students to in-state private and out of state colleges and universities.

Why don't we have higher transfer numbers? There are several reasons.

Students come to community colleges with no high school diploma, or without college-ready skills. Statewide, more than 83percent of our students' assessment test results indicate the need for remedial classes in math, and 72percent in English or reading ("Higher Ed Watch," Oct. 26).

Many students attend part time because they have families to support and need to work full time, or have no family supporting them and need to work.

Often our students are unsure what they want to major in and so they are not fully enrolled in a degree program, but are experimenting academically.

For those enrolled in at least 12 units and attempting to take transfer level math or English classes, we have a 40.9percent transfer rate (Community College League of California, 2010).

Eighty-six percent of Californians polled believe that a college degree is very important, with 63percent maintaining that a college education is necessary for a person to be successful in today's work world. Projections indicate that in 15 years, only 35percent of working-age adults in California will have college degrees, but that 41percent of jobs will require one (PPIC Statewide Survey, Nov. 2010).

So how can we achieve that goal of substantially increasing the number of students who successfully complete their bachelor's degrees, given the severe cuts in funding across the higher education system in California?

One of the major ways is through increased efficiency - at both the two-year and the four-year school levels. CCCs provide 70- 75percent of all public postsecondary student enrollment in California, about 30percent more than in other states (Institute for Higher Education Leadership & Policy, Oct. 2010).

Schools have undertaken major overhauls in how they provide educational programs and services internally, including offering online classes, online student services such as financial aid, counseling and registration, and having four-year schools offer classes on the two-year sites.

But one of the most important changes in efficiency has been addressed by the state Legislature this year with their design of a new transfer degree through Senate Bill 1440.

This bill streamlines the relationship between the CCCs and the CSUs - allowing students to complete their requirements at the CCCs more quickly and then to have those courses honored at the CSUs without question.

The CSUs are in the process of designing 12 transfer degrees, with input from the CCCs, that the respective CCCs will identify as appropriate to the programs they offer (not all CCCs offer the same programs) and then implement. The focus of these degrees is the articulation of the required classes between the CCC and the recipient CSU - meaning that the CSU would specify what its expectations are for an incoming junior level student in a specific major, and the CCC offering the degree would be able to design the curriculum to meet those standards.

Transfer degrees will start to become available at the CCCs in fall 2011. Students will be able to complete their lower level academics at the CCCs more efficiently, and transfer to a CSU prepared to complete their bachelor's degrees in a timely fashion. This saves money for both the students and the institutions, since they will not be enrolled in courses they do not need to achieve their academic goals.

Senate Bill 1440 is a definite win-win for students, institutions and the state of California.

Bruce Baron is interim chancellor of the SanBernardino Community College District.

Educational Master Plan

Information Submission Form

1) Title: Growing and Funding Experiential Learning Programs: A Recipe for Success

2) Author: Cowart, M.R.

3) Source: New Direction for Teaching and Learning

4) Taxonomy Area:

- ☐ Society
- ☐ Technology
- ☐ Economy
- ☐ Environment
- ☐ Politics and Legal Issues
- ☑ Education
- ☐ Other: ______

5) Relevance: Academic Programs

6) Page / Section: 63-68

7) Link to document: http://onlinelibrary.wiley.com.libproxy.sdsu.edu/doi/10.1002/tl.422/pdf

or

8) Attach Document Here: ______

8

This chapter describes ways in which institutions can develop thriving experiential learning programs despite challenging economic times. Stage-specific challenges and cost-effective solutions are outlined.

Growing and Funding Experiential Learning Programs: A Recipe for Success

Monica R. Cowart

While numerous professors and administrators can agree upon the benefits of infusing the curriculum with experiential learning (Higgins, 2009; Cheek and others, 2007; Beard and Wilson, 2006), a commonly stated obstacle to widespread curricular reform is funding. Specifically, given that external institutional support can be difficult to procure, especially in uncertain economic times, institutions might question whether it makes sense to start experiential learning initiatives, especially if long-term funding is uncertain. While, ideally, initiating an experiential learning program would involve allocating ample funds for faculty development grants and professional development programs, it is incorrect to assume that this is the *only* model that will result in a flourishing experiential learning program.

This chapter provides an alternative model to extensive internal funding streams by outlining how a college or university with limited resources can find the internal and external resources to start or enhance an experiential learning program. Using Merrimack College, a small tuition-dependent liberal arts college north of Boston, as a case study, this chapter will discuss the specific challenges programs can face when trying to find the resources to incorporate experiential learning initiatives into their curriculum. For each challenge that is identified, specific strategies are provided to successfully address that challenge. Moreover, challenges and solutions are provided from multiple perspectives (students, faculty, and administrative challenges) so that a comprehensive strategic plan is formulated that

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includes the perspectives of all stakeholders. Finally, these challenges and tested solutions are articulated within a larger "developmental" framework, which traces the funding challenges and solutions experiential learning programs can encounter as they grow over time. The chapter concludes with specific lessons learned from the Merrimack College case study, but the overall chapter will aim to broadly suggest strategies that other colleges can use to address funding challenges.

Merrimack College

In less than ten years, Merrimack College has progressed from a novice experiential learning (EL) institution to an institution poised to transcend to integrated status. This process started with a core group of faculty who were committed to seeing EL grow from a handful of courses to a shared pedagogical vision in which EL is integrated across the curriculum. Current EL initiatives are (1) highlighted in college brochures and alumni magazines, (2) funded through internal and external grants, and (3) showcased in one of two possible new general education programs. Given this progression, one might ask: How was Merrimack College able to progress from no coordinated EL efforts to its current status? Yet the more interesting question is: How was the college able to achieve this end despite the lack of initial resources?

Developmental Stages and Strategic Plan Development

The challenges associated with EL programs will vary depending upon the developmental stage of the program in question. While particular programs should be considered as existing on a developmental continuum, for our purposes, we will examine growing EL programs from inception (novice) to acceptance (integrated). By explaining each category and its accompanying challenges, institutional planning committees can produce strategic plans that anticipate appropriate growth and proactive problem-solving. Let's consider each program type and the corresponding challenges.

Novice EL Programs

A novice program is any program that does not have a formal institutionalized mechanism for delivering EL. In other words, there is not an EL office, no budget, nor staff members who are devoted to furthering EL initiatives on campus. Instead, EL courses might exist on campus, but they are provided by faculty members who believe in these pedagogical practices and continue to deliver these courses, despite the lack of institutional support. In addition, cooperative education or service-learning opportunities might exist, but there is no coordinated effort in terms of mission or vision that unites these various efforts. A novice EL "program" is born when faculty and administrators who are individually delivering these opportunities find one another and suggest coordinating efforts. These individuals might form a formal or informal campus group to explore the development of an official EL program on their campus. The goal of a novice program is to create an institutionalized mechanism for delivering EL opportunities, given that the college is not yet valuing, or simply does not have the resources to finance, these types of experiences. One of the biggest challenges for a novice program is to try to convince others, particularly students, of the value of EL.

Student Challenges and Solutions. Students often view EL courses as more time-intensive than "regular" versions of the same courses. They want to know why taking an EL course is worth their time and effort. The key to achieving student support is to demonstrate that course content becomes more relevant, meaningful, and clearly understood when an EL format is used. Once students recognize that the EL process provides unique opportunities to link theory and practice, they are more likely request EL courses.

The solution to this challenge is creating venues in which students are aware of the current EL opportunities on campus as well as the benefits they provide. Since students tend to respond more readily to first-hand accounts by their peers who have already had an EL course, having student-driven panel discussions, student-made videos, or student-run campus events that publicize recent EL initiatives can help to increase student interest. This, in turn, can lead to student-driven requests for more EL courses. Faculty and administrators also should be invited to these events so that they can see the positive impact these initiatives have on students.

Faculty Challenges and Solutions. Faculty members who have never taught EL courses often question whether implementing EL will be worth the extra effort required to learn new techniques and update courses. These individuals might describe the process as "too daunting" or "too difficult" to undertake without a faculty development grant. Still other faculty might argue that EL is "not really teaching" and might claim that it is not pedagogically sound. The strategy to address these concerns is twofold: (1) recognize that faculty who are new to EL will need the support of more experienced faculty who are already engaged in the process, and (2) share the outcome-based literature on EL, which demonstrates that this approach enhances the educational experience.

While students respond more to personal accounts, faculty members should be shown the growing literature that conveys the advantages of incorporating EL into the curriculum. One solution for helping those faculty members who are interested yet overwhelmed by the process is to start an EL support group and mentoring program. Experienced EL faculty members can be paired with faculty members who are contemplating offering a course. The mentoring relationship can help to diminish the anxiety that can accompany the initial offering of an EL course. In addition, a monthly support group of faculty members can offer individuals a forum to strategize, problem-solve, and build community around EL issues. Again, these efforts to raise faculty awareness of EL successes can be achieved with minimal resources.

Administrative Challenges and Solutions. Administrators might recognize that EL courses are effective ways of helping students make stronger connections between theory and practice, but in tough economic times they might rationalize that standard methods of course delivery are "good enough." Therefore, the challenge for a novice program is acquiring resources from the administration in order to fund a centralized EL office, so that further support is provided to faculty and students. After faculty support and student demand for courses have increased, then an argument can be advanced to the administration that developing an official EL program on campus that coordinates efforts will help attract new students and aid in retention of current students. Specifically, admission and retention arguments that connect with the now-growing grassroots demand for courses can result in the administration offering funding for a pilot program, a part-time staff member to coordinate efforts, or development money to attend an EL Institute in order to learn to develop a campus-wide strategic plan.

Integrated EL Programs

An integrated program is any program that has (1) a visible degree of student support and faculty delivery of EL courses, (2) a formal institutionalized mechanism for advancing EL initiatives (formal committee, campus office), and (3) some level of funding devoted to strengthening these programs. An integrated program builds upon all of the grassroots efforts that defined a novice program, but the central difference is that the EL initiatives of integrated programs are formally supported by the college or university. The degree of support, especially in difficult economic times, might vary from institution to institution, but in each case the inherent value of the EL program is recognized by the institution. Once an EL program has progressed to the integrated stage, a host of new challenges surface—including the necessity of providing consistency and preventing burnout—which require equally innovative solutions.

Student Challenges and Solutions. As programs transition from novice to integrated status, there reaches a point in which multiple forms of EL courses are offered from professors with a variety of experience levels. One consequence is that students might complain that courses have inconsistent standards for what counts as EL, resulting in some courses being more rigorous than others. One way to address this challenge is to establish a formal EL committee to develop school-wide criteria to which a course must adhere in order for it to carry the EL designation. For instance, the committee might decide that courses must involve a written reflection on the EL and that the EL component must be directly connected with the course content. Consequently, the committee would reject Professor X's request to offer his engineering course with an EL designation, since he mistakenly thought that requiring his students to hand out meals at a homeless shelter would qualify. Again, the EL committee can pull from the existing academic literature to adopt and refine a campus-wide definition of EL that will enable them to create minimal criteria that must be met for courses to carry an EL designation.

Faculty and Administrative Challenges and Solutions. As EL becomes more integrated into the curriculum and administrators begin to see its benefits, additional demands can be made on the core group of EL faculty who started these efforts, such as being asked to speak with prospective students, explaining their projects at alumni fundraising efforts, or mentoring additional interested faculty. Since a lack of funding in addition to increased demands on time can quickly lead to burnout, it is important to find ways in which experienced EL faculty can support these growing efforts without expecting them to singlehandedly carry these programs. One cost-effective solution is to have the core EL faculty rotate these responsibilities, or have members divide the work according to subcommittees. For instance, one member might agree to speak at all fundraising events, while another member will choose instead to mentor faculty who are new to EL. However, it should be noted that once a program has grown to the integrated stage of development, there should be enough support on campus to warrant pursuing internal and external funding sources that are supported by the institution. For instance, exciting EL initiatives can be showcased in the alumni magazine or included in a capital campaign.

Formalized Strategic Plan and Grants

Once top administrators and faculty recognize that they want EL to be part of their institution's long-range, pedagogical vision, it is time to formally include EL in institutional planning. If the institution currently offers faculty development grants for research and teaching, then these categories can be expanded to fund EL course development. In addition, an EL grant writing committee can be formed to explore possible regional and national teaching grants that can be written with an EL focus. One might write a three-year grant proposal that would pay for release time from teaching so that faculty members can develop new EL courses, or release time so that advanced EL faculty can mentor novice faculty. Ideally, grants should be written with a two- to three-year timetable so that there will be a few years of externally funded program stability before a new funding stream needs to be pursued.

Lessons Learned: Revisited

As a member of the initial EL committee and subsequent grant writing committee, the most surprising part of this process occurred when our program was in the novice stage of development. Specifically, I am amazed at what a small group of committed individuals was able to achieve, despite the lack of initial funding. By the time this chapter is published, our faculty senate will have voted on whether to add an EL component to our general education program. Regardless of the outcome, our campus has moved from a time when only a select few had even heard of EL to a time when faculty are debating about whether every student must take an EL course in order to graduate. Regardless of the outcome of the senate motion, I consider this a success story.

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Higgins, Peter. "Into the Big Wide World: Sustainable Experiential Learning Education for the 21st Century." *Journal of Experiential Education*, 2009, *32*(1), 44–60.

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GROSSMONT-CUYAMACA
COMMUNITY COLLEGE DISTRICT

Education Master Plan
Information Submission Form

The GCCCD is starting a year-long process to develop an Educational Master Plan that will serve as the blueprint for our future. The Educational Master Plan is a long-range, comprehensive document intended to guide institutional and program development at both the college and district levels. The priorities established in the Educational Master Plan will serve to guide College and District decisions about growth, development and resource allocation.

As the first step in this planning process, everyone in the GCCCD community (faculty, staff, students and community members) are invited to identify and submit information sources to be reviewed for the trend analysis in one of six taxonomy areas - society, technology, economy, environment, politics, and education. We are not asking you to do new research - only to identify information you already have or that you encounter during the search period (March 21 - April 25) and bring it to the attention of the Scan Teams for review.

Please feel free to submit as many of these forms as you would like. Please answer the following questions for each submission:

1) What is the document we should review? : CSU Looks at reducing Enrollment by 8000

2) Author: Patt Flynn

3) Source: Union Tribune TUESDAY, MARCH 22, 2011 (signonsandiego.com)

4) Which of the following taxonomy areas does it fit into? (Please select only one):

- ☐ Society
- ☐ Technology
- ☐ Economy
- ☐ Environment
- ☐ Politics and Legal Issues
- ☒ Education
- ☐ Other:

5) Relevance: Enrollment caps, budget, transfer

6) Page / Section: Education

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Questions: lynne.davidson@gcccd.edu *Research, Planning and Institutional Effectiveness*

Education

CSU looks at reducing enrollment by 8,000

BY PAT FLYNN
TUESDAY, MARCH 22, 2011 AT 8:21 P.M.

The California State University system will have to reduce enrollment by about 2.4 percent in the 2011-12 academic year while also cutting personnel and other costs, officials told trustees of the 23-campus system Tuesday.

Reduced enrollment targets already had been disseminated to the system's campuses, which amount to a total of about the equivalent of 8,000 full-time students.

"We believe this is simply restating what the campuses already know," said Margaret Lutz, a spokeswoman for California State University San Marcos. "Long-term, our plan is to grow. But we understand that with the current budget situation we have to make cuts."

CSUSM has a 2011-12 target of 7,400 full-time equivalent students, down from 7,583 currently.

San Diego State University faces only a small cut in actual enrollment for 2011-12. It will go to 25,914 full-time equivalents from the current enrollment of 26,037. The reason is that, despite a record spring enrollment, SDSU never achieved its 2010-11 target of 26,641, thus reducing the concrete impact of the looming funding cuts.

Gov. Jerry Brown's proposed 2011-2012 state budget calls for a $500 million reduction in state funding for the CSU system. If proposed tax extensions fail to make the ballot or are rejected by voters, the system will face much steeper funding cuts, perhaps up to $1 billion worth.

"A cut of $1 billion in state support would have devastating effects on the CSU," Chancellor Charles Reed said in a prepared statement after trustees received a briefing at their meeting in Long Beach. "A reduction of that level would force us to reexamine potentially drastic measures including much larger cuts to enrollment and increased tuition fees and other strategies." Cutting systemwide enrollment from about 339,000 full-time equivalents to 331,000 will save about $60 million, the chancellor's office said.

Personnel costs make up 84 percent of the university's budget, the chancellor's office said, and at least $250 million in cuts will have to come in that area. Individual campus presidents will be responsible for achieving cost savings at their campuses.

Ethan Singer, assistant vice chancellor for academic affairs at SDSU, said personnel savings likely would come through leaving positions unfilled and cutting part-time lecturers rather than through layoffs.

"The reductions we're facing now are very difficult to make," Singer said. "But we believe we can make the reductions without any dramatic impact on the quality of the educational experience.

"However, if there is a second round, that would be devastating. It is very difficult to come up with viable solutions to deal with that."

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	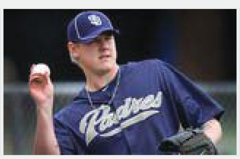	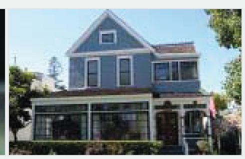	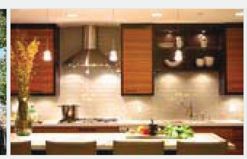	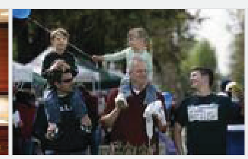	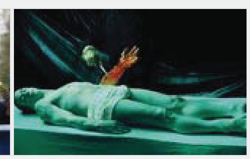
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Educational Master Plan

Information Submission Form

1) Title: Panel looks to raise graduation rates at California community colleges

2) Author: Neil Gonzales

3) Source: Oakland Tribune Article date: January 26, 2011

4) Taxonomy Area:

- [ ] Society
- [ ] Technology
- [ ] Economy
- [ ] Environment
- [ ] Politics and Legal Issues
- [x] Education
- [ ] Other: __________

5) Relevance: Success Rates

6) Page / Section: __________

7) Link to document: __________

or

8) Attach Document Here:

Panel looks to raise graduation rates at California community colleges

Article from: **Oakland Tribune** Article date: **January 26, 2011** Author: **Neil Gonzales**

SAN MATEO -- A new task force is seeking to develop a long-range plan to boost graduation rates at community colleges statewide.

Prompted by legislation passed in 2010, the California Community Colleges system launched the task force this month to create "a strategic blueprint" that could include measures to improve student assessments, remedial instruction and access to financial aid, officials said.

Senate bill 1143, signed into law last year by former Gov. Arnold Schwarzenegger, called for the California Community Colleges board to form a task force and adopt a plan to improve student success.

Richard Holober, president of the San Mateo County Community College District board, described the effort as worthwhile but said he is concerned that it could result in unfunded objectives, which would be especially difficult given the state's troubled economy.

"The question, of course, is: Will the funds be there to achieve these very worthy goals?" Holober said.

Erik Skinner, California Community Colleges vice chancellor of programs, said, "We are mindful of the fiscal limitations of the state and cognizant of the fact that the reforms we come up with need to be workable in the current fiscal environment. But that's not to say there won't be options that the task force might come up with that have additional costs."

A task force leader suggested that because of the fiscal constraints, districts redirect funding to programs that help increase the number of community college students earning an associate degree or transferring to a four-year university.

"Throughout the nation, college administrators are facing shrinking budgets and increasing demands to enroll and graduate more students," Peter MacDougall, chairman of the task force and a California Community Colleges board member, said in a news release.

"The only possible way for improving graduation rates is to realign funding priorities to coincide with academic performance. Courses and programs geared toward helping students walk across a stage wearing a cap and gown on graduation day must be our first priority."

According to the California Community Colleges chancellor's office, 52 percent of degree-seeking community college students complete a certificate, earn an associate degree or transfer to a university within six years.

The task force will explore strategies to raise that rate, including strengthening intervention programs for low-performing students, bolstering academic counseling and identifying national funding models to support such measures.

"California stands ready to lead the nation in developing innovative reforms to foster improved certificate-and degree- completion rates," Jack Scott, chancellor for California Community Colleges, said in the release. "Ensuring access to higher education is only half the equation. Equally important is granting students a legitimate opportunity to succeed upon entering the classroom."

The task force is expected to have recommendations for the California Community Colleges board by early next year, Skinner said.

The board would then send a proposal to the Legislature by March 2012.

Educational Master Plan

Information Submission Form

1) Title: Seven Habits of Highly Effective For-Profit Colleges

2) Author: Abu Noaman

3) Source: universitybusiness.com February 2011

4) Taxonomy Area:

- [ ] Society
- [ ] Technology
- [ ] Economy
- [ ] Environment
- [ ] Politics and Legal Issues
- [x] Education
- [ ] Other: ______

5) Relevance: Trends in ed./student demographics/tech.

6) Page / Section: 21-22

7) Link to document: ______

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VIEWPOINT

Seven Habits of Highly Effective For-Profit Colleges

What traditional colleges can learn from for-profits

By Abu Noaman

Investing large portions of marketing budgets on interactive touchpoints will yield a better return on investment.

FOR-PROFIT COLLEGES HAVE been under congressional scrutiny because they appear to be underperforming in enrollment, academic quality, and college loan repayment. I lead a company at the forefront of marketing traditional colleges, and our team believes that—regardless of the outcome of these investigations—traditional colleges and universities can learn some powerful lessons from the meteoric rise of their for-profit brethren. Here are seven of those lessons.

1. Embrace online channels

If you have searched lately for academic programs on Google, Yahoo!, or Bing, you are probably amazed at the dominant presence of **University of Phoenix**, **Kaplan**, **Walden University** and other for-profit colleges. For-profit colleges, with the intent of following their potential students, have moved the lion's share of their marketing investments away from traditional channels toward online channels.

For instance, according to the June 9, 2008 issue of *Advertising Age*, University of Phoenix's 2007 marketing budget was a whopping $222 million, with the largest share devoted to online marketing.

In contrast, many traditional colleges are still hanging on to ways of doing things that once worked, but certainly don't anymore. Expensive direct-mail campaigns, television ads, billboards and viewbooks continue to be the staples of traditional college marketing. But all respectable polls from Pew, Harris, and Noel-Levitz clearly indicate prospective students are using the internet to make their college choices, and are largely ignoring old-style marketing.

We recommend traditional colleges, just like their for-profit counterparts, begin investing large portions of marketing budgets in interactive touchpoints, including web, search engine marketing, social media marketing, and relationship marketing. It will certainly yield a better return on investment.

2. Respond to mega-trends

There are two trends for-profits have embraced but traditional colleges are still struggling to accept.

First, demographics clearly indicate the conventional 18- to 22-year-old, four-year college student makes up only a small portion—less than 25 percent—of total college-bound students. More than 70 percent of new students are nontraditional or adult students.

The rapid rise of for-profit colleges is a direct result of traditional colleges' failure to meet the special needs of nontraditional students. If traditional colleges decide to take care of this segment's special needs—such as flexibility, service, and mature cohorts—they stand a good chance of deriving benefit from the sheer number of adult students.

Second, new students entering college are quite comfortable with online learning paradigms. They are exposed to it as early as preschool and interact with online learning at home, school, work, and in the military. For-profit colleges have accepted that hybrid learning is here to stay, and routinely deliver their curricula in online and hybrid formats. It's time traditional colleges embrace online and hybrid learning. ▶

Abu Noaman is the CEO of Elliance, an interactive marketing agency that helps colleges and universities achieve enrollment, advancement, and awareness goals.

3. Invest in technology infrastructure

Colleges must invest more in technology infrastructure if they wish to deliver what new students are demanding: online and hybrid learning.

For-profit colleges understandably spend more than 10 percent of their operating budget on technology infrastructure; in contrast, a traditional college spends less than 3 percent. Without investing adequately in this area, traditional colleges don't stand a chance at capturing their fair share of the adult market or the respect of traditional students.

4. Innovate the curriculum

Traditional colleges have had a tough time balancing the dual goals of education: preparing students for professional careers and creating critical thinkers. Most for-profit colleges are biased toward professional development, so they will quickly create new courses to match current employer needs.

We believe traditional colleges have a competitive advantage in creating critical thinking skills. At the same time, they should follow their for-profit counterparts for ideas on modernizing their professional curricula.

Traditional colleges' timeless liberal arts courses do an excellent job teaching important critical thinking skills. These classes need to stay intact. The structure should be modified, however, to quickly adapt the rest of the courses—those designed to provide practical knowledge. Preparing students for degrees in medicine, education, engineering, design, business, media, and more means teaching them how to use current technologies.

5. Go beyond conventional metrics

Metrics such as student achievement, student-to-faculty ratio, faculty load, and brand exposure have long been the measure of excellence at traditional colleges.

For-profit schools, however, have supplemented conventional metrics with new performance metrics. By understanding cost-per-lead, revenue-per-student and profit margins, for-profit colleges are quickly measuring their operational performance and making go or no-go decisions.

Today's economic reality means traditional colleges can no longer make decisions without considering the impact on the bottom line.

6. Create an agile culture

Traditional colleges tend to move slowly because of organizational hierarchies, consensus-based decision making, and academic traditions.

For-profit colleges have organized themselves to become more agile by eliminating some hierarchies, making fact-based decisions, and creating autocratic democracies.

Traditional colleges must follow suit.

7. Excel at customer service

For-profit colleges tend to treat students like customers. They have created enrollment counselors, financial counselors, concierge services, and policies to serve students on a timely basis. Classes are often scheduled to accommodate students' needs, rather than the convenience of professors.

With the proliferation of ranking and rating websites such as studentsreview.com, ratemyprofessors.com, and ratemycollegedorm.com, traditional colleges with good service can make substantial gains in reputation.

CONCLUSION

Back in 1997, legendary management consultant Peter Drucker made this statement: "Thirty years from now, the big university campuses will be relics. Universities won't survive. ... Higher education is in deep crisis."

If institutions implement these suggestions, they can prevent Drucker's prediction from becoming a reality. U

Educational Master Plan

Information Submission Form

1) Title: Predictors of Long-Term Enrollment and Degree Outcomes for Community College Students

2) Author: Porchea, S., Allen, J.

3) Source: Journal of Higher Ed

4) Taxonomy Area:

- [ ] Society
- [ ] Technology
- [ ] Economy
- [ ] Environment
- [ ] Politics and Legal Issues
- [x] Education
- [ ] Other: ______

5) Relevance: Success Rates

6) Page / Section: 680-708

7) Link to document: ______

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8) Attach Document Here:

Sameano F. Porchea
Jeff Allen
Steve Robbins
Richard P. Phelps

Predictors of Long-Term Enrollment and Degree Outcomes for Community College Students: Integrating Academic, Psychosocial, Socio-demographic, and Situational Factors

We report on a study of how academic preparation, psychosocial, socio-demographic, situational, and institutional factors influence enrollment and degree outcomes for a sample of students who entered community college in fall 2003. We have followed the students through spring 2008 and classified them according to community college degree and four-year transfer outcomes. We are primarily interested in how academic preparation, psychosocial, socio-demographic, situational, and institutional factors predict students' outcome classification. We begin this paper by describing the need to study a comprehensive set of predictors and their relationships with long-term outcomes of community college students. We then review prior empirical studies and theoretical work on the factors that affect community college outcomes. A description of the current study's methodology and the results of our analyses follow. Finally, we discuss the practical implications and limitations of our findings.

Why Study Factors that Influence Community College Student Outcome?

Community colleges play a vital role in training a skilled workforce. According to the Bureau of Labor Statistics (2008), 45% of all job openings through 2014 will require some type of skilled training or certification (p. 27). In many cases, the necessary training and certification are

Sameano F. Porchea is currently a Psychometrician at Assessment Technologies Institute. Jeff Allen and Steve Robbins are members of the Research Division of ACT, Inc. a not-for-profit educational and workforce testing organization. Richard P. Phelps is currently Director of Assessment, District of Columbia Public Schools.

The Journal of Higher Education, Vol. 81, No. 6 (November/December 2010)

offered solely by community colleges. For example, certifications in cosmetology, automobile mechanics, and welding are considered narrow in focus, and do not align with the mission of four-year liberal arts institutions and are therefore excluded from their offerings. Many workplace-training programs have migrated from high schools to community colleges. It was common to find machine shops in U.S. high schools a few generations ago, for example, when machining was purely a mechanical skill. However, the increasing sophistication of technology has prompted a need for more skill-specific training than high schools are prepared to offer (e.g., computer-numerical-controlled machining). Consequently, community colleges have become the main gateway for much high-skill training and certification and perhaps the backbone of labor force development in manufacturing and some other industries (Chen, 2009). Moreover, community colleges train and certify nearly 80% of the firefighters, law enforcement officers, and emergency medical technicians (EMTs) securing our homeland and 59% of new nurses (American Association of Community Colleges [AACC], 2008). There is a clear financial incentive to enter community colleges: The median earnings for those who have some college or an associate degree is $6,000 higher than for those who hold only a high school diploma (Crissey, 2009, p. 9) and students who obtain at least an associate degree can expect lifetime earnings of $400,000 more than can those who obtain only a high school diploma (Day & Newberger, 2002). London (2006) suggests that community colleges can help guide welfare recipients' on their paths to self-sufficiency.

Community colleges serve a diverse and growing population of students. Growth of community college enrollment has exceeded that of four-year institutions in part due to open access and lower tuition costs (AACC, 2008). By 2006, approximately 35% of all postsecondary students were enrolled in community colleges (Provasnik & Planty, 2008, p. 2). Moreover, community colleges disproportionately serve underrepresented gender and ethnic minority groups. In 2005, female and ethnic minority percentages at two-year institutions (59% and 37%, respectively) were greater than those at both public (56% and 28%, respectively) and private four-year institutions (58% and 27%, respectively) (NCES, 2008). Relative to four-year institutions, community colleges disproportionately serve less academically prepared students. According to Adelman (2005), unlike traditional four-year institutions, "community colleges do not serve secondary school students from the first quintile of academic preparation" (p. 23). Students who enroll in community college are far less likely to have taken gateway courses such as English composition and college level mathematics during high school. Thus, they are more likely than traditional four-year students to be enrolled in remedial classes (Adelman, 2005). Community colleges also enroll more than twice as many part-time students than four-year public institutions. The Community College Survey of Student Engagement (CCSSE, 2008) reports that 62% of community college students attend part-time and in excess of 56 percent work more than 20 hours a week (p. 9). Further, 54% and 69% of part-time and full-time students respectively, receive some form of student aid (p. 18).

Attrition before degree completion is more pronounced at the community college relative to four-year institutions. Across two-year institutions, the average first-to-second-year retention rate is 54%; across four-year institutions the average rate is 73% (ACT, 2008). Another study found that 45% of those initially enrolled in a two-year public institution had dropped out three years later and only 16% had completed a degree (Berkner & Choy, 2008). Moreover, a low rate of transfer from community colleges to four-year institutions is becoming an increasingly important issue for individual institutions and the United States as a whole. There is a growing recognition in the United States that four-year institutions can improve enrollments of poor and working-class students by admitting transfer students from community colleges (Dowd, Cheslock, & Melguizo, 2008).

Towards a Conceptual Model for Understanding Community College Outcomes

The important role of the community college in society, the sheer volume and diversity of community college students, and the low degree attainment and transfer rates from community colleges to four-year institutions all suggest a great need for understanding the factors that affect the success of community college matriculates. Traditionally, most post-secondary research has involved four-year institutions, though research at the community college increased substantially during the last two decades (Pascarella, 2006). Students enroll at community colleges for many reasons—many times for more than one reason, including the pursuit of personal interests (46%), to transfer to a four-year institution (36%), to obtain an associate's degree (35%), to learn job skills (21%), to transfer to another two-year college (15%), and to obtain an occupational certificate (13%) (Provasnik & Planty, 2008). The variation in reasons for enrollment marks an important difference between community colleges and four-year institutions and confounds research on factors relating to community college degree completion.

Several prior studies have shown that combinations of academic, psychosocial, socio-demographic, and situational factors are related to postsecondary outcomes (Beal & Noel, 1980; Berger & Milem, 1999; L. Berkner & Cataldi, 2002; Blackwell, 2000; Brown, Tramayne, Hoxha, Telander, Fan, & Lent, 2008; Cowart, 1987; J. Eccles, 2005; Johnson, 2007; Napoli & Wortman, 1998; Robbins, Allen, Casillas, Peterson, & Le, 2006; Robbins, Lauver, Le, Davis, Langley, & Carlstrom, 2004; Stage, 1989; Stoever, 2002; Strage, 1999; Tinto, 1993; Tinto & Goodsell, 1993). For example, in 2008 approximately 343,000 students from more than 585 community colleges across 48 states completed the Community College Survey of Student Engagement administered by the Community College Leadership Program (CCSSE, 2008, p. 23). The study results identified academically under-prepared, low income, and working students among those who were at risk of dropping out. Further, Habley and McClanahan (2004) identified several predictors of dropout, including academic (inadequate preparation for college coursework), psychosocial (lack of motivation to succeed, poor study skills), socio-demographic (inadequate financial resources), and situational factors (too many job and family demands). These and other studies assisted us in developing a conceptually-grounded model, for community college matriculate degree and transfer outcomes, that includes each of these classes of student factors, as well as institutional factors. We now describe some of these studies in greater detail.

Prior Studies of Student Factors and Postsecondary Outcomes

Academic Preparation. Prior academic achievement is often measured by some combination of high school GPA or class rank and standardized test scores (e.g., ACT or SAT scores). Numerous studies have shown that prior academic achievement predicts academic performance and persistence in college; high school grades and standardized test scores are often used as the basis for college admissions and placement decisions. For example, “intensity” (i.e., rigor) of high school course work is predictive of college success (Adelman, 2006). Academic preparation is believed to directly affect first-year academic performance and indirectly (via effects on academic performance) affect retention and transfer behavior (Allen, Robbins, Casillas, & Oh, 2008).

Psychosocial. Tinto’s (1993) Theory of Postsecondary Education Student Attrition includes five primary student-related factors that predict a student’s decision to drop out of an institution, including: goals, commitments, institutional experiences, integration, and high school outcome. Clearly, this theory suggests that academic preparation is not the sole determinant of college success. Although academic preparation is generally regarded as the strongest predictor of academic performance and college persistence, research findings suggest that psychosocial factors and other non-cognitive factors also have important effects on college outcomes (Oswald, Schmitt, Kim, Ramsay, & Gillespie, 2004; Robbins et al., 2004; Sedlacek, 2004; Sternberg, 2005). In fact, the meta-analysis by Robbins et al. indicates that some psychosocial factors have predictive strength that is comparable to that of the traditional academic preparation factors. Their findings support the integration of educational persistence (e.g., Bean, 1980; Tinto, 1993) and motivation theories (e.g., Covington, 2000; Eccles & Wigfield, 2002) as a model for understanding the antecedents of college outcomes.

Included among the psychosocial and non-cognitive factors are personality (Trapmann, Hell, Hirk, & Schuler, 2007), biographical data (Shivpuri, Schmitt, Oswald, & Kim, 2006), motivation, social, and self-regulation skills (Robbins et al., 2006), social adjustment (Fischer, 2007), successful intelligence (Sternberg, 2006), and effort (Kress, 2006). Most of the research work in this area has attempted to isolate the effects of psychosocial from those of academic preparation factors. For example, both academic preparation and level of commitment were related to course withdrawal rates (Manning & Bostonian, 2006; Sandiford & Jackson, 2003). In a study of four-year matriculates, Allen et al. (2008) found evidence that academic-specific motivation has an indirect effect on retention and transfer (via its effect on first-year college GPA), and commitment to college and social connection have direct effects on retention. Fischer (2007) found evidence that formal on-campus social ties had positive relationships with grades, satisfaction, and persistence through the junior year. Moreover, informal on-campus social ties had positive relationships with satisfaction and persistence. Other work in this area has compared the relative effects of different types of psychosocial and non-cognitive factors. Peterson, Casillas, and Robbins (2006) compared the predictive strength of personality (measured with the Big Five Inventory) and a specific measure of ten psychosocial factors (the Student Readiness Inventory, [SRI]). The study found that both instruments significantly predicted college GPA, but that the SRI explained more variance.

Other related research includes Napoli and Wortman's (1998) extension of Tinto's (1993) models. They found that psychosocial factors such as social support, self-esteem, and social competence influenced persistence directly and indirectly. Important to the current study, their findings also suggested that their model was generalizable to two-year institutions. In a study of approximately 2,000 community college students, Johnson (2007) found extracurricular student involvement to be one of the strongest predictors of transfer readiness. Bryant (2007) specifically investigated "transfer-intending" students and had similar findings (p. 1).

Socio-demographic. Prior research suggests that certain socio-demographic groups are less likely to succeed academically and persist at community colleges. For example, Morest and Bailey (2005) indicate that completion rates for minority and low socioeconomic status (SES) students are lower at community colleges. Greene, Marti, and McClenney (2008) found that, relative to White students, African American students reported higher levels of academic engagement (including class assignments, preparation, and mental activity factors); Hispanic students also reported higher levels of mental activities. Still, both African American and Hispanic students demonstrated lower academic outcomes, relative to White students. Several prior studies have shown that first-generation students are less likely to persist. For example, Ishitani (2006) found that students whose parents did not attend college were more likely to leave higher education in years one through four, facing the highest risk period of departure during the second year. The risk difference between first-generation students, relative to students whose parents both held bachelor's degrees was comparable in size to the difference between being in the 4th quintile of high school class rank, relative to the 1st quintile.

Several studies have shown that females earn higher grades than males during the first year of college, but persistence differences across gender are smaller (Robbins et al., 2006). Students' social capital is believed to affect their likelihood of entering and persisting in higher education. Perna and Titus (2005) viewed parental involvement as a form of social capital and found that certain types of parental involvement (with student, school, and other parents) was predictive of enrollment at two-year institutions, after controlling for many other factors known to affect enrollment. They also found that the likelihood of enrolling at a community college was related to the amount of resources accessible through social networks at the student's high school. According to Berkner, He, and Cataldi (2002), students who enroll in college immediately after high school graduation generally complete college at higher rates than those who do not; this suggests a negative relationship between age at matriculation and college outcomes.

Situational. Community college students are more likely to delay enrollment after high school and enroll part-time (Morest & Bailey, 2005, p. B21), and have work and family obligations that affect their commitment to college (Horn, Neville, & Griffith, 2006). We consider these *situational factors* to be potentially important predictors of success for community college matriculates. Other situational factors include degree expectation (e.g., certificate, AA, BA/BS or higher), level of financial aid received, student residence, distance from home to college, and having alumni parents. For example, 46% of new community college students chose an institution because it was close to home (Adelman, 2005, p. 38), and the "location effect" may be one of the most important factors in understanding students' educational attainment (Rouse, 1995, p. 219). Also, in-state students and students with alumni parents are more likely to persist (Chase, Dalton, Johnson, & Anastasiow, 1976, p. ii).

Prior Studies of Institutional Factors and Postsecondary Outcomes

The question of which institutional characteristics and practices lead to positive outcomes is especially pertinent in this age of institutional accountability. Though persistence and degree attainment rates vary considerably across institutions, student characteristics (rather than institutional characteristics) tend to explain more of the variation in outcomes (Chang, Denson, Sáenz, & Misa, 2006; Habley & McClanahan, 2004; Robbins et al., 2006). Still, institutional characteristics have been of interest in many studies of postsecondary outcomes (Bailey, Calcagno, Jenkins, Kienzl, & Leinbach, 2005; Morest & Bailey, 2005; Shulock & Morre, 2007; Vaughan, 1985). For example, using data from the National Education Longitudinal Study of 1988 and the Integrated Postsecondary Education Data System, Bailey et al. (2005) investigated the relationship of institutional characteristics and community college students' likelihood to complete a certificate or degree or transfer to a four-year institution. They found negative relationships between student outcomes and institution size, proportion of part-time faculty, and proportion of minority students. Chang et al. (2006) found that students at institutions with greater mean cross-racial interaction had greater openness to diversity, after controlling for several other factors including students' individual level of cross-racial interaction. Jacoby (2006) found that community college graduation rates decrease as the proportion of part-time faculty employed increases. Complicating matters, faculty to student ratios also increased which positively relates with graduation rates—but not enough to offset the decrease attributed to more part-time faculty.

Research Questions

We have collected pre-enrollment data on a wide variety of student characteristics, including academic preparation (high school grades and standardized test scores), psychosocial factors (measures of motivation, self-regulation, and socialization), socio-demographic factors (gender, race/ethnicity, age, family income, and parent's education level), and situational factors (degree expectations, full-time/part-time enrollment, planned hours working, distance from home). Approximately 4,500 entering community college students have been tracked for five years across 21 institutions. Our conceptual model for relating student and institutional factors to varying outcomes is given in Figure 1.

Our primary research question was: "What are the student characteristics that are predictive of enrollment and degree outcomes for students that initially enroll at a community college and how does the predictive value of each characteristic vary by specific outcome?" Our expectations were: (a) students with higher levels of academic preparation will be more likely to obtain a degree and transfer to a four-year institution, (b) students with higher motivation will be more likely to obtain a degree and transfer, (c) students of higher socioeconomic status will be more likely to transfer to four-year institutions, (d) part-time students

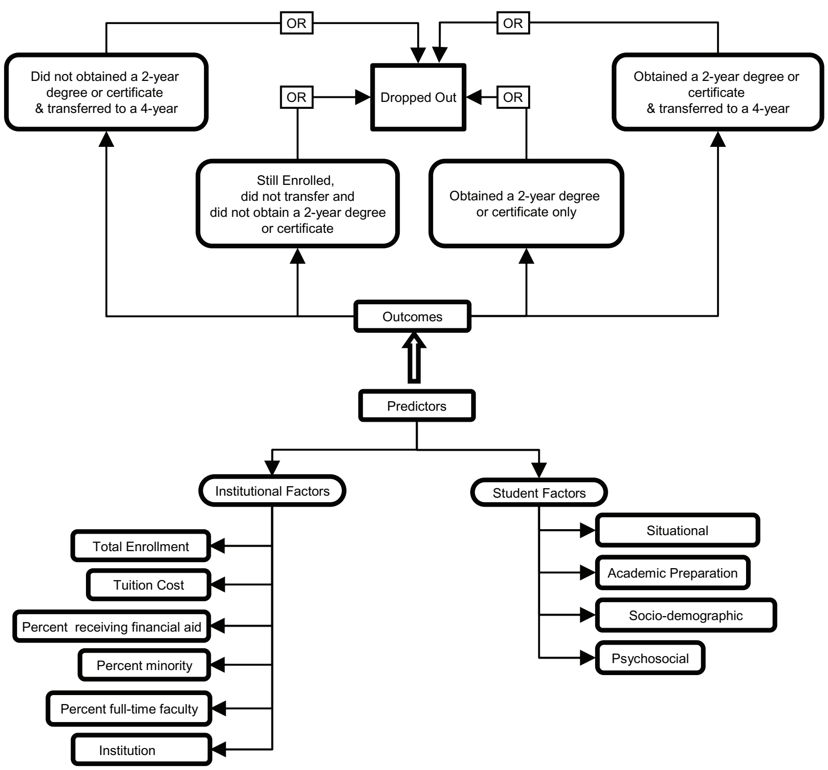

FIG. 1. Conceptual model.

and those who work more will be less likely to obtain a degree and transfer, and (e) students with higher degree expectations will be more likely to obtain a degree and transfer.

By addressing these research questions, we add to the understanding of community college student attributes that influence enrollment and degree outcomes. This, in turn, aids institutions as they target their student affairs programs towards students at the greatest risk of not fulfilling their postsecondary degree aspirations. The current study differs from previous studies in two important ways. First, our model includes four important sets of student characteristics (academic preparation, psychosocial, socio-demographic, and situational) as well as institutional characteristics—prior studies typically feature two or three of these sets of characteristics. By considering these five sets of predictor variables, we hope to better isolate and measure the distinct effects of individual characteristics. Second, our outcome measure spans five years of follow-up after community college matriculation and encompasses transfer to other institutions. Prior studies are often limited by length of follow-up time, the inability to track transfer students across multiple institutions, or both of these constraints.

Method

Sample

The current study is based on community college matriculates of fall 2003 who participated in the Student Readiness Inventory (SRI) validity study. The primary purpose of that study was to estimate the effects of psychosocial constructs, measured at matriculation, on postsecondary outcomes. Students' psychosocial constructs were measured with the SRI, a self-report instrument consisting of 108 Likert-type items yielding ten scale scores. Institutions solicited student participation in the study during summer and fall orientation programs and courses with heavy freshmen enrollment. Student participation was voluntary, but institutions reported that most students who were asked to participate did so. (Please see Robbins, et al., 2006, for a more thorough description of the study methodology.) The current study sample consists of 21 community colleges and 4,481 students.

Describing the institutions. Because we were interested in studying psychosocial factors, as measured by the SRI, only institutions who agreed to participate in the survey are represented in the analysis. The institutions are located in thirteen states mostly concentrated in the Midwest. The institutions were not all independent in the sense that the same community or technical college state systems were represented more than once: seven institutions, within three state systems, were represented, along with fourteen other institutions. In Table 1, we present some descriptive statistics for these institutions. Enrollment sizes ranged from 670 to 7,380 with a mean of 3,677; in-state tuition ranged from $1,000 to $4,000 with a mean of $2,605. The percentage of students receiving financial aid ranged from 29% to 94% with a mean of 67% while the percentage of minority (African American and Hispanic) students ranged from 4% to 51% with a mean of 20%. Because the 21 institutions studied represent a convenience sample, we used data from ACT's Institutional Data Questionnaire to compare the sample of institutions to the population of two-year vocational-technical and community or junior colleges. In the population, the mean percentage of African American and Hispanic students is 23, the mean enrollment size is 2,293, the mean in-state tuition is $3,261, and the mean percentage of students receiving financial aid is 56.

Therefore, the 21 institutions in the sample tend to have larger enrollments, cost slightly less, enroll fewer minority students, and enroll more students with financial aid. In the population, 22% of the institutions are

TABLE 1
Descriptive Statistics

Variable	*N*	%	*M*	*SD*	Min	Max
Academic Preparation						
Standardized achievement score			18.2	3.8	4	32
High school GPA			2.71	0.64	0.50	4.00
Psychosocial Factors						
Academic Discipline			47.0	8.1	15	60
Academic Self-Confidence			51.1	9.9	13	72
Commitment to College			53.4	7.1	11	60
Steadiness			50.6	10.6	15	72
Social Activity			42.6	9.5	11	60
Social Connection			47.3	8.8	14	66
Socio-demographic Factors						
Age			22.1	7.4	16	65
Race/Ethnicity						
African American	744	16.6				
Asian American	102	2.3				
Caucasian	3,330	74.3				
Hispanic	119	2.7				
Other Race/Ethnicity	186	4.2				
Gender						
Male	1,928	43.0				
Female	2,553	57.0				
Parent's income (in $ thousands)			55.0	33.7	15	175

TABLE 1 (*Continued*)
Descriptive Statistics

Variable	*N*	%	*M*	*SD*	Min	Max
Parent's education level						
< High school	287	6.4				
High school diploma/GED	1,455	32.5				
Business/tech. or certificate	394	8.8				
Some college, no degree	661	14.8				
AA degree	498	11.1				
BA/BS degree	758	16.9				
Master's degree	323	7.2				
PhD/MD/JD, etc.	105	2.3				
Situational Factors						
Initial enrollment						
Full-time	3,656	81.6				
Part-time	825	18.4				
Degree expectation						
Certificate	300	6.7				
AA	1,155	25.8				
BA/BS	2,046	45.7				
MA/MS/MBA	530	11.8				
PhD/MD/JD	450	10.0				
Distance from home (miles)			27.1	103.7	0	2,598
Planned hours working (per week)						
1–5	572	12.8				
6–10	483	10.8				
11–15	742	16.6				
16–20	1,110	24.8				
>20	1,574	35.1				
Institution Characteristics (*n* = 21)						
Total enrollment			3,677	2,383	670	7,380
Tuition ($)			2,605	725	1,000	4,000
Percentage receiving financial aid			67.2	20.2	29	94
Percentage minority			19.9	15.4	4	51
Percentage full-time faculty			37.8	18.5	17	100
Institution type						
Two-year community or junior college	18	85.7				
Two-year vocational/technical college	3	14.3				
Outcomes						
Degree, transfer to four-year	343	7.7				
Degree only	509	11.4				
No degree, transfer to four-year	955	21.3				
No degree, still enrolled	518	11.6				
Dropped out	2,156	48.1				

classified as two-year vocational-technical colleges while 78% are two-year community or junior colleges; three of the institutions in the sample (14%) are two-year vocational-technical colleges and 21 (86%) are two-year community or junior colleges.

Describing the students. Descriptive statistics for our sample are presented in Table 1. The sample was less academically prepared, relative to college-going students in general. The estimated mean ACT score was 18.2, which is one-half of a standard deviation below the mean of ACT-tested high school graduates of 2003 (ACT, 2003). The mean student-reported high school GPA was 2.71, which is eight-tenths of a standard deviation below the mean of for ACT-tested high school graduates of 2003 (ACT, 2006). The sample was 57% female and 74% Caucasian, 17% African Americans, 3% Hispanic, and 6% identified with another racial ethnic group. Age at enrollment ranged from 16 to 65, with a median of 19 and a mean of 22.1; 71% of the students were between 17 and 21 years old. More than 67% of the students expected to obtain at least a BA/BS degree, 26% sought an AA degree, and 7% sought a certificate. Thirty-nine percent of the students were first-generation students; 26% had a parent with at least a bachelor's degree.

Independent and Dependent Variables

We now describe the data used to address the research questions. We begin with a description of the five sets of independent variables: academic preparation, psychosocial, socio-demographic, situational, and institutional.

Academic preparation. Of the 4,481 students, 2,332 (52%) took the ACT tests of educational achievement before enrolling. Of those remaining, 180 took the Scholastic Aptitude Test (SAT I) and 1,968 used the Computer-Adaptive Placement Assessment and Support System (COMPASS), which is designed to assess students' mathematical, reading, and writing skills. The ACT Composite score is the average of scores in four areas: English, mathematics, science, and reading. For students who did not take the ACT but did take the SAT I, we found a predicted ACT Composite score based on a pre-established ACT-SAT concordance (Dorans, Lyu, Pommerich, & Houston, 1997). For students who took COMPASS, we found a predicted ACT Composite score based on concordances of ACT Composite scores and (a) the sum of COMPASS writing skills and pre-algebra scores or (b) the sum of COMPASS writing skills and algebra scores. These concordances were established with a large sample of jointly-tested students through equipercentile equating (see Kolen & Brennan, 1995, for a discussion of this procedure). Thus, ACT Composite score (actual or derived through concordance) was used as a predictor for all students. Students' high school GPA was collected when they took the SRI and used as an additional measure of academic preparation.

Psychosocial. Psychosocial factors were measured on students at matriculation using the SRI, a battery of 108 Likert-type items that was constructed using a rational empirical approach. The SRI yields ten scales with reliability (measured with Cronbach's alpha) ranging from 0.72 to 0.87 (Le, Casillas, Robbins, & Langley, 2005). Each scale consists of 10 to 12 items, and each item has a scoring rubric of 1 to 6. Therefore, the minimum possible score of the ten scales ranges from 10 to 12, and the maximum possible score ranges from 60 to 72. Prior research on SRI scale scores has shown patterns of convergent/discriminate relations with other non-cognitive measures. Peterson et al. (2006) examined the relations between the SRI and the Big Five Inventory, finding that SRI scales tapping motivation (e.g., Academic Discipline, General Determination, Goal Striving) were most strongly related to Conscientiousness. The SRI scales Social Activity and Social Connection were most strongly related to Extraversion; Steadiness to Emotional Stability (vs. Neuroticism); and Communication Skills to Agreeableness.

A factor analysis of the 10 SRI scales (Le et al., 2005) suggested a three factor solution. For use in the current study, we chose to use two scales from each of the three factors: motivation (Academic Discipline and Commitment to College), social engagement (Social Activity and Social Connection), and self-regulation (Academic Self-Confidence and Steadiness). Academic Discipline reflects the amount of effort a student puts into schoolwork and the degree to which he or she sees himself or herself as hardworking and conscientious—sample items are "I turn in my homework assignments on time" and "Others consider me a hard-working student." Commitment to College reflects a student's commitment to staying in college and getting a degree—sample items are "A college education will help me achieve my goals" and "I would rather be somewhere else than in college." Social Activity reflects how comfortable a student feels meeting and interacting with other people—sample items are "I avoid activities that require meeting new people" and "I make friends easily." Social Connection reflects a student's feelings of connection and involvement with the college/school community—sample items are "I feel part of this college" and "I have developed close friendships wherever I go." Academic Self-Confidence reflects the extent to which a student believes he or she can perform well in school—sample items are "I achieve little for the amount of time I spend studying" and "I am less talented than other students." Steadiness reflects how a student responds to strong feelings and how he or she manages those feelings—sample items are "I have a bad temper" and "I stay calm in difficult situations" (ACT, 2009).

Socio-demographic. When students took the SRI, we also collected data on age, race/ethnicity, gender, parent's income, and parent's education level. The racial/ethnic categories used for analysis are Caucasian, African American, Asian American, Hispanic, and Other. Students were asked for their mother and father's highest level of education completed using an eight-level categorization (less than high school, high school graduate/GED, business/tech. school or certificate, some college but no degree, AA degree, BA/BS degree, MA/MS degree, or doctorate or professional degree). For analyses, we used three categories: first generation (at most a high school degree), some college or a two-year degree (at most an AA), and at least a bachelor's degree. We expected that the effect of age on outcomes would not be linear; for example, we expected that the difference between a 50- and 55-year-old student would be less than the difference between an 18- and 23-year-old student. Thus, we used the natural logarithm of age as a predictor variable. Parent's income was collected using a six-level ordinal categorization (e.g. $75,001 to $100,000); we used natural logarithm of the midpoint of each level (e.g., log of $87,500) for analyses.

Situational. At matriculation, we also collected data on students' planned enrollment status (full-time or part-time), level of degree expectations (business/tech. or certificate program, AA, BA/BS, MA/MS/MBA, or PhD/MD/JD), and the number of hours they planned to work for pay. For analyses, degree expectation was considered a nominal variable (we did not assume any type of ordering of the categories). Because working more hours for pay is associated with lower degree attainment rates (Hoachlander, Sikora, & Horn, 2003, p. 27), we used number of planned hours working for pay as a predictor variable. This variable was coded as the midpoint of a five-level ordinal categorization (e.g., 3, 8, 13, 18, or 30 hours).

Due to the importance of the "location effect" (Rouse, 1995, p. 219), distance from home to college was used as a predictor variable. With student home and institution zip codes, and the latitudinal and longitudinal coordinates for U.S. zip codes, we calculated the distance between home and school. We used distance from student's home instead of distance from their current residence in hopes of capturing effects of homesickness and being in an unfamiliar city or locale. For analyses, we used the natural logarithm of miles because we expected the effect of distance from home to be nonlinear (e.g., the difference between being 10 and 60 miles from home is larger than the difference between being 500 and 550 miles from home).

Institutional characteristics. Using data from ACT's Institutional Data Questionnaire, we gleaned institutions' total enrollment, in-state tuition, and institution type (two-year vocational-technical college or two-year junior or community college). Using data from the National

Center for Education Statistics' College Navigator (http://nces.ed.gov/collegenavigator), we also obtained each institution's percentage of students receiving financial aid, percentage of minority (African American and Hispanic) students, and percentage of full-time faculty.

Defining Outcome Categories

Using data from the National Student Clearinghouse (NSC), we tracked students' enrollment, degree, and transfer outcomes for five academic years (2003–2004 through 2007–2008) across postsecondary institutions. Over 3,300 postsecondary institutions in the U.S. provide the NSC with degree and enrollment information (http://www.studentclearinghouse.org). The NSC data include term-by-term enrollments at postsecondary institutions, type of degree earned, and graduation date. The 21 community colleges in our study all provided the NSC with enrollment and degree data. It is possible that some students in our sample transferred to a non-NSC participating institution. However, we expect this to occur rarely given that 91% of all U.S. postsecondary students attend NSC-participating institutions.

While processing the enrollment, transfer, and degree data, we quickly realized that community college students can take several different paths and it would be impossible, both practically and conceptually, to treat each path as a distinct outcome category. Thus, we sought a categorization of enrollment and degree paths that was simple enough to enable analyses, yet complex enough to distinguish important outcomes. The categorization we adopted defines five outcome groups: (1) obtained a degree or certificate from a community college and transferred to a four-year institution, (2) obtained a degree or certificate from a community college and did not transfer to a four-year institution, (3) did not obtain a degree or certificate from a community college and transferred to a four-year institution, (4) did not obtain a degree or certificate from a community college, did not transfer to a four-year institution, but still enrolled at a community college during fifth year, and (5) did not obtain a degree or certificate from a community college, did not transfer to a four-year institution, and no longer enrolled during fifth year. Because our outcomes only capture transfer to a four-year institution, hereafter we use the phrases "transfer" and "transfer to a four-year institution" interchangeably.

The five outcome categories are mutually exclusive and exhaustive—meaning that each student belongs to one and only one category. We will refer to the fifth category as "dropped out"—these are the students that did not obtain a degree at a community college, did not transfer, and were no longer enrolled during the fifth year. This categorization does have some limitations. For example, two students who did not obtain a community colleges degree but transferred to a four-year institution are placed in the same category—even if one student drops out of the four-year institution after one semester while the other goes on to obtain a bachelor's degree.

Statistical Modeling

Because our outcome variable involves five mutually exclusive categories, an appropriate model for analysis is the multinomial logit model (Agresti, 1990). This model is a type of discrete-choice model that permits the predictor variables to have differential effects on the different response choices (e.g., the five outcome categories). For example, under this model, we might observe that parent's income affects the likelihood of transferring to a four-year institution, but not the likelihood of obtaining a community college degree or certificate. The multinomial logit model can also be viewed as an extension of the usual logistic regression model, appropriate when there are three or more outcome categories. Similar to the logistic regression model, we must assign one outcome category to be the reference category. The logical choice for us is the "dropped out" category. Thus, for each outcome category other than "dropped out," the multinomial logit model will estimate the effect of each predictor variable on the likelihood of a student belonging to the outcome category as opposed to the "dropped out" category.

Because we have students nested within 21 entering institutions and we seek to determine both the effects of student and institution-level characteristics, a hierarchical multinomial logit model is appropriate (Raudenbush & Bryk, 2002). We specified institution-specific random intercepts, but not institution-specific (random) slopes. This means that the institutions may influence the intercept (i.e., the overall likelihood of each outcome category), but not the effects of student-level predictors. We chose not to use institution-specific slopes because (a) we did not believe, a priori, that the effects of student characteristics would vary considerably across institutions and (b) inclusion of institution-specific slopes would cause a greater computational burden and perhaps instability in the model's parameter estimates. With five outcome categories, this model generates four institution-specific intercepts (with dropped out as the reference group). However, we found that there was insufficient variation (across institutions) in the intercepts for latter outcome category ("still enrolled"). Thus, we fit the model with three institution-specific intercepts. Dimensional student-level predictors (standardized achievement score, high school GPA, the six measures of psychosocial factors, log of age, log of parent's income, log of distance from home to college, and planned hours working) were scaled to have mean zero and standard deviation one. This standardization facilitates the comparison of estimated regression coefficients. The categorical student-level predictors (race/ethnicity, gender, parent's education, full-time enrollment, and type of degree expectation) were captured with sets of dummy-coded variables. Five of the institution-level predictors (enrollment size, tuition, percentage receiving financial aid, percentage minority, percentage full-time faculty) are dimensional and were scaled to have mean zero and standard deviation one among the 21 institutions; institution type was dummy-coded. We fit the hierarchical multinomial logit regression model using SAS PROC GLIMMIX (SAS, 2006). Estimated regression coefficients were considered statistically significant if the *p*-value was less than 0.01.

Results

By far, the most prevalent outcome among students in our sample was dropout—48% of our sample had not obtained a community college degree or certificate, had not transferred to a four-year institution, and were no longer enrolled. This percentage alone speaks to the need for programs to help community college matriculates attain their degree goals. The five-year dropout rate we observed (48%) is similar to the 45% six-year dropout rate observed in a national sample of community college matriculates of 1995–1996 (NCES, 2008). Only 8% of the sample obtained a degree or certificate and then transferred to a four-year institution, 11% obtained a degree or certificate and did not transfer, 21% transferred without obtaining a degree or certificate, and 12% were still enrolled having not obtained a degree or transferred.

Multinomial Logit Regression Results

We now present the results of the hierarchical multinomial logit model. We first discuss the student-level predictors by group (academic preparation, psychosocial, socio-demographic, and situational), followed by the institution-level predictors. All results are presented in Table 2.

Academic preparation. The results confirm that the likelihood of transferring to a four-year institution, rather than dropping out, increases with better academic preparation. For example, the multinomial logit regression coefficient pertaining to standardized achievement score for the

TABLE 2
Multinomial Logit Regression Results

Predictor	Degree		No Degree	
	Transfer	No Transfer	Transfer	No Transfer, Still Enrolled
Intercept	**–2.94	–0.21	**–2.31	**–2.36
Institutional variance	*0.96	*0.30	0.03	NA[6]
Academic Preparation				
Standardized Achievement Score	** 0.23	0.06	** 0.25	0.03
High School GPA	** 0.60	** 0.49	** 0.45	0.07
Psychosocial Factors				
Academic Discipline	* 0.22	** 0.43	0.09	–0.09
Academic Self-Confidence	*–0.19	*–0.15	–0.02	0.10
Commitment to College	** 0.26	–0.09	0.07	* 0.17
Steadiness	0.12	0.05	–0.03	–0.11
Social Activity	**–0.22	–0.05	0.00	–0.05
Social Connection	0.15	–0.02	0.04	0.05
Socio-demographic Factors				
Age (log)	0.01	* 0.14	** –0.30	–0.07
Race/ethnicity[1]				
African American	0.00	** –0.55	0.08	0.17
Asian American	–0.14	–0.39	–0.60	0.39
Other race/ethnicity	0.03	–0.44	0.23	0.25
Gender[2]	0.21	0.02	0.09	** –0.50
Parent's income (log)	* 0.23	0.15	* 0.17	–0.09
Parentss education level[3]				
Some college or two-yr. degree	0.11	0.03	–0.02	0.13
BA/BS or higher	* 0.35	0.02	** 0.41	** 0.43
Situational Factors				
Full-time enrollment	** 0.60	** 0.39	0.19	0.03
Degree expectations[4]				
AA	0.62	–0.07	0.52	* 0.55
BA/BS	** 1.36	** –0.54	** 1.24	0.43
MA/MS/MBA	** 1.97	–0.38	** 1.82	* 0.66
PhD/MD/JD	** 1.68	** –1.00	** 1.60	0.43
Distance from home (log miles)	0.05	** 0.13	** 0.17	* 0.09
Planned hours working	–0.09	–0.03	** –0.27	–0.03
Institution Characteristics				
Total enrollment	–0.19	–0.29	*0.21	0.07
Tuition	0.27	0.29	**0.32	**0.33
Percentage receiving financial aid	–0.32	–0.28	–0.05	**–0.38
Percentage minority	–0.20	0.23	0.17	**0.33
Percentage full-time faculty	0.07	0.02	**–0.27	**–0.21
Institution type[5]	0.54	*0.88	–0.16	*–0.43

Note. n = 4,481; [1]Caucasian is reference group; [2]Female is reference group; [3]High school graduate or less is reference group; [4]Business/Technical/Certificate program is reference group; [5]Two-year community or junior college is the reference group, [6]Intercept was assumed to be constant across institutions.

"obtain degree and transfer to a four-year institution" category was 0.23. Because this coefficient is positive and significantly greater than 0 (p value less than 0.01), it suggests that having a higher standardized achievement score is predictive of obtaining a degree or certificate and transferring to a four-year institution, rather than dropping out. The increase (relative to 0.50) in the probability of obtaining a degree and transferring, relative to dropping out, is derived from this estimate as $\exp(0.23) / (1 + \exp(0.23)) = 0.557$. The interpretation of this measure of effect size is "The probability of obtaining a degree and transferring (rather than dropping out) increased from 0.50 to 0.56 with each standard-deviation increase in standardized achievement score, all else being held equal." Throughout the results and discussion of this paper, we use the probability increase (relative to 0.50) to interpret effect sizes. Students with higher high school grades are more likely to obtain a two-year degree and not transfer, rather than drop out. The probability of obtaining a degree and not transferring (rather than dropping out) increased from 0.50 to 0.65 with each standard-deviation increase in high school GPA.

Psychosocial. Of the six measures of psychosocial factors, Academic Discipline, Commitment to College, and Social Activity were significantly predictive of outcomes (p value < 0.01). Students with greater motivation (measured with Academic Discipline and Commitment to College) were more likely to obtain a degree and transfer, rather than drop out. Higher Academic Discipline scores were also related to transferring without a degree and higher Commitment to College scores were related to being still enrolled, rather than dropping out. Social Activity scores were inversely related to degree attainment and transfer, suggested that, all else being equal, students who perceived themselves as more socially active at matriculation were less likely to obtain a degree and transfer, relative to drop out. Students with higher self-ratings of academic self-confidence at matriculation were less likely to obtain a two-year degree as opposed to drop out, though the findings were only borderline significant ($0.01 < p$ value < 0.05). Neither students' perceptions of feeling socially connected, nor their self-ratings of steadiness, were significantly predictive of outcomes.

Socio-demographic. The results suggest that older students are more likely to obtain a two-year degree and not transfer, rather than drop out. However, younger students are more likely to transfer to a four-year institution without first obtaining a two-year degree. The estimates pertaining to the racial/ethnic variables (African American, Asian, Hispanic, Other) are made with respect to Caucasian as the reference group. Relative to Caucasian students, African American students were less likely to obtain a two-year degree without transferring rather than drop out (probability decreased from 0.50 to 0.37). Male students were less likely to be still enrolled during the fifth year without a degree and without having transferred, rather than drop out. Students who had a parent with at least a bachelor's degree were more likely to transfer and also more likely to be still enrolled during the fifth year without a degree and without having transferred. Students with greater family income were also more likely to transfer.

Situational. Students who planned on enrolling full-time at matriculation were more likely to obtain a two-year degree, regardless of transfer status. The probability of obtaining a degree and transferring, rather than dropping out, increased from 0.50 to 0.65 for full-time students relative to part-time students. Students' degree expectations were significantly predictive of outcomes. Students who expected to complete at least a bachelor's degree were much more likely to transfer and much less likely to obtain a degree and not transfer. For example, the probability of obtaining a degree and transferring, rather than dropping out, increased from 0.50 to 0.80 for students who expected a bachelor's degree, relative to students who expected to complete a business/technical or certificate program. Conversely, the probability of obtaining a community college degree and not transferring (rather than dropping out) decreased from 0.50 to 0.37 for students who expected a bachelor's degree, relative to students who expected to complete a business/technical or certificate program. These results suggest that students' degree expectations at matriculation are strongly predictive of the paths they end up taking.

We also found that greater distance from home to college was associated with greater likelihood of obtaining a degree and not transferring, transferring without a degree, and being still enrolled, rather than dropping out. Furthermore, students who planned on working more were less likely to transfer without obtaining a two-year degree.

Institutional. With only 21 entering institutions in our sample, we had little power to detect effects of institutional characteristics. However, we did observe that students at institutions classified as vocational-technical colleges were more likely to obtain a degree and not transfer (rather than drop out), relative to students at institutions classified as community or junior colleges. We also found that greater enrollment size, greater in-state tuition, and fewer full-time faculty were predictive of transfer to a four-year institution without obtaining a degree. Greater in-state tuition, smaller percentage receiving financial aid, and greater percentage of minority students was associated with being still enrolled, rather than dropping out.

Discussion

We followed a large sample of community college matriculates across five academic years and across multiple postsecondary institutions. We used a diverse set of predictor variables, capturing academic preparation, psychosocial, socioeconomic, situational, and institutional factors, to model degree and transfer outcomes relevant to community college matriculates. Here we summarize the study's findings, discuss practical implications, and discuss the study's limitations.

Summary of Findings

The results confirmed our expectation that higher levels of academic preparation would predict community college degree attainment and transfer to four-year institutions. The probability of obtaining a degree and then transferring (rather than dropping out) increased with each standard-deviation increase in high school GPA and standardized achievement score. The probability of obtaining a degree and not transferring (rather than dropping out) increased from 0.50 to 0.62 with each standard deviation increase in high school GPA and the probability of transferring without obtaining a degree increased from 0.50 to 0.56 with each standard deviation increase in standardized achievement score. These findings are consistent with retention and transfer results observed for students entering four-year institutions (Allen et al., 2008).

Our expectation that students with greater motivation (i.e., Academic Discipline and Commitment to College) would be more likely to obtain a degree and transfer was met. The probability of obtaining a degree and transferring (rather than dropping out) increased from 0.50 to 0.55 with each standard deviation increase in Academic Discipline score; the probability of obtaining a degree and not transferring increased from 0.50 to 0.61. The probability of obtaining a degree and transferring (rather than dropping out) increased from 0.50 to 0.56 with each standard deviation increase in Commitment to College score; the probability of still being enrolled during the fifth year (rather than dropping out) increased from 0.50 to 0.54. Higher academic self-confidence was associated with lower degree attainment, all else being equal. Though these results were only borderline significant ($0.01 < p$ value < 0.05), they suggest that students with modest ratings of their own academic ability are more likely to obtain a degree or certificate, rather than drop out, all else being equal. One possible explanation for this is that students with higher self-ratings may be less likely to seek academic help such as tutors or supplemental instruction.

Both family income and parent's education level of a bachelor's or higher were predictive of transfer to a four-year institution, regardless of whether or not a community college degree was obtained. Consistent with Ishitani's (2006) findings, first-generation students were much more likely, relative to students with a parent holding a bachelor's degree, to drop out without having obtained a degree or transferring. Older students were less likely to transfer to a four-year institution without having obtained a degree, rather than dropping out. The results suggest that older students are more likely to obtain a two-year degree and not transfer, rather than drop out. However, younger students are more likely to transfer to a four-year institution without first obtaining a two-year degree. This finding may be due to younger students being more mobile, while older students may be more likely to have work and family obligations that prevent them from transferring.

Consistent with our expectations, situational factors that were significantly predictive of obtaining a degree or transferring (rather than dropping out) included full-time enrollment, higher degree expectations, and fewer planned hours worked. Full-time initial enrollment increased the probability of obtaining a degree (rather than dropping out) regardless of transfer decision. Students with degree expectations of BA/BS or higher were much more likely to transfer to a four-year institution, regardless of whether they first obtained a degree. Contrary to our expectations, students who planned to work less were not significantly more likely to obtain a degree and then transfer, but were more likely to transfer without first obtaining a degree (rather than dropping out). Students with greater distance from home to college were more likely to obtain a degree and not transfer, transfer without a degree, or be still enrolled, rather than drop out. Distance from home to college may be an indirect marker of commitment, which would lead to an increased likelihood of obtaining a degree and not transferring or being still enrolled, rather than dropping out. One possible explanation for the relationship between distance from home to college and transfer (without obtaining a degree) is that students who travel greater distances want to return to a four-year institution that is closer to their home.

To account for the nesting of students within institutions, hierarchical modeling was used with institution enrollment, tuition cost, percentage receiving financial aid, percentage minority, percentage full-time faculty, and institution type (vocational/technical vs. junior/community college) used as institution-level predictors. Greater enrollment size and in-state tuition were predictive of transfer without first obtaining a degree. Also, students at vocational/technical colleges were more likely to obtain a degree without transferring—which is consistent with the idea that students entering vocational/technical colleges are more likely to obtain their degree and seek employment rather than further their education at a four-year institution. A greater concentration of full-time faculty was not significantly predictive of degree attainment, but was inversely related to transfer without obtaining a degree and still being enrolled (rather than dropping out). In contrast, other studies found that graduation rates decreased as the proportion of part-time faculty employed increased (Jacoby, 2006) and persistence rates decreased with greater exposure to part-time faculty in gatekeeper courses (Eagen & Jaeger, 2008).

Practical Implications

These results are pertinent to community college administrators and leaders of student affairs programs as they seek to identify the students at greatest risk of not fulfilling their degree aspirations. With early identification based on multiple dimensions of risk, institutions can allocate their support programs based on students' unique needs, thereby increasing the likelihood of successful outcomes. Many of the student variables we identified as predictive are already in the hands of community college administrators because of the college admissions and financial aid application processes, including high school grades, standardized achievement scores, age, race/ethnicity, gender, family income, enrollment status, and distance from home. Other variables can be collected with assessment at matriculation, including measures of psychosocial factors, parent's education level, degree expectations and aspirations, and planned hours working.

The results of the multinomial logit model could provide a means of determining which students are at high risk of not fulfilling their degree aspirations. For example, if a student planned on obtaining an AA degree at the community college and then transferring to a four-year institution, the second column of Table 2 (Degree, Transfer) could be used to derive the student's risk of not fulfilling their degree aspiration. A score could be computed as the sum of the contributions of the significant predictors, where the contribution of each predictor is equal to the regression coefficient multiplied by the student's value. For example, if a student scored one and a half standard deviations below the mean on the Academic Discipline scale (using the means and standard deviations from Table 1, this would be an Academic Discipline score of 35 out of 60), the contribution of Academic Discipline would be -0.345 (-1.5×0.23). The sum of the contributions of the significant predictors could then be used as the basis for ranking students according to overall risk level.

This study's findings also have implications for community college accountability systems. Clearly, student characteristics, measured at matriculation, are strong predictors of outcomes. Thus, comparing two institutions' degree attainment or four-year transfer rates only makes sense when the two institutions serve identical student populations. Similar to value-added accountability models that are implemented in K–12 systems (Ballou, Sanders, & Wright, 2004), community college accountability measures should be adjusted for entering student characteristics. Our results suggest that several student characteristics should be included in this adjustment, perhaps most importantly degree expectations, prior academic achievement, enrollment status, and motivation. Community colleges' missions often include but are not limited to preparing students for transfer to four-year institutions, academic remediation, workforce development and skills training, and non-credit programs (i.e. English as a second language, skills retraining, community enrichment, and cultural activities) (AACC, 2008, p. 1). Because of these varying missions, accounting for students' pre-college degree expectations and intentions provide a means of "leveling the playing the field" across institutions. Future work needs to address community college accountability by devising a transparent system of measuring institutions' effects on outcomes, while adjusting for differences in student populations. Ideally, the resulting accountability measures would enable institutions to compare their annual performance to other similar institutions and to their own performance in previous years.

Study Limitations

One limitation of this study is that it was confined to a convenience sample of matriculates of just 21 community colleges. Due to this limitation, we had little power to detect possible effects of institutional characteristics. Moreover, the institutional characteristic we studied (enrollment size, tuition, percentage receiving financial aid, percentage minority, percentage full-time faculty, institution type) do not capture well the institutional practices and policies that might affect student enrollment and degree outcomes. Examples of institutional practices and policies that may affect outcomes are: expenditures on instructional resources, type of articulation agreements with a four-year institution regarding expectations for transfer students, professional training of faculty and staff for removing student barriers to degree attainment and/or transfer, the extent that the institution's student affairs programs are driven by student need identified through assessment, the ways in which teaching ability is assessed in faculty hiring decisions (Meizlish & Kaplan, 2008), whether faculty are evaluated based on their performance as academic advisors, and the extent that faculty members are evaluated based on students' academic growth. Future studies should attempt to incorporate a more representative sample of two-year institutions and to gather data that enable the analyses of specific institutional policies and practices.

Another limitation of this study is that we used several predictor variables, with each predictor variable allowed its own regression coefficient for each outcome category. With so many parameters being estimated (see Table 2), there is a stronger possibility of type-I errors where we detect spurious relationships. Most of our findings were consistent with our expectations and with prior studies. Still, our results should be viewed with some caution and replicated in future studies. Despite using a diverse set of predictor variables that capture multiple dimensions of student risk factors, there are invariably some that we didn't capture—such as direct measures of students' family obligations (e.g., whether the student had children to provide for), level of financial aid received, and social capital factors such as parental involvement and access to social network resources (Perna & Titus, 2005).

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Educational Master Plan

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THE APPLIED BACCALAUREATE DEGREE: THE RIGHT TIME AND PLACE

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The applied baccalaureate degree, which integrates once-terminal applied associate degrees and course work into a four-year degree, is a relatively new phenomenon in higher education. This article presents findings from the first of two phases of research conducted—utilizing Kingdon's (1995) Multiple Streams framework—exploring the status of

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these degrees in both traditional associate- and baccalaureate-granting institutions and the policy context surrounding their implementation. Results of two purposefully chosen state-level cases showed implementation of applied baccalaureate degrees happens when an individual or a group of individuals drives the conversation toward the adoption of such degrees. It is a combination of the right time and place, as well as the right people, that make the applied baccalaureate degree a reality.

The expansion and increased competitiveness of the American workforce is dependent upon expanding educational opportunities and attainment for those entering into and already a part of the workforce (Pusser et al., 2007). Yet, one of the most compelling challenges for educational policy makers is providing suitable pathways for working and nonworking adults. The percentage of adults with a baccalaureate degree or higher is as low as 18% in some states; at best, it is as high as 41% (National Center for Public Policy and Higher Education, 2006). The National Center's most recent *Measuring up 2008* report contends participation rates of working-age adults have declined since the 1990s, heightening the need for improved access to college for this population (National Center for Public Policy and Higher Education, 2008). In the nation's changing economy, there is an increasing necessity for baccalaureate level education for a number of jobs that have never before required these credentials. One potential solution to issues related to baccalaureate attainment and workforce development for adults is a phenomenon known as the applied baccalaureate degree.

This article presents results from the first of a two-phase study funded by Lumina Foundation for Education, and it further analyzes these phase-one qualitative data to address a more specialized question about state adoption of the applied baccalaureate. The project, entitled The Adult Learner and the Applied Baccalaureate, was designed to expand knowledge on the phenomenon of applied baccalaureate degrees, which we defined as "bachelor's [degrees] designed to incorporate applied associate courses and degrees once considered as 'terminal' or non-baccalaureate level while providing students with the higher-order thinking skills and advanced technical knowledge and skills so desired in today's job market" (Townsend, Bragg, & Ruud, 2008, p. 4).

We, with support of our sponsor, Lumina Foundation for Education, used telephone interview and document analysis methods to gather data on the use of applied baccalaureate degrees to address the needs of adult learners. We sought to understand the extent to which the degree was emerging as a means to facilitate baccalaureate completion for adults who accumulated some college credits but failed to obtain a degree and for adults who had not enrolled in college. More specifically, this article examines the state's role in adopting applied baccalaureate degree programs, using two states as purposive cases to understand the forces that influence the adoption of applied baccalaureate degree programs.

During 2007–2008, we conducted a national and state-by-state inventory of applied baccalaureate degree programs using data obtained from telephone interviews with state officials and from Web sites, reports, legislation, and other materials. Our results showed applied baccalaureate degrees are offered by at least one higher education institution in 30 of the 50 United States. Among those states, 10 indicated that they provide the degree at both the two- and four-year institutional level, which we label traditional associate- and baccalaureate-degree granting institutions. The other 29 have institutions that provide the degree at the traditional baccalaureate-degree granting level only. Of the states offering these, 16 offer it at one to two institutions only, 15 at three to six institutions, and 8 at seven or more institutions.

Results from our interviews with state agency officials showed the creation of applied baccalaureate degrees often relies on the advocacy by one person or a small group of leaders within education, the legislature, or other political areas. Especially among states with several institutions providing applied baccalaureate degrees, the articulated goal of states for the creation of the degrees stemmed from the need for a multifaceted approach to multifaceted problems. Such problems include addressing workforce shortages and reaching state-defined goals for educational (baccalaureate) attainment. For states with few applied baccalaureate degrees, the impetus tended toward meeting regional employment needs and creating programs specific to smaller geographic areas. With respect to adult learners, our state-to-state inventory showed varied results. Those having a greater number of institutions, such as in Florida and Washington, more likely to cite adult learner needs as an impetus to create the degrees.

Our national inventory confirmed earlier studies of the applied baccalaureate (see, for example, Floyd, 2006; Floyd, Skolnik, & Walker, 2005; Ignash & Kotun, 2005; and Seppanen, Bloomer, & Thompson, 2005), suggesting the creation of applied baccalaureate degrees is the result of a convergence of different issues in higher education and state policies. Officials in each state identified a unique set of circumstances and challenges that influence the adoption and implementation of the degree. Across the 50 states, four contributing forces emerged as principal to precipitating applied baccalaureate degrees. These forces are related to associate-to-baccalaureate transfer, adult learners, baccalaureate attainment, and workforce and economic interests (Bragg, Townsend, & Ruud, 2009).

Greater attention is being paid to the transfer missions of public institutions as more students utilize community colleges as a stepping-stone to the baccalaureate degree. In some states, efforts to enhance the transfer mission have contributed to development of applied baccalaureate degrees. In 2003, Cohen noted that, of students receiving a baccalaureate degree, over 40% had received some credits from a community college or other two-year institution. In some states, this influx of community college enrollments has influenced state policymakers to call to the forefront the transfer mission of both two- and four-year institutions. Evidence of this is especially apparent in current initiatives to create or expand P-16 and P-20 councils, to generate statewide articulation agreements, and to place two- and four-year institutions under the same administrative umbrella. Even Secretary Spellings' Commission on Higher Education suggested an increased focus nationwide on students' ability of transfer to facilitate greater educational attainment (United States Department of Education, 2006).

Townsend (2007) noted that community college missions and facilities have changed to meet the needs of a changing student body. Community college baccalaureate degrees—baccalaureate degrees awarded from traditionally associate degree-granting institutions—are sometimes linked to increasing access to the baccalaureate and to complement associate-to-baccalaureate transfer policies (Floyd, 2006; Floyd et al., 2005). Representatives of several states noted an increased focus on the transfer process within two- and four-year institutions as the impetus for the creation of applied baccalaureate degrees. This is especially true in states where implementation of these degrees occurred at the institutional rather than statewide level, although it is not exclusive to these states. States with these institutionally-created applied baccalaureate programs like Idaho, Delaware, and Kansas indicated the degrees were largely created to respond to demands for seamless transfer options for associate's degrees in applied science. Administrators from states with more comprehensive statewide applied baccalaureate degrees, like Minnesota, indicated that the degrees were a part of the larger transfer mission. For these state policy makers, the applied baccalaureate degree was a logical solution to an issue related to transfer, especially for adults. Results from our study also showed parallels to other research on the applied baccalaureate.

Similar to the increase in community college enrollment, enrollment by adults, defined as individuals age 25 and over, increased in the end of the 20th and beginning of the 21st centuries, potentially contributing to the development of applied baccalaureate degrees. Chao, DeRocco, and Flynn (2007) indicated that adults are returning to higher education due to what they call "a premium on an educated workforce" (p. 3). Leigh and Gill (1997) found that each year of education resulted in earnings increases of 5% to 8%. Especially in today's economic times, returns on the investment are important to job seekers. Some have chosen to enroll in applied associate degrees, two-year degrees often defined as terminal (Bragg, 2001). However, institutions of higher education are experimenting with innovative instructional and institutional policies to encourage adult learners to return to learning. These policies range from credit-for-experience (Pusser et al., 2007) to greater transferability of these once-terminal degrees (Townsend, 2004). Our study revealed Kentucky's completer degree programs, for example, were created to encourage adult students with partial college credit to return to the learning environment and finish a baccalaureate degree. The inclusion of applied associate's course work as acceptable credits for transfer suggests the degree fits the definition of the applied baccalaureate degree. Moreover, North Dakota's applied baccalaureate degrees were created to bolster dropping enrollment figures by tapping the niche market of adult learners.

Many states in our inventory indicated a dedication to general baccalaureate attainment within their states. For example, Kentucky implemented a statewide Double the Number campaign designed to "double the number of bachelor's degree holders in the state by 2020" (Kentucky Council on Postsecondary Education, 2007, p. 7). Much of the impetus driving these states to focus on baccalaureate attainment is the desire to enhance the return on investment in baccalaureate education. Other initiatives cited by state officials included the following: the addition of university centers defined as four-year institutions providing baccalaureate instruction on a two-year campus (Lorenzo, 2005); the use of online and distance education delivery models; and efforts to enhance the transferability of associate's degrees. In part, community college baccalaureate degrees have emerged from the desire to enhance states' baccalaureate attainment rates, particularly among states seeking increased degree-holders in nursing and education (Floyd, 2006). To some, community college baccalaureate programs are contentious, challenging the integrity of the baccalaureate degree and causing mission creep within associate-degree granting institutions (Mills, 2003).

Finally, the workforce and economic needs of states have an important influence on state higher education policy, including contributing to the increase in applied baccalaureate degrees. The National Commission on Adult Literacy (2008) all but claims an emergency in the nation, by emphasizing that policies that are currently in place are "putting our country in great jeopardy and threatening our nation's standard of living and economic viability" (p. v). The need to compete on a global level and to respond to workforce demands has put institutions of higher education at the forefront of workforce development. Some state officials noted that employers are increasingly demanding a workforce educated at the baccalaureate level, rather than the high school or associate's degree level. Pusser et al. (2007) noted that the greatest return to states would come from educating adults in workforce-centered education. Legislation such as the Workforce Investment Act of 1998 and the Carl D. Perkins Career and Technical Education Improvement Act of 2006 address these needs by giving increased attention to the role of higher education institutions in meeting workforce demands. Many of Oklahoma's applied baccalaureate degree offerings, for example, were created to address gaps and respond to workforce shortages. The applied baccalaureate degree was "seen as a vehicle to address these areas" (Townsend et al., 2008, p. 54).

This study examined the adoption of applied baccalaureate degrees using Kingdon's (1995) Multiple Streams framework. Although documentation of the extent and breadth of these degrees across the United States is useful, state and local policy makers would be well-served by an analysis of the policy contexts and political environments by which the degrees emerged. Specifically, this study addresses the following two questions: (a) What conditions were necessary to prompt states to implement a statewide policy of awarding applied baccalaureate degrees? (b) To what extent do policy development frameworks, such as Kingdon's (1995) Multiple Streams, enhance understanding of the phenomenon of applied baccalaureate degrees?

By understanding the complexities of the adoption of applied baccalaureate degrees and the circumstances by which the degrees were considered and implemented, policy makers and practitioners may begin to determine if these degrees are appropriate for their particular state or locale, if the time is appropriate for these degrees, and how these degrees can be considered for institutional and statewide policy decisions. To determine the utility of policy analysis frameworks in the examination of applied baccalaureate degrees, this study presents two cases of states that have implemented these degrees as a part of statewide policy. This study also looks at states that decided not to implement such degrees.

THE MULTIPLE STREAMS FRAMEWORK

Kingdon's (1995) Multiple Streams framework operates on the basis that policy decisions are based largely on three separate "streams" that are constantly flowing throughout any policy making system: problems, policies, and politics. These streams largely behave independently of one another but are occasionally brought together to affect change within a given policy setting. The "problem stream" consists of existing conditions within the policy context and significant events that give rise to a new policy decision. The "politics stream" is based largely upon the party makeup of a given policy making group, and it is influenced by the politics of the process. This stream can be significantly affected by large-scale changes in party power, such as a new political party taking over the legislative majority. Finally, the "policies stream" includes a multiplicity of potential policies that address particular issues. These policies are not necessarily equal in support or ease of implementation.

The interaction of the three streams is what is most important to the Multiple Streams framework. During times in which new policy decisions are not being made, these streams do not significantly affect one another. During "critical moments in time" (Zahariadis, 2007, p. 73) which are referred to as "policy windows," certain individuals influence the streams to interact and to affect policy changes. These individuals, known as policy entrepreneurs, use their power and influence over other policy makers to implement an item from a policy stream to solve a particular problem within a political context. Although the framework is highly generalized, we think it provides adequate potentially useful means to understand a particular context for determining if there is an opportunity for significant policy change.

The convergence of these streams involves three processes: the focus of attention on a particular problem, the search for solutions, and the selection of an appropriate solution. Attention depends largely on the policy entrepreneur to garner enough public support to merit an issue to be addressed. Kingdon's Multiple Streams framework is useful for understanding how issues move to the formal policy agenda, referred to as the agenda-setting stage of the stages heuristic (Sabatier, 2007). The process used to search for issues can follow a number of patterns, but can be quick or gradual depending on the players involved in the policy decision, the urgency of the policy issue, and the effectiveness of the policy entrepreneur. The process of selection involves the impetus behind a particular decision and the influences in play.

At both the institutional and state level, Kingdon's (1995) framework offers a useful means to examine the timing of the adoption of applied baccalaureate degrees. Institutions and states alike are faced with problems that can be solved in numerous ways, including the applied baccalaureate degree, and need a political entity that is receptive to this type of degree to seriously consider it an appropriate solution. In states that did not implement applied baccalaureate degrees, the lack of support in one of these three streams influenced this decision. Some states implemented other policies and programs to address the needs for baccalaureate attainment and the improvement of postsecondary education for adult learners, suggesting a different policy stream predominated. Other states cited resistance to applied baccalaureate degrees. They noted issues such as mission creep (in the case of associate degree-granting institutions receiving authority to award these degrees) and maintaining the quality of the baccalaureate degree, suggesting the politics stream was not receptive to the degree. Still other states noted that there were no significant issues in access, equity, or transfer that necessitated such degree programs, suggestive of the lack of a solid problem that the applied baccalaureate degree could address.

To examine the adoption of the applied baccalaureate degree in states engaging in its adoption, we look at two states that have adopted both the applied baccalaureate degree at the traditional associate- and baccalaureate-degree institutional levels. These states are two of eight that have adopted state level policy on the applied baccalaureate degree. The Multiple Streams framework is used as a lens to better understand why and how these degree programs came to the forefront of the state policy agenda.

CASES

Florida

Florida began allowing community colleges to award baccalaureate degrees (beyond applied baccalaureate degrees) in 2001 via legislative mandate. Because of its early activities, Florida has been named by some scholars (see Floyd & Walker, 2009 in particular) as a "bellwether" state on this issue. Support for policies related to the community college baccalaureate degree can be traced to a study released by Florida's Postsecondary Education Planning Commission (PEPC; now known as the Council for Education Policy Research and Improvement [CEPRI]) in 1999. That study noted that the state's two-plus-two articulation system was not equipped to facilitate an influx of transfer students and those seeking baccalaureate degrees. Although the report did not specifically recommend the community college baccalaureate as the solution to the problem at that time, it set into motion an environment supportive of change. An example from this report of the necessity of change includes, "in view of the social, economic, and technological changes taking place in our environment . . . [Florida] should strive to eliminate any systemic, institutional, or geographic barriers to providing qualified students with postsecondary opportunities which will allow them timely access to degree attainment" (PEPC, 1999, p. 15).

When looking back on the creation of community college baccalaureate degree programs in Florida, one of our interviewees noted myriad issues within higher education, akin to Kingdon's problem stream. The first issue was an identified need to improve baccalaureate attainment in state: our contact indicated that the state had a low ranking for baccalaureate degree production. With a growing populace, the state had 11 four-year institutions that awarded baccalaureate degrees at that time. Capacity could not keep up with demand for four-year degrees. The second issue, a workforce need, was evident in the influx of industrial and technical employers due partly to the existence of no state income tax. The allure for businesses yielded a higher demand for a baccalaureate-educated workforce. Workforce needs were also evident in the increased demand for baccalaureate degree-holders in the fields of nursing and education, with which four-year institutions could not keep up. Although Florida had encouraged associate-degree institutions to partner with baccalaureate-degree institutions to facilitate transfer, issues of capacity led policy makers to seek other avenues.

With respect to the political stream, there was resistance to the degree in Florida. This was perhaps due to the proposal advancing community college baccalaureate degrees in fields beyond those of applied baccalaureate degrees such as education and nursing. Opponents to the degree noted worries regarding a departure from the open access mission of community colleges, issues regarding the integrity of the community college baccalaureate degrees, subpar proposals from community colleges, and issues of competition with four-year institutions. In the area of the applied baccalaureate degree, there was an increased demand for institutions to offer the degrees, as only two of the four-year institutions offered a transfer option for those with applied associate's degrees. Ultimately, it seemed to be easier for state policy makers to take advantage of existing educational structures to improve baccalaureate attainment rather than fund the creation of additional four-year institutions.

The policy stream was largely directed at community college baccalaureate degrees. This is important, as from what we discovered through our research, it seemed as if the community college baccalaureate was the primary policy being considered. This could be due in large part to the activities of a policy entrepreneur in the state, recognized by several individuals as the champion of community college baccalaureate degrees. This individual, an author of publications and articles pertaining to the community college baccalaureate as well as a president of a community college system in Florida, was able to emphasize how these particular degrees could address the myriad concerns the state faced. Kingdon (1995) recognizes these activities as significant in the creation of the windows of opportunity by which the time and place is ideal for significant policy changes. The policy entrepreneur often is the one directing the conversation around a particular policy consideration. He/she makes known the problems and how they can be solved by the policy and brings the politics stream into a more supportive role by interacting with policymakers and the public. By directing these conversations in that way, it became a near-inevitability that such degrees would be created.

Washington

Compared to Florida, applied baccalaureate degrees are a relatively new phenomenon in Washington state, where the degrees were mandated at the state level beginning in the fall semester of 2007 (Townsend et al., 2008). The degree itself emerged from legislation passed in 2005 that established pilot applied baccalaureate programs in several community colleges to be implemented no earlier than fall 2006. The impetus behind the legislation, according to a member of Washington's Higher Education Coordinating Board (HECB), was a report on baccalaureate capacity conducted primarily by Washington's Community and Technical College System (WCTCS) (Seppanen et al., 2005). This report found a marked need for new and innovative pathways to the baccalaureate degree, especially for applied associate's degree holders. Of those receiving these applied associate's degrees, 10% already transferred into a baccalaureate degree program, even though these associate's degrees were traditionally considered terminal. Some students with these degrees found transfer options in applied baccalaureate programs created at a few public four-year institutions. In the traditional baccalaureate programs into which many students transferred, few credits were considered transferable, but students still sought the four-year degree due to employer demands, increased wages for four-year degrees, and a market need in fields that primarily require baccalaureate degrees such as nursing, engineering, and technology.

Seppanen et al. (2005) concluded that Washington should increase its transfer options for applied associate's degree holders—from its current 10% level to a 32% level—through the provision of applied baccalaureate degrees at a limited number of two-year colleges. State legislation established four pilot programs wherein community and technical colleges were given the opportunity to submit proposals for applied baccalaureate degree programs. No institution would be allowed to award more than one of these degrees, so four institutions were ultimately given the ability to serve as pilot programs for new applied baccalaureate degrees offered at the associate degree-granting level.

At the same time, Washington's HECB made recommendations regarding two-year branch campuses of four-year institutions, particularly that some around the state be expanded into full four-year institutions (still branch campuses) that would provide greater geographic access to baccalaureate degrees. These two recommendations and the subsequent legislation, included in the same bill as the applied baccalaureate pilot programs, indicated a greater emphasis on the transfer mission of higher education within the state. In essence, the two recommendations were seen as complementary to forging a statewide solution to a statewide problem.

When examining the creation of these applied baccalaureate degree pilots in Washington using the Multiple Streams framework, several important features emerge. One implication is that these degrees emerged at the right place at the right time. The problem stream in particular gives evidence to the justification for these degrees. Washington, like most states, was faced with issues such as access, affordability, and workforce needs that could be uniquely addressed by an innovative policy such as the applied baccalaureate degree. Seppanen et al. (2005) reported an awareness of state and institutional policy makers on the issues the state faced regarding baccalaureate attainment, one of the four issues noted earlier in this paper. Taken further, the report also pointed out that pathways to the baccalaureate degree, including transfer options, were not fully utilized by the state.

Concurrently, the political context seemed open to the idea of implementing baccalaureate degrees at the community college level.

The idea of these degrees, although not new, encountered resistance in many states, including Illinois, due to complaints of mission creep, redundancy of degrees, and the integrity of the baccalaureate degree. In Washington, however, it became a recommended option within the state. Zahariadis (2007) noted that the politics stream within the model consists of three separate elements: the political atmosphere of the area, lobbying and other groups creating pressure on policy-makers, and legislative and executive turnover. In the case of Washington, it appeared that the first two elements were most prominent at the time of the policy's creation. The pressure from postsecondary institutions, particularly those within WCTCS as well as the HECB, encouraged policy makers to propose broad changes and examine implementation via pilot sites. The reports released by these bodies informed state citizens of the problem, offering rationale and encouraging acceptance of policies described as innovative and beneficial to college access and the economic well-being of the state.

The final stream, the policies stream, seemed to be directed toward applied baccalaureate degrees. As a presented option in reports released in 2004 and 2005, it became one of a few options that could address the issues in transfer and baccalaureate attainment. These few options included expanding the role of four-year branch campuses to include all four years of baccalaureate education, implementing community college baccalaureate and applied baccalaureate degrees, and utilizing strategic funding initiatives to facilitate the strengthening of two- and four-year institutional partnerships. The support of these solutions from these state organizations made them prime contenders as the solution to the established problems. In a unique move by the Washington state legislature, all three of those solutions were implemented simultaneously in hopes of rapidly improving baccalaureate attainment in the state. From examining the policy in the Multiple Streams framework, it became evident that conditions seemed ideal and the "policy window" was present to allow for quick implementation of applied baccalaureate degrees.

States Without Applied Baccalaureates

Kingdon's (1995) framework can also be used to examine those states that did not implement applied baccalaureate degrees. One example of a state that has not seriously considered the applied baccalaureate degree is Connecticut. For this state, according to one official we interviewed, the demand for applied associate's degree transfer has declined in recent years as more institutions offered transfer-friendly Associate of Science degrees. For adult learners, a Bachelor of

General Studies degree entices those who have gone years without enrolling to return and complete a degree. However, these degrees do not allow applied associate degrees or credits to transfer. Although the policy stream may contain the applied baccalaureate degree as an option and the politics stream may be open to the idea of that specific policy, the problems pertaining to transfer are not perceived to reach the level of significance (relative to other problems) to trigger a serious or sustained policy discussion. Based on our results, should the state witness an increase in demand for transfer options for applied associate's degree holders or encounter significant competition from other states in the area of baccalaureate attainment, we would expect the state to consider the applied baccalaureate degree.

In Virginia, there is no applied baccalaureate degree offered but it is for different reasons than in Connecticut. A state official there stated that the prospect of the applied baccalaureate degree has "no foothold," noting that the state is addressing its issues by utilizing other innovative policies and practices to support transfer. An example is the increased use of higher education or university centers. These were defined by a state official as locations in which joint programs between two- and four-year programs are offered and where institutions share instruction to provide an associate-to-baccalaureate pathway. These programs are offered in areas such as education, nursing, and technology, and they address workforce development needs. However, they do not provide transfer opportunities for applied associate's degrees. In this case, both the policy and politics streams seem lacking for the applied baccalaureate degree to be given serious consideration. Policy makers tend to utilize the existing higher education model described by the state official as a "traditional pattern." This is a less intrusive modification in the form of higher education centers that sustains the norm that assumes applied associate's degrees are terminal, and those who desire to transfer will move to the transferable associate's of science or associate's of arts degrees. The politics are not supportive of applied baccalaureate degrees. The emphasis on existing policies also shows that applied baccalaureate degrees may not be considered the appropriate way to address statewide needs.

DISCUSSION AND IMPLICATIONS

Policy process frameworks, while imperfect, do provide the benefit of examining certain policy decisions through an organized format to better understand the contexts surrounding the decisions. Kingdon's

(1995) Multiple Streams framework is an example of one such policy framework for understanding the creation and implementation of applied baccalaureate degrees within several states, but it is not the only possible framework. Several models may be useful for understanding the process of the creation and implementation of applied baccalaureate degrees; we have chosen to focus on the Multiple Streams model due to its straightforward approach to understanding significant policy changes in federal and state governments. As our research continues, we intend to use additional frameworks, including the advocacy coalition framework (ACF) and network analysis (Sabatier, 2007), to examine issues of access, process, and outcomes on a deeper and more nuanced level.

Through the Multiple Streams framework, it is relatively simple to create a picture of how applied baccalaureate degrees fit within the state context. Several states in our initial national state-by-state inventory (Townsend et al., 2008) moved quickly to implement state policy directives leading to the degrees, through a single legislative session, or through a year of discussion followed by the implementation of pilot projects. Officials of these states noted that the applied baccalaureate degree seemed an appropriate fit due to the concerns of the state and the receptivity of policymakers to implement such a policy. In these cases, it is difficult to think about some sort of linear, incremental stepping stone approach to policy adoption (see, for example Sabatier, 2007) by which applied baccalaureate degrees would gradually come into existence; hence the Multiple Streams policy framework that allowed for the possibility of change happening relatively quickly made sense for our analysis. Especially within politically charged environments, where economic and educational issues are highlighted, changes to educational systems and policies can be proposed and adopted frequently. Admittedly, incremental change is a likely scenario, though the adoption of applied baccalaureate degree programs in Florida and Washington suggests it is not the only one. Although some state officials noted resistance to the notion of implementing applied baccalaureate degrees, especially within community colleges, the proverbial "proof is in the pudding." By setting standards for the degrees and making realistic expectations for the success of students, along with appropriate data tracking, states could, for example, find ways of following Washington's pattern of legislative mandate of applied baccalaureate pilot programs, with explicit goals and deadlines.

The utility of such a policy framework for studying of applied baccalaureate degrees is twofold. First, it provides a valuable lens for understanding the data we acquired in our first year of research.

Since we recognized a gap in research specifically addressing applied baccalaureate degrees, we knew our inventory would have to take a basic approach, examining the existence of the degrees at states and institutions rather than focusing in-depth on the development of these degrees. Our conversations with state officials within several states, however, suggested that we could begin using such a policy framework to understand the creation and implementation of applied baccalaureate degrees. When looking back on several of the conversations we had with state officials, we became especially appreciative of the utility of such a framework. This was especially so within states that implemented the degrees as part of a larger statewide initiative, rather than the degrees emerging from the institutional level only. Second, the Multiple Streams framework allowed us to refine our questions for the second phase of research. This second phase was intended to examine the creation of the degrees at eight states through comprehensive case studies. In this phase, eight states were chosen purposefully to examine implementation at the state level and by higher education institutions across each state.

Finally, the title of this article makes implicit the simple question, "Is this the right time and place for applied baccalaureate degrees?" Unfortunately, the answer to that question is not nearly as simple. Using Kingdon's (1995) framework, we showed that each state is operating within a different context as it relates to the applied baccalaureate degree. For some states, the applied baccalaureate degree is too strongly opposed by political actors or not seriously considered as a policy alternative; for other states, the degree was implemented by institutions responding to local needs but has yet to reach a statewide scope. Those states that implemented statewide changes, including the implementation of applied baccalaureate degrees, did so because it was the appropriate time and place. Or, they did it because an individual or group of individuals was capable of driving the conversation toward the consideration of such degrees.

Our findings suggest the applied baccalaureate degree will go through continuous growth. Some states have found it to be an effective means for securing pathways for applied associate's degree holders to the baccalaureate degree. This may, in turn, improve statewide retention and graduation rates as well as improve the percentage of individuals within the state that hold a baccalaureate degree. In a few states, the applied baccalaureate degree has been used as a stepping stone to graduate course work. This growth could potentially expand into those states that offer few or no applied baccalaureate degrees, given the right political climate for these types of changes. When data on the effectiveness of applied baccalaureate degrees become more readily available, it is likely that the results can influence the receptivity of states to further expand the degree. It is up to the states, particularly the stakeholders within the states, to determine when the appropriate time is to consider applied baccalaureate degrees.

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Educational Master Plan

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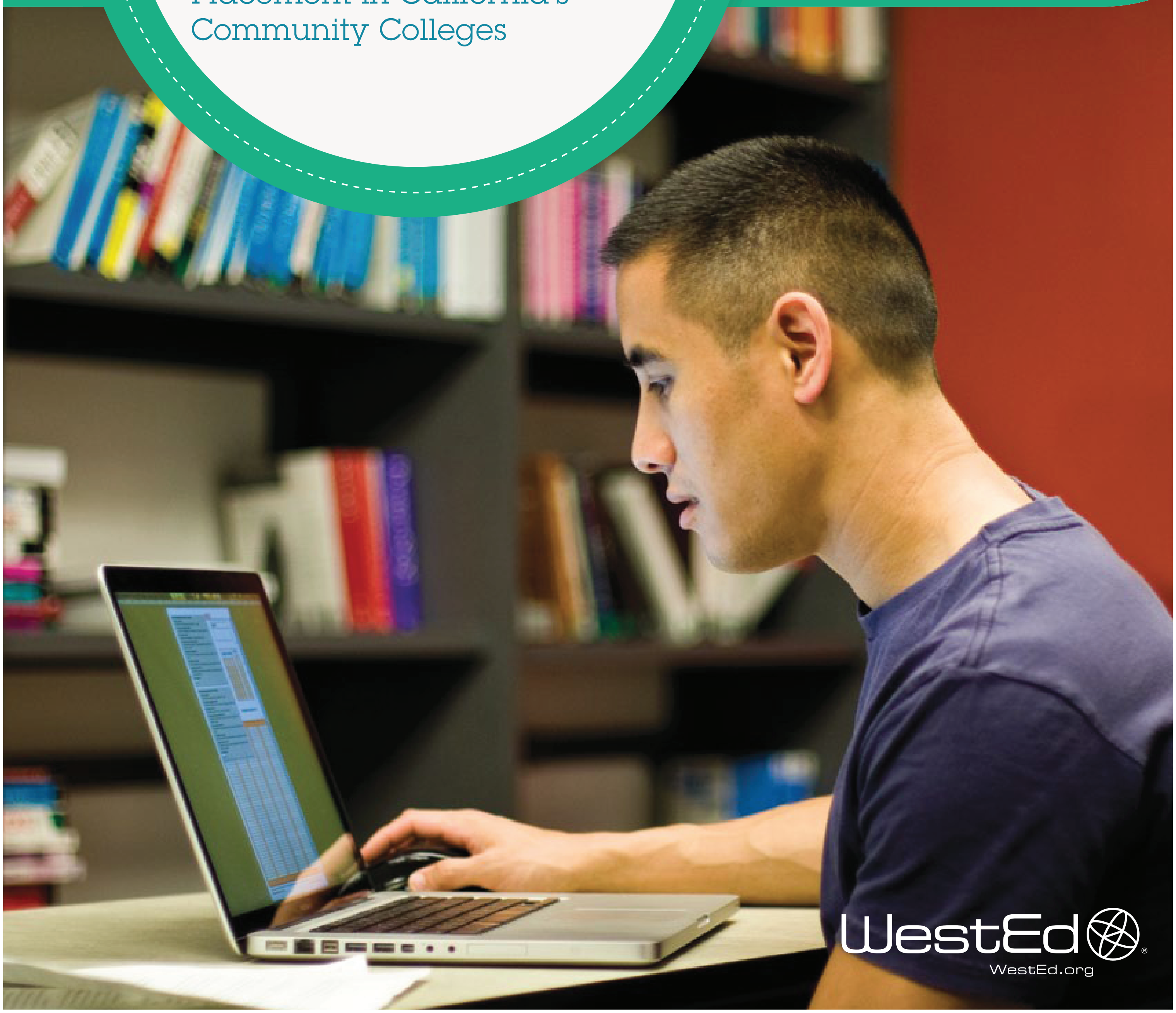
ONE-SHOT DEAL?

Students' Perceptions of Assessment and Course Placement in California's Community Colleges

by Andrea Venezia,
Kathy Reeves Bracco,
and Thad Nodine



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This study analyzes a system that has undergone much public scrutiny in recent years and that is currently facing substantial fiscal challenges. Aware that people within the community colleges are working extremely hard with diminishing resources to provide student services, we were careful to include their insider perspectives as well as those of people outside the system. Similarly, we strove to frame our findings and recommendations in an appropriate and balanced way.

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Contents

Introduction

The California Community Colleges system, with an enrollment of about 2.9 million students annually at 112 colleges, is the largest system of postsecondary education in the world. Open enrollment policies at the colleges ensure that anyone age 18 or older can attend, and younger students can take courses as well. By providing this opportunity, California has, year after year, opened the doors of higher education to a substantial portion of its young population. The state has been less successful, however, in preparing high school students to succeed in college-level courses and ensuring that those in college complete their postsecondary educational programs.[1]

Several studies, including our own previous research, have examined student perceptions of the transitions and barriers between K–12 and postsecondary education systems. These studies have recommended better alignment of coursework and assessments between the two systems to ensure that high school students are better informed about and prepared for college-level academic work.[2] There is substantial work being done—in California and nationwide—to develop college readiness standards; expand concurrent enrollment programs; communicate clearly about the key cognitive strategies necessary for postsecondary success (e.g., analytical thinking); improve student supports; and implement other approaches to improve students' postsecondary readiness and success.

This report focuses on assessment and placement processes, pivotal pieces of this picture because they determine which level of courses students will be placed in when they begin community college.

This study had two main purposes. One was to examine and describe the set of policies and practices that shape assessment and placement in California's community colleges. The other was to hear directly from students—whose voices are crucial yet generally missing in the policy process—about their assessment and placement experiences. We then compared the policies' supportive intent with the reality of the students' experiences—as well as with observations from counselors and matriculation officers—to draw conclusions about how the policies and practices may need to be adjusted.

Unquestionably, the assessment and placement process involves very high stakes for students. Whether students are placed immediately in college-credit or transfer-level courses in English and mathematics[3] or are instead required to start with basic skills courses has a major impact on students' trajectories. Course placement

[1] A survey of assessment results in California's Community Colleges found that 83 percent of community college students placed in remedial-level mathematics, and 72 percent placed in remedial-level English. See California Community Colleges Chancellor's Office (2009).

[2] See, for example, Venezia, Kirst, and Antonio (2003).

[3] Not all courses require prerequisites or placement testing.

affects not only how quickly they can earn a certificate or degree—a factor affecting the cost of their program of study—but also their likelihood of completing a credential at all.

Studies show that fewer students who place into basic skills courses complete their intended educational paths than do students placed in transfer-level courses. Those starting with basic skills courses who do complete a certificate or degree tend to take longer than their peers who are college ready. Notably, some studies have called into question whether remedial education is worthwhile at all, since even students who seem to need more basics may have better outcomes without remedial courses (Jenkins, 2010).

With so much riding on assessment and placement, it is important that students know the requirements early in their high school years so they can master the needed knowledge, skills, and cognitive strategies. They need ways to gauge their level of preparation and get the support they need—in high school and in college—to succeed. But such seamless processes do not appear to be the norm. On the contrary, community college students describe assessment and placement as something they encounter for the first time upon arrival at the college. They describe an isolated event that happens one day with minimal to no advance information. They walk into a testing center and take a test that seems disconnected to any recent academic work they had in high school. They receive a printout of their results and then register for courses. Many do not meet with a counselor to discuss their test results, and believe they are on their own to determine course-taking options. Thus, while counselors and matriculation officers have set up a continuum of services, most students believe that matriculation services are *a one-shot deal*—something that happens over the course of one day and is never revisited.

Their stories make it clear that although the assessment and placement processes are crucial to students' engagement, perseverance, and ultimate success, students hear little about them in high school. They arrive at community college knowing next to nothing about what to expect, and, thus, are unprepared to affect their own outcomes.

We have directed our recommendations toward developing a more seamless, longer-lasting set of processes wherein high schools and community colleges align their efforts toward informing and preparing students. In addition, during this time of scarcity, we focused on finding and recommending better efficiencies. That is admittedly difficult, since what students most want is more one-on-one time with counselors, an expensive intervention.

The Study's Approach

Despite many studies about the placement assessments,[4] little is known about students' related perspectives and experiences. Unanswered questions include:

- Do incoming students—particularly high school graduates—typically know that they will be assessed before they can enroll in rigorous college courses?
- Do students prepare for the assessments, and, if so, how?
- How do students describe the course placement process and its impact on their educational goals and achievement?
- What are the areas of variation and consistency—in college practices and in student perceptions—across the state?

Addressing these questions is critical to understanding—and improving—how high school students prepare for college and how colleges serve underprepared students. To find answers, our research included two components. First, we conducted focus groups with students at five community colleges throughout the state, with a primary focus on students not more than two years out of high school. (See the appendix on page 25 for a full description of the methodology.) Students were asked about their experiences with assessment and placement practices at the colleges and about their high school experiences related to college preparation. Secondly, we interviewed counselors at the five colleges and also surveyed matriculation officers across the state (total of 73 colleges), basing the questions we asked on preliminary findings from our student interviews. Throughout the paper we incorporate student quotes and identify their colleges with A, B, C, D, or E and the classes they were in for the focus group with designations such as "transfer," "non-transfer/basic skills," and "ESL." Since we used focus groups to gather

[4] This research did not study the effectiveness of the assessment and placement instruments. We did not address whether the assessment instruments or the cutoff scores used at the colleges are valid or reliable. These are important questions requiring further research, but they are not the focus of this study.

information from students, we often cannot provide exact numbers regarding how many students experienced particular concerns or frustrations. In order for an issue to merit becoming a finding, it had to be discussed in multiple focus groups with general agreement.

The California Context

California's community colleges face the challenge of accurately assessing a large number of students who enter college at a wide range of readiness levels and with diverse academic and career interests. Under the local, decentralized governance structure of the community college system, each of the 112 colleges bears the financial and administrative responsibilities of assessing students in three areas: English, mathematics, and English as a Second Language (ESL). Each is responsible for selecting or developing its own assessments and determining the "cutoff" scores that correspond with various levels of course placement for students.

Given this structure, a large number of instruments is used across the system, though a small core of assessments is used most consistently statewide (Brown and Niemi, 2007).[5] Some view these variations as important, given different student populations served and the need for local autonomy. But the system's use of multiple placement assessments causes problems. The California Community Colleges Chancellor's Office (2010) reports that the variations generate:

- a lack of uniformity, comparability, and mobility from one community college to another;
- expenses related to the retesting of the same students who attend multiple institutions; and
- difficulty generating success algorithms across the state for research purposes.

In addition, having different assessments at its various campuses across the state makes it difficult for the system to inform prospective students about common readiness levels needed for success in all California community colleges.[6]

As a step toward addressing these problems, the Chancellor's Office is exploring the feasibility of incentivizing the use of a small number of assessments systemwide by offering those assessments to the colleges free of charge. In exchange, colleges would need to agree to include their test data in the soon-to-be-developed Assessment Warehouse. The system hopes to achieve cost efficiency by negotiating a price break based on testing instrument volume. Under this approach, colleges choosing not to participate could continue to offer locally selected and purchased instruments, but they would then continue to bear their own costs (Perry, n.d.).

Besides minimizing the number of different assessments across the system, the Chancellor's Office envisions this centralized approach as a means to:

- develop a secure, central data repository for community college and K–12 test data;
- provide an assessment portal through which community college counselors could access K–12 test results, transcript data, and college test data; and
- allow for the development of algorithms of placement success, based on test scores and the highest level of courses students have taken in that subject.

Prior to the Assessment Warehouse, the Chancellor's Office launched the Basic Skills Initiative (BSI) in 2006, as part of its strategic planning process. Developed as additional student support when the required course levels for an associate's degree in mathematics and English were raised,[7] the BSI also responded to concerns that too few students would qualify for credit-level courses. With an overall goal of improving student access and success, the BSI has two main activities: 1) providing supplemental funding to every college to address basic skills needs; and 2) providing training for faculty and staff in the effective

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[5] See also Legislative Analyst's Office (2008) and Consultation Council Task Force on Assessment (2008).

[6] The variations in placement assessments across the state make it difficult to develop testing instruments outside of the community college system that might be relevant for placement, such as K–12 tests, the Early Assessment Program (EAP), or transcript data. See Perry, P. (n.d.).

[7] In 2006, the Board of Governors adopted changes to Title 5 of the California Education Code that increased the minimum requirements for an associate's degree. The new requirements, effective as of fall 2009, state that students had to successfully complete a transfer-level English course (English 1A or equivalent), whereas previously the requirement had been a course one level below transfer-level English. In mathematics, the new requirements state that students must complete intermediate algebra (which is one level below transfer-level mathematics) or an equivalent course, whereas previously students needed to complete elementary algebra.

delivery of basic skills and ESL (California Community Colleges Chancellor's Office, 2009a).

Another effort to improve college readiness and success, the California State University's Early Assessment Program (EAP), is now also being adopted in the California Community Colleges system. The EAP combines 11th-grade testing of college readiness with 12th-grade opportunities to polish skills: new high school courses in English and mathematics aligned with postsecondary (CSU and community college) entry level expectations; and professional development for high school teachers that is aligned with postsecondary expectations.

In another approach to improving student transitions, the Foundation for the California Community Colleges (FCCC) has funded the design or conversion of 23 Early College Schools in California. These schools provide structure and support for broad populations of students to enroll in college courses while they attend high school and the opportunity to earn an associate's degree upon high school graduation (Foundation for California Community Colleges, 2010).

Discussions are also occurring about whether placement test results should indicate a mandatory level of course placement for students. Technically, current placement results are not binding; students can theoretically enroll in courses at the level they choose. Yet, as this study found, many colleges have mechanisms in place to ensure that students select courses at the levels indicated by placement test results.

Challenges in a negative fiscal climate. The need for action to improve student success in California collides with the reality that colleges are already trying to accomplish more with fewer resources. Since this study began in 2008, Californians have suffered the consequences of a severe recession, including job losses, drops in income, decreases in property values and wealth, increases in debt, and cutbacks in public services. The state's key revenue sources—taxes on income, sales, and capital gains—have fallen off, and the resulting declines have thrown state budgets into disarray. In 2009, postsecondary education took a $2 billion hit, including cuts of about $680 million at the community colleges, $584 million at California State University, and $813 million at the University of California (Marcus, 2009, and Steinhauer, 2009).

Student fees shot up, with increases of 30 percent at the community colleges and 32 percent in the CSU and UC systems, while services and course availability decreased. In addition to raising fees, the postsecondary systems are furloughing employees, reducing course offerings, accepting fewer students, and reducing overhead costs by eliminating or consolidating positions (Wilson, Fuller, & Newell, 2010). Students across the state are facing more crowded classrooms, getting less access to faculty and counselors, receiving fewer campus services, and having difficulty getting into the classes they need to graduate.

Yet student demand for college has reached unprecedented levels. During 2008–09, enrollment at the community colleges increased by nearly 5 percent, to 2.9 million students—the highest in the history of the system and more than twice as high as the 2 percent funding increase the colleges received that year (California Community Colleges Chancellor's Office, 2009c). Fall 2009 enrollments were down by about 1 percent from fall 2008, and course offerings were down by approximately 5 percent (Legislative Analyst's Office, 2010). For summer 2009, the Los Angeles Community College District canceled summer sessions at its nine campuses (Chea, 2009). That fall, the San Diego Community College District turned away about 18,000 students and dropped 600 classes. The Los Rios Community College District in Sacramento saw an increase of 5,000 students, yet reduced courses by 4 percent (California Community Colleges Chancellor's Office, 2009c). In December 2009 at Cabrillo College in Santa Cruz, the number of students seeking to register for spring 2010 was so high that the online system crashed, leaving students to stand in line for two hours to register the old-fashioned way, by hand.

These fiscal challenges are not new. Higher education institutions faced similar circumstances during the recession of the early 1990s and 2000s (Wilson, Fuller, & Newell, 2010). Many community colleges have routinely enrolled more students than the state has funded. But the budget cuts for 2009–10 may have an unprecedented impact. This year the California Legislature, aware that it was passing a budget that underfunded the community colleges, allowed the colleges greater flexibility in the use of state funds. This flexibility language relieved colleges from adhering to state regulations concerning assessment of incoming students, counseling in relation to their educational plans, and placement into appropriate courses. As a result, colleges could choose not to do a formal assessment of student readiness for college-level courses or to provide students with an educational plan. The full effects of these changes remain to be seen, but they are already creating challenges in effectively meeting the needs of incoming students.

Improvements such as those we recommend in this study will be extremely challenging for the system to implement in this environment of budgetary crisis and program instability. Yet the adversity of the environment underscores the urgency of ensuring that more students become ready for college while in high school, that community college practices are easy to navigate for incoming students, that processes for placing students into classes are efficient and effective, and that students are placed in classes that will help them reach their educational goals.

Moreover, as interviewees in the colleges suggested consistently, taking innovative action now to implement more streamlined, effective, and cost-effective processes would not only help improve student success but also make more efficient use of scarce resources.

Findings

This section highlights our findings on student perceptions and experiences and conveys information from our interviews with counselors and surveys of matriculation officers. Findings are presented in four categories: 1) preparation of high school students for community college; 2) assessments of incoming students; 3) counseling; and 4) post-assessment confusion and frustration among students.

1. Preparation of High School Students for Community College

One goal of the assessment and placement process is to ensure that students are steered to courses that are appropriate to their level of preparation. Previous research studies in California have found that, based on placement test results, over 83 percent of incoming community college students place into remedial-level mathematics (with 61 percent placing two or more levels below college-level mathematics), and 72 percent place into remedial-level English (with 38 percent placing two or more levels below college-level English) (California Community Colleges Chancellor's Office, 2009b). In the focus groups, we asked the community college students several questions about their high school experiences and how well prepared they thought they were for college courses. The vast majority of students expressed frustration about what they perceived to be low expectations in high school for their academic abilities and a lack of information about community colleges.

Low expectations for academic ability. A few students (often those who had not placed in basic skills classes) said that their high schools prepared them for the academic work they were experiencing as college students. For example, one student qualified for transfer-level classes upon entry into the community college:

> *"My high school was all about prepping for college. So they would have classes just on prepping for college, and all my teachers would basically say, 'You need to study for this and do your best and score the highest.' So I was pretty well informed." [College C, transfer]*

The vast majority of these students, however, experienced low expectations in high school, and they often had low expectations themselves for what they could achieve academically. In many cases, students said they were not encouraged to take difficult courses of study:

> *"My high school was just mostly concerned with getting us out of high school. All of my teachers are kind of surprised that I went to college." [College C, transfer/English 1A]*

> *"I didn't have anyone during my high school years pushing me, [saying] 'You need all this because when you get to college, if you don't know it, you're going to start from rock bottom.'" [College D, non-transfer/student success]*

Another student said that she wished she had been told that all college-bound students need to take the challenging courses required for UC and CSU (that is, the a-g course requirements):

> *"They don't tell you that the a-g requirements [university eligibility requirements] are required*

[to prepare for community college]. After you graduate from high school, you figure that out: 'Oh, these classes they told me were options weren't actually [just] options.'" [College D, non-transfer/student success]

Since students knew that they could attend a community college even without a high school diploma, many didn't think they needed to prepare much beyond passing high school courses. Consistent with previous research,[8] many of the students, in hindsight, held themselves responsible; they said they wished they had applied themselves more, taken more advanced classes, and learned more about what to expect in college.

Many students also reported that their high school's culture of low expectations extended into college. As one student said:

"[My college counselor] told me to just take easy classes. She said, 'Let's get you settled. Take it easy, work your way up. Then after you get back into it, take as many hard classes as you want.'" [College B, basic skills]

Counselors and students both reported that if students were on the borderline between two levels of courses, counselors often suggested that students take the easier course. The counselors who advocated this practice stated that they wanted to increase the chances that students would succeed in the course. Yet many counselors and students indicated that low placement tends to increase student frustration and may negatively affect persistence.

Lack of information about community colleges. Many students said that they had not been told much about community colleges while in high school and that they did not notice a community college presence—visits by college counselors, for example—at their high schools. Students also indicated that the information they received about colleges was mostly about four-year institutions:

"[In high school] I never saw any representatives from any city colleges. I saw university reps, I saw military, I saw everybody else but them." [College D, non-transfer/learning community]

"I think high school spent more time preparing me to take the SAT test than for how to enter college." [College A, transfer/English 1A]

Many perceptions students had in high school about community college were incorrect or misguided:

"At my high school, they said junior college is at the bottom. I always thought junior college was for people who really didn't care about school and weren't going to do anything with their life." [College D, non-transfer/learning community]

The few students who mentioned being involved in college outreach activities—particularly college visits—found those helpful.

"[The community college outreach program to my high school] was really helpful. I got to know where the campus was. I didn't know where it was before, but I'd heard of it. So I came, and I really liked it." [College C, non-transfer/learning community]

Promising Approaches in the Community Colleges

Improving high school students' understanding of the rigor of community college—and the importance of preparing while in high school—is difficult and complex. A fundamental issue is the structural divide between K–12 and postsecondary education. But the challenges are magnified by the long-term and current underfunding of California's community colleges as well as by the colleges' local governance approach, which complicates the development of systemwide programming or coordination.

Yet local development of programs may also facilitate innovation and regional collaboration with school districts. The purpose of this research project was not to examine effective matriculation programs in individual community colleges—of which there are many. Rather, we sought to gather information about variance and similarities in practices across the colleges and to better understand the perceptions and experiences of students concerning those practices. In the course of our research, however, we found many promising programs. Two other sidebars in this section highlight a few programs in the following key areas: bringing high school students on campus to take placement assessments that help them understand where they stand in terms of preparation for community college; and providing options for students to complete basic skills requirements in accelerated ways.

[8] See, for example, Venezia et al. (2003).

Students reported that they were not informed about community college readiness requirements. They said they wished they had gotten early information about the kinds of academic challenges to expect if they enrolled at a community college, so that they could have changed their high school course sequence to prepare better.

Yet students in the focus groups consistently said they weren't sure what kinds of information or messages might have changed their high school behavior. This demonstrates the challenges community colleges face in communicating effectively with high school students about readiness. The realities of college may still seem remote, rather than urgent, to many adolescents. Moreover, "readiness" may depend on a student's education goals. Prerequisites for a student whose goal is a career certificate or associate's degree differ from those for a student planning to transfer to a four-year college. Community colleges are also concerned about setting the bar too high, since they do not want to discourage prospective students who may not expect to get an associate's degree or a certificate.

Every college surveyed for this study indicated that it engaged in some kind of outreach to high schools, with an average of 19 high schools targeted per college. Most of the reported outreach efforts target juniors and seniors. Fourteen percent of colleges indicated that they target 9th graders, while 99 percent said they target 12th graders. Survey respondents said that they engaged in the following activities to reach high school students: visited high schools more than once a year (83 percent); met with high school counselors and/or teachers to discuss college readiness or preparation issues (91 percent); brought high school students to the college campus to learn about assessment and placement requirements (87 percent); and conducted placement testing at the high school campuses (84 percent).

Promising Approaches: Bringing High School Students on Campus for Placement Exams

After the budget cuts of 2003, Santa Monica College developed an outreach program that engages high school students in activities that help them understand the preparation needed for community college. Originally called Fantastic Fridays, the program brings high school students onto the college campus for several activities, including taking the placement exam.

The college and each participating high school split the cost of a bus, an investment that ensures a level of commitment from the high schools. On the campus, students receive an orientation, a tour of the campus, some free time to mingle and feel the culture of a college campus, and some merchandise—from highlighters to backpacks—that prominently displays the Santa Monica College logo.

Most importantly, students are taken into a computer lab where they fill out online applications and take the placement exams in mathematics and English that are required by the college. The students receive the test results immediately, and at the Welcome Center afterward, the students talk with counselors about their results. Each student receives a placement chart that lays out the course levels, as well as a booklet that explains the majors at the college. Students refer to these materials as counselors talk to them about the requirements for general education courses in the community colleges and about requirements for the majors. Based on their scores, students are shown exactly how many basic skills courses they need before they can begin taking courses for college credit. The counselors let them know that they can come back after a couple of weeks and retake the test free of charge.

The college shares individual placement test results with high school counselors and aggregates results with the schools. The program has been such a success that it expanded from Fantastic Fridays to also include all other weekdays.

While the matriculation officers reported having all of these activities in place, it is unclear how specific the information is about such high-stakes issues as placement into college-credit classes. Also unclear is how many students were reached through these services. Given the comments reported in this study from students at the community colleges, what is clear is that many students did not get the intended benefit.

2. Assessments of Incoming Students

Most incoming students are required to take assessments in mathematics and English to place into courses that offer transfer-level credit. We asked students in the focus groups what they knew about these placement assessments prior to taking them and how well they had prepared. In general, students said they were uninformed about the assessments. Some did not even know there were such tests. Others were unaware of the stakes involved and/or unprepared for the tests' content and format. Nearly all experienced the assessments as discrete tasks that they had to complete, not as part of a process in an overall education plan.

Uninformed about the assessments and unprepared for the content and format. Many students said that they had heard (often from friends or family members) that they needed to take assessments when they got to the community college. Others said they did not know about the assessments until they were admitted. Generally, even the few students who said they received information from the college about the tests did not know much about what was on them beyond the general area of study.

> *"[The college gives] you a little packet, or a little piece of paper that's about that narrow, and it gives [just] two examples for both [placement tests]. So you have no idea what to study." [College E, non-transfer/student success]*

When asked, retrospectively, what they thought about preparation for community college when they were high school students, the students in the focus groups said they had not understood that there might be important reasons to prepare for the assessments. As a result, some students just did not bother to prepare. Others said that they thought the assessments were supposed to capture them at a point in time without the benefit of studying.

> *"We had [information about the tests], it was online and everything, and, actually, the counselor told me to go online and try the sample questions, but I didn't." [College E, non-transfer/student success]*

> *"Normally I don't really like to prepare for anything that has to do with things like placement tests, because in a way it feels like I'm cheating myself a little. I'm thinking, 'Well, I didn't know these concepts before the test, and all of a sudden they tell me that I have a test coming up. So let me prepare for it.' And it feels like I'm sort of cheating." [College D, non-transfer/student success]*

Fewer than half (44 percent) of the colleges that responded to our survey indicated that they provide practice placement tests for their students. Even in cases in which practice tests were available, however, many students did not know they were available, did not think they should prepare, or thought that preparation would not change their placement. Counselors at one college reported that they have a flier about practice tests but only hand it out if students specifically request it.

Many students indicated that the assessment they took was not connected to what they studied in high school. The tests were not seen as part of a process of preparation that began in high school, but as a hurdle unconnected to their previous studies. Even when students did not place into college-level courses, they often said that they thought the tests were "basic" or "easy" but that they had learned the information such a long time ago that they no longer remembered it.

Some of the main content-related difficulties cited by students concerning the mathematics assessments included the challenge of doing mathematics on the computer and the difficulty of the mathematics vocabulary for English language learner students. Many students said that the test covered topics they could and should have reviewed. Several student quotes illustrate the frustrations students had with test content:

> *"It wasn't a test of what you could do, but about what you could remember from a long time ago." [College A, non-transfer/basic skills]*

> *"I came straight after high school, and I was doing algebra and geometry. After you are at so high a level, to come to college and get an assessment on just all basics—you're really not in that mindset anymore. Even right after high school, you're on to bigger and better*

problems, so to come back in [and do] fractions— what are fractions?" [College B, basic skills]

Unaware of the stakes. Before taking the assessment, most students did not understand that their performance on it would determine which classes they would be able to take. Many did not realize that their performance would affect whether they would be able to get college credit for their classes right away or that it would affect how long it would take them to complete their education goals.

"I thought it was one of those tests that you take just to see what kind of field they were going to recommend. And then I found out it places you in classes." [College D, non-transfer/learning community]

Preparing for Placement

Interviewees stated that the factors important for adequate assessment preparation include knowing the purpose of the test; its format and procedures (whether it is timed, multiple choice, computer adaptive, etc.); its range of content; and methods for studying and preparing. Students in basic skills classes had much less clarity about these issues before taking the tests than did their counterparts in transfer-level classes like English 1A.

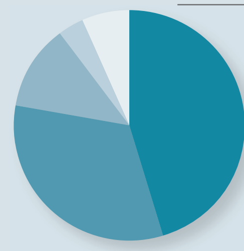
"[The woman at the test center] said, 'It doesn't matter how you place. It's just to see where you are.' Looking back, that's not true. It's really important." [College E, transfer/student success]

3. Counseling

Many community colleges require or advise students to meet with a counselor before being placed in their courses. We asked students about their experiences meeting with counselors, particularly concerning their assessment results, placement in courses, and course selection, but also in seeking guidance on their education plans generally. Many students reported frustration over long waiting lines and limited attention, and some said counselors conveyed low expectations about the level of courses the student could master. In general, students participating in programs that made them eligible for special counseling (e.g., Puente, Umoja, or athletics, which tend to have lower student/counselor ratios) reported greater satisfaction about counseling received.

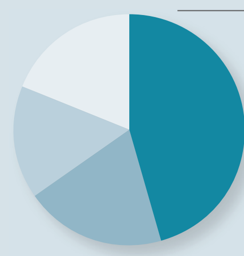
Placement Assessments

Our survey of matriculation officers in the community colleges found variation in the placement tests used on different campuses but also some convergence around a few common assessments: 84 percent of colleges that responded indicated that they used one of two assessments in mathematics, and 70 percent said that they used one of two assessments in English (see figures). The ACCUPLACER is the most common assessment for both mathematics and English.



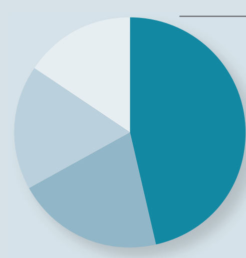
Assessments for Placement in Mathematics by Percentage of Colleges Using These Tests

- 49%–ACCUPLACER
- 35%–Mathematics Diagnostic Testing Project (MDTP)
- 13%–COMPASS
- 4%–Self-Assessment
- 7%–Locally developed test



Assessments for Placement in English by Percentage of Colleges Using These Tests

- 49%–ACCUPLACER
- 21%–College Tests for English Placement (CTEP)
- 17%–COMPASS
- 20%–Locally developed test



Assessments for Placement in English as a Second Language (ESL) by Percentage of Colleges Using These Tests

- 48%–Combined English Language Skills Assessment (CELSA)
- 21%–COMPASS
- 18%–ACCUPLACER
- 16%–Locally developed test

Source: Survey of matriculation officers that was sent to all community colleges, with 73 of the 110 community colleges responding, 2009.

Students and counselors alike told us that they wanted counseling to be in-depth, consistent, and available to all incoming students prior to registration for classes, but students generally did not view counseling as part of a continuous process. Rather, they described a series of independent, uncoordinated events. Counselors themselves reiterated points they made in assessment discussions about feeling increasingly hamstrung as numbers of students swelled while funding for programs and staff shrank.

Such counseling challenges result not only from budget cuts, but also from the dictates of state policy. State law requires that 50 percent of all community college operating expenses be dedicated to direct classroom instruction. Counseling, therefore, has had to compete with other "non-instructional" costs for an increasingly limited portion of funds.

High student-counselor ratios. High student-counselor ratios throughout California's community colleges make it impossible for counselors to do what most told us they wish they could do: get to know students well, work with them to develop an education plan, and meet with them multiple times to select classes and help them track and meet their objectives. Counselors reported that with their limited one-to-one time, they focus on helping students make a personal connection with the college—"whether through the Puente club or with an instructor or counselor or with the janitor," as

Cut Scores

Each college sets its own qualifying test score level, meaning that students scoring below that level lack readiness for enrollment in college-credit courses. Across the system, these "cut scores" vary considerably. For example, in mathematics, cut scores to place into transfer-level mathematics courses ranged from 43 to 63 on the ACCUPLACER College Level Mathematics exam. Such variation in cut scores can send mixed signals to high school students across the state about what qualifies as college readiness. Some of the students we interviewed had received different placements at two different colleges based on the same test scores. More research is needed to understand the rationale for cut score variation as well as to determine the implications of such variation.

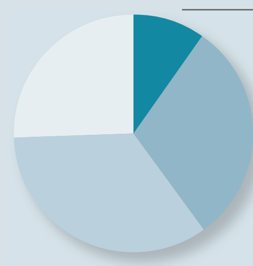
Common Assessment Across the System

Nearly all (97 percent) of the matriculation officers surveyed were aware of state-level policy discussions about the possibility of adopting a single placement test in each subject area for all California community colleges. While 62 percent of them personally believed that such a change would be beneficial, only 16 percent believed faculty and staff at their campuses would agree. The two benefits the matriculation officers most commonly mentioned were cost effectiveness and portability (i.e., students transferring within the system would not need to take another assessment).

Individualized Counseling

Community college students want individual counseling for placement advice, but many do not have access to it. While estimates from matriculation officers vary, about 41 percent of those surveyed said that less than half of students at their college gained individual access to an advisor or counselor to discuss placement results.

Variation in the responses of matriculation officers as to whether students met individually with a counselor



- At 10% of the colleges, less than one-quarter of students met individually with a counselor
- At 31% of the colleges, between one-quarter and one-half of students met individually with a counselor
- At 35% of the colleges, between one-half and three-quarters of students met individually with a counselor
- At 26% of the colleges, more than three-quarters of students met individually with a counselor

Note: These percentages reflect the estimates of matriculation officers about their colleges and are not necessarily based on counseling data at the colleges. Percentages do not add to 100 due to rounding.

Source: Survey of matriculation officers that was sent to all community colleges, with 73 of the 110 community colleges responding, 2009.

one counselor said, "if there is no connection, it's going to be hard for them to stick around."

In focus groups, students verified that their actual contact with counselors was fragmentary. Students did not perceive course selection, counseling, and education planning as integrated.

Many students were frustrated that they could not talk with a counselor between receiving their placement scores and registering for classes. Many counselors echoed this concern, citing the challenge of finding time to see every student during the registration period. Students at some colleges signed up to see counselors months in advance to get an appointment during the registration period, but that did not seem a viable option for incoming students. Moreover, many counselors stated that, this year in particular, many courses were already filled before incoming students took their placement exams.

Student Success Courses

With resources for one-to-one counseling increasingly scarce, California's community colleges are devising alternative ways to help entering students become college ready and succeed in college. Nearly all the colleges surveyed (97 percent) reported offering courses designed to provide students with college information and to teach them study skills and the habits of mind associated with college success. In addition, most colleges (81 percent) reported offering summer preparatory courses for incoming students. Matriculation officers reported that approximately 22 percent of incoming students participate in these programs, and recent research indicates that such "student success" courses do have positive effects on a student's chances of earning a credential.[9]

Long wait lines and limited attention. Given the limited funding for counseling, it is not surprising that none of the participating colleges had enough counselors to meet demand. At one college, a counselor told us that there were 17 counselors for 20,000 students. Ratios of 1 counselor per 1,000 students are not uncommon across the state (MDRC, 2010).

Counselor appointments that fill up weeks in advance are the norm at many colleges. Survey data showed that students' inability to get appointments when they need them was a source of frustration to counselors and students alike.

> *"It's hard if the classes are going to start and you don't know what classes to take because you can't get an appointment." [College B, non-transfer/basic skills]*

Some students tried for walk-in appointments, expecting to have to wait. But one reported being exasperated when there was no way to tell how long the wait would be.

> *"I kind of wanted to have a one-on-one counselor [appointment], but there were no appointments, and you had to sit there for hours. They didn't tell you if it was an hour, two or three hours—just sit there and wait to see a counselor. I didn't have the time to do it, so I had to just get whatever [courses] I could get." [College B, non-transfer/basic skills]*

Students also expressed frustration that their sessions with counselors were so short. They felt that counselors explained too little about the meaning of their assessment scores and did not clarify how those scores were linked to their course placement.

> *"They don't go over [the test result] with you. They just give [the score] to you." [College D, non-transfer/learning community]*

> *"They should at least guide me through some classes that I wanted to take. The counselor just asked me, 'What classes do you want? Sign this paper.' I was out of there in ten minutes." [College B, non-transfer/basic skills]*

> *"You have a question, and the counselors just give you a website. You're like, 'Well then, what are you here for?'" [College C, non-transfer/learning community]*

More satisfaction with dedicated programs. Students were most satisfied with counseling experiences focused on particular communities, such as international programs, athletic programs, Puente, Umoja, and career programs. Students said that counselors within these programs better understood their individual situations and goals, were more available to them, and provided more useful advice. Because these programs generally have lower student/counselor ratios, their costs make them difficult to scale. Yet student comments suggest significant benefits:

> *"I used to have different counselors. Every single one was giving me different directions, and I was so lost. I didn't understand so many things. Then I got into the*

[9] See, for example, Zeidenberg, Jenkins, and Calcagno (2007); O'Gara, Karp, and Hughes (2009, January 1); and Karp and Hughes (2008).

Puente program. The counselor I have is the best, and now I know my direction, I understand it, and it's really good." [College D, non-transfer/learning community]

Given that access to these programs is limited, some students believed it would be helpful if they were at least assigned to a specific counselor, a practice used by 13 percent of the surveyed colleges to help avert disjointed, unhelpful experiences. As one student said,

"I met several counselors, and each of them said something different. So you start to have your own opinion on the subject." [College C, ESL]

One of the ironies in our higher education system is that community colleges, which serve higher education's most at-risk students, have the worst student-counselor ratios due to budget constraints. In other words, the students most in need of comprehensive counseling are often least likely to get it.

Four-year universities with competitive admissions policies—that is, with students who have already demonstrated success—often have quite comprehensive, one-on-one supports for their students. For example, at Stanford University, all freshmen and sophomores have a pre-major advisor and a residential academic advisor. All students have access to a professional (career services) advisor, a departmental academic advisor (once a student declares a major), an honors advisor (for those in honors programs), a faculty research advisor (for those who wish to do independent projects), an overseas planning advisor (for those who study abroad), peer tutoring, writing tutors, oral communications tutoring, and academic skills coaching (one-on-one tutoring) (Stanford University, n.d.). In the community colleges, each counselor must play all of those roles for thousands of students.

At Stanford, moreover, the menu of services is targeted and differentiated; students at all stages of the readiness spectrum can receive special attention. And some of Stanford's services are almost free to the university, since they are provided by a cadre of volunteer faculty and graduate students.

4. Post-Assessment Confusion and Frustration

Many students remain confused about the assessment and placement process throughout their community college experience. They may feel stuck in the courses they are taking, with no way to advance more quickly, even if they are motivated to do so. Both students and counselors voiced concerns that many students in such predicaments drop out.

Counseling Information

The counselors interviewed recognized the need to provide information to students in several forms, including websites, student success classes, and one-on-one sessions. Students agreed that many routine issues could be handled better online. That would free up counseling time, they noted, for the personalized, face-to-face meetings they preferred for discussing assessment and placement issues and for getting their related questions answered.

Problems students reported encountering or discovering after taking placement assessments included an uneven enforcement of rules, inconsistent policies across colleges in their area, and confusion about test-retaking policies. Students and counselors alike reported confusion about multiple measures, and that confusion added to the challenge for students who questioned their course placements. These issues caused considerable student frustration; some students ended up curtailing or abandoning their education aspirations.

Uneven enforcement of rules. Many students reported their perception that a college's rules are often unevenly enforced. Some said that their friends at the same college enrolled in classes without taking placement exams, while they were told they could not do so. Others said they knew people who enrolled in courses in their major without first taking the required English and mathematics classes.

Inconsistent policies across colleges. Students were also frustrated by a lack of consistency among colleges in their area. For example, at many community colleges, students receive a score promptly after taking the assessment, along with information about the level of courses into which they have been placed. At other colleges, students have to wait up to several weeks to receive their scores.[10] One student who waited two weeks for her scores explained the consequences:

[10] It often takes several weeks for colleges to return scores on writing tests, which are scored by hand and cannot be scored instantly like the multiple-choice assessments.

"When I got the scores, I wasn't able to get into the classes because the classes were already filled up. So I had to basically wait a semester or go to a different college." [College E, non-transfer/learning community]

She did go to a different, nearby college—where she had to go through placement processes again because the second college didn't accept the scores from the first. The inconsistencies were most problematic for students who were shopping around for classes at different colleges in the same region and receiving different answers, or encountering different expectations, from the various colleges. For example, we spoke with students who started in a particular level of basic skills and worked their way out of that level at one college, only to place below that level at another. Whether this was due to different assessments or to variations in instruction and grading is not clear, but it was not an isolated experience.

Lack of clarity about policies for retaking placement tests. Many students in the focus groups were not sure whether or when they could retake a placement exam, how they would go about doing so, which materials they should study if they could retake it, and whether or not studying would make any difference.

Confusion about multiple measures and ways to challenge course placement. Students who were unhappy about their course placement did not know that multiple measures, not just their assessment results, can help determine placement. Many had heard of students who had challenged placements, but they were not sure how to do so. Some said they did not take action because by the time they realized that the course they had been placed in was too easy, the semester was underway and course sections were already full.

The community colleges are required to consider multiple measures[11]—not just the results of a single assessment—to place students into courses. For example, counselors can include such factors as how recently students have taken coursework in a given subject area and how high a level they reached in that subject in high school. But students are not always clear exactly which measures are used and how, and several counselors reported similar confusion.

In addition, while many colleges use high school transcript data as one measure, at one campus we studied, the lack of a high school transcript triggers the use of other measures and possibly more extensive choices. There, if students provide their high school transcript, they are more likely to be locked into the course placement identified through their assessment. If they do not submit their transcript, they are allowed more flexibility in their placement, and can meet with a counselor to decide together on the best placement. Three counselors interviewed about this policy find it confusing and counterintuitive, but they did not know who could change it.

Matriculation officers surveyed noted a wide variety of multiple measures in use across the colleges. Sixty-five percent of those responding cited questions embedded in their college's placement test as one type of measure—that is, the test opens with questions that ask the student, for example, how prepared he or she is for the test. This practice raises serious concerns, since asking students at the outset to reflect on their level of preparation could negatively influence students' views of their abilities and, consequently, could negatively influence students' scores.

One student, who said he wished his counselor had discussed test preparation with him, said that at the very least, he was taken aback by the embedded questions:

"I was surprised that, when you're starting the test, the test [asks], 'How prepared are you?' And then it says, 'Really Good,' 'Bad…' I put 'Really Bad,' because I was not at all prepared for the mathematics, and I did score very low. It was stuff that I would know, but I just couldn't remember how to do it." [College E, non-transfer/student success]

Students' frustration about their predicament. Of the students interviewed, most who were in the basic skills classes reported feeling frustrated as they began to understand how long it would take for them to "catch up." They were upset to be paying for what they felt were essentially high school classes all over again.

"[The class they put me in] was too easy for me. It was great to review, but I just felt like I wasted a whole quarter not doing anything." [College C, non-transfer/learning community]

"I didn't know what to expect. Now that I see what classes my scoring brought me to, I feel kind of

[11] The California Education Code stipulates that a test score cannot be the only criterion used to place a student.

bummed out that [the classes] are not going to count towards my degree yet." [College D, non-transfer/learning community]

"You spent four years in your high school, and they're judging your four years just off of that test. It puts you backwards." [College A, non-transfer/basic skills]

As noted earlier, although many students said that they had not been encouraged to take more rigorous classes in high school, they often blamed themselves for not working harder back then:

"It's like, oh my gosh, I just basically wasted four years [in high school] by taking the easy track, when I should have taken the more advanced." [College D, non-transfer/student success]

"I realize there were so many classes that I should have taken [in high school]. I should have maybe added

Problems with Transparency of Policies

Confusion, inconsistency, or lack of transparency result from many community college practices related to the assessment and placement of incoming students. Problems include:

Lack of course alignment. Many counselors discussed the extent to which lack of alignment in coursework between high school and college is problematic for students, who are often confused by common course names in high school and college when the courses themselves are set at very different levels. For example, a common complaint was that high school algebra bears little resemblance to college algebra. As one college counselor noted, many students come from high school and say that they have already taken calculus, but then do not score high enough on their placement tests to even take intermediate algebra, which is one level below transfer-level mathematics.

Confusion about multiple measures. While almost all the students said that they thought their test scores alone determined their course placement, the counselors we spoke with reported that, in accordance with state policy, other measures are also included in the calculation of course placement. Yet many counselors were not certain how multiple measures are integrated with the test scores at their campus, except in cases where students came in to challenge their placement score. In these cases, counselors said, transcripts, other documents, and student motivations or aspirations were considered. According to our survey, 65 percent of the matriculation officers estimated that their colleges included multiple measures within the computerized placement exam and automatically factored the measures into the assessment score. This is done, for example, by asking questions on the exam about student aspirations and level of preparation. About two-thirds of the matriculation officers estimated that the use of multiple measures helped students place in higher-level classes than would otherwise be the case.

Variation in retake policies across colleges. Variations in retake policies across colleges create confusion and coursework delays for many students. One variation example provided by our survey is that across the system, the mean wait time to retake a mathematics assessment was 160 days; the median was 73 days (responses ranged from 0 to 1,095 days). Responses for English were similar.

Variation in acceptance of scores from other colleges within the system. Student mobility is hindered when assessment results from another college are not accepted. Yet according to research conducted by the Consultation Council Task Force on Assessment (2007), only some of the system's colleges accept all scores. Some accept scores from colleges within the district or region, and some rarely accept scores from other colleges. The percentages that fall into each category vary by subject matter, but approximately 12 percent of colleges reported that they never accept mathematics placement test scores from other colleges, and approximately 14 percent reported that they never accept English placement test scores from other colleges.

a class to this semester, to that semester, but I didn't." [College E, non-transfer/learning community]

Students also expressed frustration at the limited number of course sections available generally, and specifically at the basic skills levels:

> *"There are no classes. If you have a low assessment score, you're trying to get into classes you can take, and those classes are full. It's just really frustrating." [College B, non-transfer/basic skills]*

Basic Skills Course Enrollment

Matriculation officers estimated that, on average, 65 percent of students at their colleges enroll in the courses recommended by their placement. The estimates varied substantially, however, ranging from 25 percent to 98 percent across the state, suggesting that placement may be perceived as mandatory at some colleges and not at others. While placement cannot technically be mandatory, all of our survey respondents reported that their colleges use mechanisms to make sure that students enroll in courses sequentially. For example, some colleges block students who try to enroll in a course higher than the level at which they placed or without the required prerequisites.

Colleges offer, on average, three or more levels of basic skills classes in mathematics and English. More specifically, 74 percent offer two levels, and 83 percent offer four. Matriculation officers estimated that, on average, 32 percent of their students placed in the lowest level in both mathematics and English.

Slightly more than half (54 percent) of survey respondents said their college provides opportunities for students to accelerate their progress through basic skills. More research is needed to know how broadly these opportunities are made available, how students are informed of them, and how often they use them.

Impact on education aspirations. Not surprisingly, as students realized that they would need to take a year or more of coursework before they could register for college credit-level courses, many felt stuck or considered dropping out.

> *"At the beginning, you just think what you're taking is good, but then after a few days, you see how you messed up, and you can't reverse it." [College E, non-transfer/learning community]*

> *"If you take a placement test and find out you're one or two classes behind, that's okay—three years [to earn an associate's degree]. That's if you place right below transfer-level classes. If you place further down, you're going to be here for a while. And I think that's the community college's way. I see people that have been here, it seems like, forever and they're kind of stuck here." [College C, non-transfer/learning community]*

> *"You don't really know that it's going to take that much longer to transfer… If you put that in someone's mentality, they're going to be [thinking], 'Oh, it's going to take forever.' And that's when they say, 'This is not for me,' and they're going to drop out." [College C, non-transfer/learning community]*

Wide Variation

Survey respondents reported that faculty members are typically responsible for establishing assessment and placement policies in the colleges. Counselors implement those decisions. In our interviews and surveys, counselors and matriculation officers often questioned the effectiveness of their college's policies and practices. For example, we learned that one college requires students who place into the lowest level of "reading" to enroll in the same reading course—not different versions of it, but the same actual course—four times in a row before moving on to more rigorous coursework. Of the three counselors we interviewed at that college, none thought that was an effective policy; they all believed that it encouraged students to drop out, and none knew why it was implemented.

Another college requires students to wait three years before retaking a placement exam—meaning that, in effect, there is no real "retake" option at that college. The counselors we interviewed did not believe that this policy was appropriate.

While these are anomalies, they demonstrate the wide variation in policies and practices throughout the community colleges and, thus, in the challenges students encounter.

Promising Approaches: Providing Options for Acceleration

In California and nationally, many efforts are underway to develop instructional models that help students gain the basic skills they need to qualify for college-credit classes. These include identifying the specific academic deficiencies students may have (for example, in a specific aspect of mathematics that they may have learned several years ago) and helping them master those specific areas rather than requiring them to take a full-semester course. Other efforts include intensive classes, accelerated coursework, and targeted student supports.

Mathematics academy for incoming freshmen. At Cabrillo College, the Academy for College Excellence (ACE, formerly known as the Digital Bridge Academy) is an intensive program that aims to help at-risk students build confidence, become well-organized and effective learners, and ultimately move into regular community college courses. Cohorts of approximately 29 students begin with a two-week foundation course that emphasizes team building, communication skills, exploration of learning and working styles, self-efficacy, and motivation. The group then enrolls in a 13-week bridge semester that includes accelerated academic work and directed academic and personal support. At the core of the bridge semester is a project-based course in which students conduct primary research on a social justice issue (Jenkins, Zeidenberg, Wachen, & Heyward, 2009). Since its beginning in 2002, the program has transitioned more than 675 at-risk students into the college's regular courses. A recent study by the Community College Research Center (CCRC) at Columbia University examined nine cohorts of ACE students from 2003 to 2007. The study found that while more than two-thirds of ACE students tested two levels below college ready in math or reading, 80 percent passed associate degree–level English within two years. The strength of these results led to the addition of accelerated classes in 2009–2010 (Academy for College Excellence, 2010).

Accelerated courses in developmental English. Chabot and Las Positas Colleges have implemented accelerated, one-semester courses in developmental English. Research completed on five years of data at Chabot provides evidence that students in this accelerated class show greater success in English 1A than those who took the traditional two-semester, developmental sequence. The research also shows improved success for these students in other courses across the curriculum (Hern, 2010, and Hern, Arnold, & Samra, 2009).

Research at Las Positas appears to show that students in an open-entry, accelerated, one-semester course in developmental English were more successful than those in the traditional two-semester course. Students in the accelerated course were more likely to complete the class and go on to earn higher grades in English 1A. In addition, students who received higher reading scores on the placement exam (but below the cut-off score) were more likely to withdraw when enrolled in the two-semester developmental sequence. These findings are still preliminary, and are serving as the starting point for a collaborative team of English and counseling faculty to examine the English curriculum in light of student needs and success rates (http://www.facultyinquiry.net/teams/las-positas-college/).

Recommendations

This study found that students in California's community colleges generally experience assessment and placement not as a process for which they begin preparing in high school, but as a single event—a one-shot deal, with pivotal consequences, for which many feel uninformed and underprepared.

These findings add to a body of research showing that California's K–12 and community college systems are not currently structured to support successful transitions from high school to community college for a large proportion of students. Because the systems lack alignment, the courses taught and tests administered in middle and high school are not connected to the knowledge and skills required in college.[12] Because cross-system collaboration and communication lag, students often get few, if any, signals about community college expectations. Many are unprepared, in part, because they never hear in advance what they are expected to know for community college readiness.

In this larger picture, students could move more successfully from K–12 to the community college system if the systems better aligned their content and strategies and forged closer links in terms of supports they offer students, especially as students transition between systems. But a major barrier to enacting closer, cross-system connections is the decentralized structure of the community college system, which operates less as a system than as a confederation of autonomous units. The community colleges' long history of local control does allow for the tailoring of curricula to meet local needs. But it also does students a large disservice by impeding the needed systemwide connections with K–12 education, including the alignment of policies, practices, pedagogies, and expectations. Students are often not "ready" because the systems lack coherent ways to signal to them what community college readiness means.

Local autonomy is important. But given how many students are not succeeding in their desired educational paths, and given state and federal initiatives pushing for greater student success in higher education, the authors urge California's community college leaders to work together to connect with K–12 and clarify and publicize their expectations for incoming students. Many of the following recommendations would be more effective if the colleges could agree upon common policies and practices and communicate one unified message clearly to prospective students. Especially in this time of fiscal crisis, coming together could save money and increase efficiencies; it does not make practical sense for students for policies to be so locally based and idiosyncratic. That idiosyncratic nature demands a personal touch that is currently impossible due to funding constraints.

But creating systemwide changes is difficult because of a lack of governance authority at the state level. The Chancellor's Office is urging colleges to use common assessments, but the system office does not have the regulatory authority to change campus-level policies.

[12] See, for example, Venezia et al. (2003)

Only the colleges can voluntarily and collectively make these changes to benefit students. The large disconnects across the systems seem unlikely to be fixed in the short term, due to the state's fiscal crisis. Yet *particularly* in these difficult budget times, when educational services are limited, students need to receive clear signals—early in their high school career—about the importance of preparing rigorously for community college, and prospective students deserve a clear roadmap that will show them how assessment and placement can have real effects on their educational goals.

Community colleges already view matriculation services as an iterative process that seeks to support students in reaching their education goals.[13] Many community colleges are leading the way in developing, implementing, and testing innovative, student-centered reforms, as evidenced in the "Promising Approaches" sidebars in the "Findings" section of this report. Additional action can further strengthen the process for students. With an awareness of the challenges facing already underfunded and overburdened community colleges, we offer the set of recommendations below, grouped in two large categories: 1) work across systems to ensure that assessment and placement are part of an overall process, not a one-shot deal; and 2) experiment with innovative practices in student services and instruction.

Necessarily narrow, since they stem from this one study, these recommendations represent steps that can lead to the bigger vision of broad and deep system change supported by a body of research that now includes this study.[14]

1. Work across systems to ensure that assessment and placement are part of an overall process, *not* a one-shot deal.

Assessment and placement should be part of a continuous process of learning that starts in middle or high school and ends once students complete their intended path in higher education. Educators in K–12 and postsecondary systems need to be conscious of each aspect of the process as they shepherd students through it. Students should not be distracted by the process itself; rather, the mechanisms put into place to support their transition to college should simply be a matter of course, starting in the early grades and self-reinforcing across the systems. For example, counseling in middle and high school should reinforce issues of importance for the colleges (such as assessment and placement expectations), and college and high school standards should be explicitly connected so that students will have an early understanding of their level of readiness.

Community college professionals we interviewed believe the process has improved and become more integrated, though they say it is not necessarily transparent, even to all educators. The following recommendations suggest different ways through which students can receive more information earlier about community college preparedness and have access to relevant coursework and support.

Recommendation: The California Community Colleges Chancellor's Office, and the California Department of Education should work together to develop strategies and programs to engage middle and high school students early in activities that help them know where they stand in terms of community college readiness, learn ways to stay on track, and understand the costs of not preparing.

At least by early high school, all students should be engaged in regular, ongoing processes that inform them about community college placement standards (as well as those of CSU and UC); provide them with diagnostic information (through assessments and other measures) about their preparation for community college coursework; and encourage them to improve their academic and career readiness through challenging classes and incentives. This is a shared responsibility between secondary and postsecondary education systems and state agencies.

Early outreach to high school students. Across the board, students interviewed for this study mentioned that they wished they had more information about community college earlier in their educational lives.

[13] See the Riverside Community College website at http://www.rcc.edu/services/matriculation/index.cfm. As another example, Linda Michalowski, Vice Chancellor for Student Services and Special Programs for the California Community Colleges, in an email to chief matriculation officers at the community colleges, emphasized the importance of matriculation services "that you provide to help students be successful and attain their educational goals" ("Further Clarification about Matriculation," October 26, 2009).

[14] See, for example, Moore, Shulock, and Offenstein (2009) and Bueschel (2003).

Particularly when budget conditions are challenging and postsecondary education offerings are limited at every level, it is crucial that community colleges continue their outreach to high school students. We suggest expanding outreach as well as improving messaging, and targeting students earlier, by 9th and 10th grades at the latest. The specific focus should be readiness *for community college*. The goal is to change student understanding about the rigor of community colleges and to affect their course-taking choices early in high school—not to exclude students, but to ensure that all students have the opportunity to prepare effectively. Reaching that goal requires coordinated training and professional development opportunities for high school counselors, provided by partnerships between high schools and local community colleges.

High school curricula. As many studies have recommended, the high school curricula should be connected to community college expectations as a baseline. The connection should be clear in the academic core as well as in career and technical education, structured pathways, and concurrent enrollment programs. While not all students wish to attend college, the sequence of courses should be transparently connected. For example, articulation agreements can ensure a scope and sequence across high school and college. If aware of the sequence, high school students can make more informed decisions. Right now, the status quo is disjuncture. High school graduation requirements and the California High School Exit Exam are not linked to college readiness and success. Many high school graduates in this study will need two years or more of basic skills courses before being ready to take college-level courses—and no one is held accountable.

Assessments in high school. Early assessments of high school students concerning their postsecondary readiness can also help by providing diagnostic information about each student's readiness. The results would not only engage students, but help the system identify where resources need to be focused to address student gaps *while students are in high school*. In Michael Kirst's paper about the CSU Early Assessment Program (2010), he proposes ways to use the EAP not just as an indicator of CSU readiness, but as a common indicator of college readiness, including for community college. He also suggests that the program include earlier preparation efforts. While the EAP sends an important signal about college readiness, he writes, it should also include scaffolded instruction and content in earlier grades so that students are prepared in advance for the 11th grade assessment. In addition, he recommends that the EAP incorporate an early warning assessment system, based on the California Standards Tests, in grades 8–10 and that modules from the EAP's writing course, now available only to 12th graders, be offered in earlier grades.

The idea of revising the EAP offers a good starting point for a conversation about whether California should have a common indicator of college readiness. The EAP model, however, has limitations relative to community colleges, since community-college-bound students generally need earlier interventions than those bound for four-year colleges. Moreover, four-year-university-bound students often receive additional signals of college readiness (such as the SAT/ACT and grades in a-g courses). Community-college-bound students often receive no other signals, despite being, as a group, the least prepared.

Recommendation: The Chancellor's Office should develop a statewide interactive website to provide prospective and incoming students with clear information about placement assessments statewide and opportunities to prepare for them. This requires more uniformity across colleges in terms of policies and practices.

To assist prospective and incoming community college students, the Chancellor's Office should establish interactive online information and preparation opportunities for placement assessments and encourage all incoming students to take practice tests. The test preparation activities should be aligned with the main assessments included in the Assessment Warehouse. Creating statewide practice assessments would likely require moving toward more uniformity of assessments and cutoff scores across the community college system, since providing separate information and assessments for each college would be unwieldy and confusing for students.

The online features would provide information about the purposes of the assessments and their impact on the students' educational opportunities. In addition, the features could inform students of likely course placements associated with various scores—as well as the average time to degree, based on the course placement. Over time, these online opportunities should include college readiness and matriculation issues more generally.

The Chancellor's Office should also work in collaboration with the California Department of Education to develop and add interactive features that lay out connected courses of study from high school through community college. This effort includes developing and providing clear information about community college readiness standards statewide and how they connect with and build from high-level coursework in high school. The website should include pathways (and samples of articulation agreements) featuring career and technical education and showing the high levels of mathematics and English readiness required for those options in the community colleges. The site could also connect to social networking sites that students already use.

Statewide online engagement would be an efficient way to bolster individual college outreach efforts concerning assessment preparation and postsecondary readiness, though the Chancellor's Office would need to pilot several strategies to determine the most effective way(s) to ensure that the information is used. The website's elements could build from efforts currently underway in the Chancellor's Office to work with the Academic Senate, matriculation officers, counselors, and others to explore opportunities for developing state-level support systems such as online assessments, counseling, and orientation tools.[15]

Recommendation: Community colleges should develop clear messages about assessment and placement, pilot different approaches to communicating this information to high school students, and determine which one(s) are most effective.

While all colleges have information available (on their websites or through brochures) about placement tests, many high school students do not access the information, nor do they understand how the assessments may impact their educational goals. Colleges should clarify all key matriculation policies at the college level that affect course-taking and education goals. These policies include but are not limited to the use of multiple measures, assessment retake policies, challenge policies regarding course placement, the mandatory nature of course placement, and course acceleration opportunities. Colleges should develop clear messages and experiment with different approaches for communicating this assessment and placement information to prospective students. Possible pilots include:

- repeated dissemination of information through multiple channels, including flyers, college websites, emails, texting, social networking, and student testimonials;
- specific information about the costs of not preparing for college and not performing well on the assessments;
- practice testing and actual assessments on high school campuses;
- online practice testing on college websites;
- user testing and analysis of website information to gauge its accessibility and clarity for high school students;
- online educational modules that provide students with study guides exposing them to the format and content of the test; and
- working with local high schools to embed information into high school curricula.

2. Experiment with innovative practices in student services and instruction.

Community college staff interviewed for this study emphasized that now is the time to develop and try new approaches. When colleges have excess capacity, they focus on increasing enrollment, since each additional student brings more state funding. Since enrollment is not a problem at most colleges right now, attention and energy can be focused on innovation.

Recommendation: Assessment developers need to develop new and better diagnostic instruments for assessing college readiness. Once diagnostic assessments are available, the state should create incentives for colleges to adopt them and to offer diagnostic testing opportunities directly to high school students.

[15] For recommendations about online opportunities for counseling and academic planning while in college, see the next category of recommendations.

Most of the placement tests used by the community colleges do not provide diagnostic information to the students to help them identify the specific areas in which they need the most support. In addition, there is evidence that current placement tests are not well connected to the key cognitive strategies necessary for postsecondary success, such as analytical thinking (Conley, Hiatt, McGaughy, Seburn, & Venezia, 2010). Better diagnostic instruments could be very helpful to students trying to understand why they are not considered college ready and to high school and college faculty trying to bring students up to speed quickly.

Examples exist of diagnostic assessments that could be used more widely. These include the Mathematics Diagnostic Testing Project of CSU and UC as well as the College-Readiness Performance Assessment System developed by the Educational Policy Improvement Center. More tests of this type need to be developed and validated. Once more such tests are available, incentives to adopt these instruments should be put in place. Given the decentralized nature of the community colleges, incentives tied to funding streams tend to be effective at influencing change at the local level. The Chancellor's Office's Basic Skill Initiative offers one example.[16] It remains to be seen whether similar success occurs with the Chancellor's Office's Assessment Warehouse and the implementation grants for the EAP.

Recommendation: Colleges should encourage experimentation with delivery systems for counseling services and information to leverage limited resources and provide the strongest possible support for the least-prepared students.

Pilot different counseling delivery modes. Current resource constraints present significant barriers to a universal one-on-one counseling approach. Given this, a menu of alternatives should be considered and piloted to determine which types of information are most effectively provided by counselors, versus information that could be most effectively delivered by other means. Options include interactive online counseling services (described in more detail below), college websites that are more student-friendly, "express" lines in counseling offices, text messaging for frequently asked questions, and the use of counseling assistants for routine questions. New policies adopted as a result of findings from pilots would then help to reserve face-to-face counseling time for the individualized needs that most require it.[17]

Pilot interactive online counseling services. The Chancellor's Office should consider developing interactive online counseling services for community college students statewide. The services could enable students to access general information about college policies; access their own educational history, assessment scores, multiple measures, and placement recommendations; develop their own individual education plan; and engage in step-by-step processes for educational goal setting. These services could also facilitate meetings with counselors and document students' goals and progress in ways that could be easily accessed and updated, so as to better address student needs over time. If appropriate, the online counseling services could be connected to the online assessment preparation services described in the previous recommendation.

Recommendation: California's community colleges should pilot innovative practices for improving and accelerating students' progression through basic skills.

Efforts underway in California and nationally show the benefits of offering accelerated approaches to help students progress through specific areas of basic skills more quickly. Colleges should pilot different approaches that help students achieve the basic skills they need in the most efficient manner possible.

Accelerated sequences in developmental mathematics and English. Colleges should continue to develop instructional models that help students gain the

[16] The Basic Skills Initiative (BSI) is a grant-funded initiative from the California Community Colleges Chancellor's Office, which began in 2006 as part of the strategic planning process. The goal of the BSI was to improve student access and success. It used two approaches. One was to allocate colleges' supplemental funding to specifically address basic skills needs. This funding was guided by locally developed action plans documenting usage of the funding. The outcomes of the BSI are tracked using the Accountability Report for Community Colleges (ARCC), specifically the ARCC Basic Skills report. The other approach offered colleges a Professional Development Grant designed to address training needs for faculty and staff in basic skills and English as a Second Language (ESL) (California Community Colleges Chancellor's Office, 2009a).

[17] The Chancellor's Office is working on developing some statewide support systems, such as online orientation and counseling tools, which could help to free up counselors' time at the colleges.

basic skills they need to qualify for college-level courses through intensive classes, accelerated coursework, and targeted student supports. Efforts such as those at Cabrillo, Chabot, and Las Positas Colleges (described in the "Findings" section) are a few examples of the good work that colleges are already doing in this area.

Summer boot camps and course modules for targeted incoming community college students. The efforts to accelerate student learning should include intensive short-term "boot camp" approaches as well as evening and other sessions for students who work. Course options should include student success courses, accelerated modules in areas of specific academic preparation (probably in mathematics and English), and review of key concepts in mathematics and English (particularly for those who have been out of school for some time). This is a particularly difficult time for this recommendation, since summer offerings are being eliminated across the state. But it is important to determine how short-term modular approaches can help meet specific student needs.

Recommendation: The legislature should provide funding to build capacity at the state level to assess the return on investment of the various approaches recommended in this report.

Since the Chancellor's Office does not currently collect assessment scores or placement recommendations, doing so would be a first step in determining the effectiveness of the pilot efforts recommended in this report. The legislature could allocate resources for the Chancellor's Office to issue an RFP for campuses to run their own pilots (like Cal-PASS and the BSI), or colleges could form a voluntary consortium. Greater administrative capacity will also be important to assess the effectiveness of efforts already underway, such as the Assessment Warehouse and the EAP. Without the capacity to conduct evaluations and cost-benefit analyses, in the long run it will be difficult to tell what, if any, differences these changes will make.

Preparation for placement into college-level courses is closely related to the challenges of improving college readiness generally. That being the case, these recommendations are directed toward matriculation generally—toward ensuring that more students experience components of matriculation not as a series of one-time, disjointed events, but more as an integrated process that engages students in early preparation activities; provides practice tests and early diagnostic assessments; offers tailored online support, guidance, and career and educational planning, as well as in-person individual counseling; provides course placement through transparent policies and practices that students understand; and offers accelerated opportunities for students to fill specific academic gaps and otherwise complete basic skills more quickly.

Conclusion

This research study began with two main objectives: to describe current assessment- and placement-related policies and practices at community colleges across the state, and to provide a voice for students in describing their experiences leading up to and during community college with regard to assessment and placement. Those two components provided useful points of comparison and allowed us to identify areas where community college policies and practices are falling short in terms of their key purpose—student support.

We expected to limit our recommendations to assessment and placement policies in the community colleges. But then we heard how surprised and frustrated students felt to have seen years slip away after they realized how rigorous community college was, and we heard them describe the disconnect between the community college assessment and placement process and their own high school experience. We concluded that if our recommendations did not include preparation for community college generally, they would not be addressing the students' central concerns.

It is often the case that education policies and reforms that make perfect sense from the perspective of an elected official or an administrator end up needing adjustment once put into practice. In this report, we have attempted to provide corrective policy feedback by featuring student perceptions and experiences.

For years, policymakers in Sacramento have discussed reducing the number of placement assessments offered in the community colleges. Many at the colleges oppose that idea in the interest of preserving local control, but the majority of the matriculation officers surveyed and students interviewed for this study thought that it would be useful to have a more streamlined system with clearer expectations. This issue merits further debate and discussion.

The history and realities of local control join a host of other factors, including the current fiscal crisis and the wide range of programs and degree offerings across California community colleges, that make policy changes difficult. But, as interviewees consistently stressed, now is the opportune time to try new approaches. The urgency to increase enrollment, which in previous years took all available energy, is now absent. Instead, all eyes nationally and across the state are focused on increasing student success and persistence. To succeed in community college, students need and deserve clearer messages, information, and activities that connect their high school and community college experiences. Through its approach to assessment and placement, the California Community Colleges system can play a strong role in providing these links.

Appendix

Methodology

Data Collection

The research for this project was conducted in two parts. In Part One, researchers selected five community colleges at which to conduct field research. We collected qualitative data about student experiences with assessment and placement practices and information from counselors about policies and practices. Colleges were promised anonymity in return for their participation. The five colleges are located in the Bay Area, central California, and southern California. To ensure a diverse set of institutions, we selected them based on factors such as geographic location, student population (ethnicity and size of student body), and transfer rates.

To conduct the work, we developed protocols for student focus groups and counselor interviews and pilot tested the questions with students and counselors at one college. Questions were then refined and reorganized prior to conducting the additional field research. We worked with matriculation officers, counselors, and faculty at the colleges to set up student focus groups.

Since a major part of this project focused on the signals students receive in high school about assessment and placement, we wanted to focus on students who were within two years of high school graduation. However, we found that high participation required conducting most focus groups during class time, meaning that the focus groups included both older and younger students.

To learn whether there were differences in understandings, experiences, and information received by students who placed into different levels of courses, we met separately with students in basic skills classes, students in transfer-level classes, and students in ESL classes (though that design did not work perfectly at each college).

In all, we conducted 28 focus groups with a total of 257 students. Focus groups followed a semi-structured protocol, with questions focusing on the student experience with assessment and placement in the community college.

With counselors at each of the colleges, we conducted open-ended interviews. These were geared toward gaining a better understanding of the policies and practices related to assessment and placement at each college. A total of 12 such interviews were conducted.

We also reviewed the websites at each of the five colleges to determine the type and accessibility of information on assessment and placement practices available to incoming students.

For Part Two of this research, we used preliminary findings from the field research to develop a telephone survey, which we conducted with matriculation officers at all 110[18] California community colleges. The survey asked matriculation officers to describe the assessment and placement policies and practices at their college. We pilot tested it with matriculation officers at three

[18] At the time we conducted the surveys, there were 110 colleges in the California Community Colleges system. In February of 2010, two former satellite campuses of Riverside City College became independent colleges, increasing the total number of colleges to 112.

colleges and made revisions accordingly. In cases where the person listed on the Chancellor's Office list was no longer the matriculation officer at the college, the college referred us to the appropriate individual to answer the questions.

We contacted each college at least three times and set up appointments for administering the survey. When an individual could not answer all questions, s/he referred us to the appropriate person who could. In total, we completed surveys with staff at 73 colleges (66 percent).

Data Analysis

Focus group and counselor interviews were recorded and then transcribed for analysis. We developed a coding scheme to capture key themes and responses, then organized the data by these codes. Once analyses were done for each individual college, we created a template that helped us systematically examine trends and differences across the five colleges.

We used SPSS to code and analyze the survey data. We examined variation and trends for all colleges and also looked at different ways to "cut" the data to see if there were any interesting variations by types of college. ANOVA and Chi-squared analyses of surveys by region (North, Bay Area, Central, and South) revealed no meaningful differences. We conducted a separate analysis comparing colleges identified as minority- and Hispanic-serving institutions and those that were not. Again, no meaningful differences were found. Ultimately, we determined that the variation in the data was due to individual college differences and could not be attributed to the other factors we tested.

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ONE-SHOT DEAL?

Students' Perceptions of Assessment and Course Placement in California's Community Colleges

WestEd.org

Educational Master Plan

Information Submission Form

1) Title: Aligning Undergraduate IS Curricula with Industry Needs

2) Author: John H. Benamati, Zafer D. Ozdemir, and H. Jeff Smith

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BY JOHN H. BENAMATI, ZAFER D. OZDEMIR, AND H. JEFF SMITH

Aligning Undergraduate IS Curricula With Industry Needs

A PARADOX IS BECOMING OBVIOUS TO BOTH INFORMATION systems (IS) academics and executives: U.S. demand for IS graduates is increasing, but graduation numbers from university IS programs are flat or in decline. As a result, many CIOs are devoting increasing proportions of their organizations' resources to recruiting IS graduates, through outreach programs to both students and faculty. In spite of these efforts, however, many CIOs report continuing frustrations in attracting enough newly-minted IS talent.

Complicating the picture is a temporal shift in the nature of entry-level IS jobs. Based on a 2006 study that interviewed 104 senior IS managers, skills associated with business domain knowledge, project management, and client-facing tasks (for example, systems analysis and design) are becoming quite important at the entry level.[1] A second study identified a lack of leadership skills and indicated that team work, collaboration, and communication skills need to be enhanced in IS undergraduates.[2] Industry also prefers that academic programs impart this higher level business and leadership knowledge using more experiential learning models.[1,2] While some level of technical knowledge – particularly in the areas of programming, architecture/standards and security – is still desired, firms are attempting to hire entry-level IS personnel who have been trained in areas that go well beyond the technical.

Jobs previously viewed as entry-level—largely technical and programming-related—are now more likely to be outsourced overseas.[5,8,10] An earlier model, in which new hires were expected to spend some time programming while learning the firm's business processes and applications portfolio, is quickly becoming outmoded. Early on, new hires are expected to perform at a higher level of complexity, quickly understanding the business domain and driving projects to completion. Programming and other technical work may well be done in another country.

As the number and nature of IS jobs evolve, the demand and supply curves change. On the demand side, it is expected that the number of IS jobs in non-IS organizations will start growing rapidly due to retirement of the baby-boom generation.[1] In fact, the U.S. Department of Labor predicts that growth in occupations such as database administrators, computer software engineers, and systems administrators will be much faster than most other jobs between 2004 and 2014.[11] As IS enrollments have declined over the last five years at most universities,[1] a "looming shortage" of IS professionals is on the horizon (See Figure 1).[4]

Unfortunately, many students and parents seem to harbor misperceptions – sometimes referred to believing in "myths"[5] - about the IS discipline, and this may be impacting enrollments. One misperception is related to the state of "off shoring"; perhaps relying on media reports, many students and parents have apparently overestimated the impact on U.S.-based IS jobs and salaries. Another misperception appears to be that the IS profession is not an exciting one, and many students and parents seem to equate IS jobs with "coding." Of course, few MIS graduates are actually assigned programming duties, with most focusing instead on tasks such as design and project management.

The supply-demand gap, troubling on its face, may be even more problematic if the IS graduates do not possess the skills that are being demanded by industry. Simply attracting more students will not adequately address all of the looming workforce issues. Thus, IS programs must simultaneously increase their throughput and ensure that they are inculcating a skills set that is of value to employers.

To that end, we have attempted to answer these two questions:

- How are IS programs evolving to address the changing nature of IS entry level positions?
- What are IS programs doing to attract more students into the discipline?

To address these two questions, we studied the IS curricula of undergraduate business programs ranked in the Top 50 by the *U.S. News and World Report* in 2006 or 2007. 57 schools appeared in that ranking in either 2006 or 2007; of those 57, 47 offer an undergraduate degree in IS. We contacted all 47 schools with IS programs. At least one senior faculty member or administrator at 32 of these schools participated in a 30 minute, telephone-based structured interview. Interview questions addressed curricular changes within the past five years, curricular changes currently in process, involvement of an advisory board, and marketing.

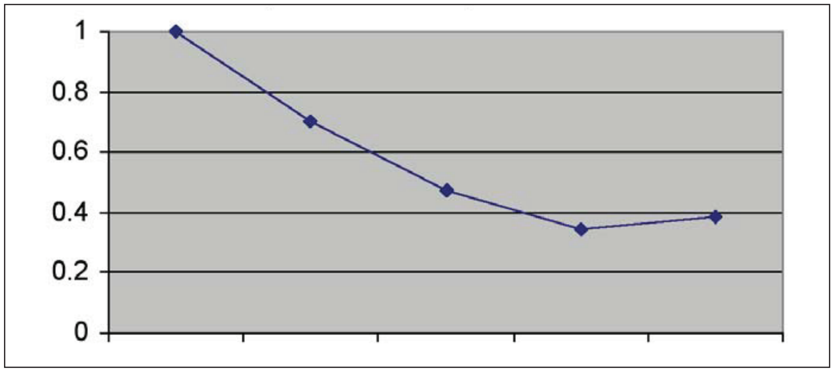
We now turn to a discussion of the findings from our study.

A Little Progress

Universities' IS programs are making some progress on both fronts: the knowledge and skills gap is narrowing, and declines in graduation numbers appear to have leveled off.

Knowledge and Skills Gap. Industry executives now seek IS graduates with higher level skills. Business knowledge, leadership and communication skills acquired via experiential, business context centered learning are the most desired changes from industry executives' perspectives.[1,4,9]

Figure 1[a]. Annual proportion of total number of IS graduates compared to total IS graduates in 2003



a Based on the 21 schools (all in the *U.S. News* Top 50) that supplied complete graduation data in our study. See details above.

To establish how IS academics view their programs, we asked each interviewee to estimate the percentages of their 2007 IS curriculum that were technical and managerial. Eight of the curricula were more managerial, twelve were more technical, and twelve were best viewed as a balanced blend. Since CIOs' recent comments suggest a desire for a more managerial perspective, it appears that a substantial proportion of the curricula may still be somewhat out of balance as of 2007.

On the other hand, viewed in a temporal perspective, the vast majority of the schools (69%) have made some curricular changes consistent with the changing industry demands in the last three years, and other changes are in process at half of the schools (see Table 1). Nearly a third of the universities have not changed their programs in the last three years, and sixty percent of these schools are planning to stay that course.

The changes vary greatly across the universities studied and affect both programs (adding and removing courses or changing program requirements) and courses (changing content or number of contact hours). Table 2 details the actual courses added and dropped. Although somewhat mixed, more managerial than technical courses are being added. Similarly, more technical than managerial courses are being dropped. Thus, there is some evidence that IS curricula – although modestly mismatched with CIOs' expectations as of 2007 – are being revised in a direction more consistent with CIOs' desires.

Table 1. Level of Curricular Change

Schools with changes *completed* in last 3 years	Level of *in process* change
None: 10	None: 6
	Some: 4
Some: 22	None: 10
	Some: 12

This is particularly the case at a limited number of schools in which IS students are given more hands-on, context-based experience. For example, one private university has instigated a hands-on design and management course in which U.S. students design an application and then send functional requirements to students in India, who do the development.[2] IT projects or practicum courses have also been added by four schools, and two universities are adding courses involving experiential trips. One takes students to the Silicon Valley over spring break, and the other is proposing a course to visit and study outsourcing companies in India. These initiatives apparently have as their objective the inculcation of a real-world, managerial perspective, thereby producing IS graduates who possess the higher-level skills being desired by industry executives.

Increasing Demand and Shrinking Graduation Numbers

Relative to the news on the knowledge and skills gap, the news on the number of IS graduates is not as positive. Figure 1 indicates that the collective number of IS graduates is down 60% compared to the output in 2003 and down

Table 2. Courses Added/Dropped

Course	Req'd	Elect
Non-technical Knowledge and Skills classes added		
Project Management	2	8
Knowledge Management/Business Intelligence		6
Strategy/Management	1	3
It Projects/Practicum	2	2
Business Process/Consulting	2	1
Financial Systems		3
Data Mining	1	2
Organizational Change/Change management	1	1
Risk Management		2
Experiential Trip Courses		2
Business Problem Solving	1	
Business Communications	1	
Database/Advanced Database		1
Information Economics		1
E-services		1
Leadership		1
Accounting Information Systems		1
Emerging Technologies		1
Computer Forensics		1
Global IT		1
IT Audit and Controls		1
Data Visualization		1
Psychology of Decision Making		1
Innovation and Technology Management		1
Technical Classes added		
Security/Advanced Security		9
Web Application Development/Adv. WAD	1	5
Enterprise Architecture/ Enterprise Systems		4
Programming	1	2
Systems Design/Advanced SAD	1	
Infrastructure	1	
Systems Integration	1	
Telecommunications		1
Systems Analysis and Design		1
Middleware		1
Advanced Multi-tier App Development		1
Dropped Classes		
Programming	3	
ERP		2
Web Services/Adv. Web Development		2
Calculus	1	
IS In Organizations	1	
Advanced Database		1
E-Commerce		1

40% compared to the output in 2004 based on data provided from 21 of the 32 schools participating in our study. For most of those schools, the decline started earlier than 2003. However, in 2007 these schools combined have graduated slightly more IS majors than the previous year for the first time since the decline began.

As noted, a number of schools are taking steps to modify their curricula (see Table 1), and there may be evidence that these efforts are being rewarded. As depicted in Table 3, schools with no recent changes continue to decline while those with changes combined to graduate 19% more IS students in 2007 than in 2006.

Nine of the 32 schools added flexibility in their curricula, usually by reducing the number of required hours, providing for more choices among courses, or cross-listing courses from other programs such as Accounting or Finance. These efforts may also be yielding some positive benefits with respect to graduation numbers (see Table 3).

Perhaps the simplest way to address the numbers problem is to market the programs more aggressively. Twenty seven of the 32 schools market their IS programs internally, and five market externally.

In terms of *internal* marketing, most schools provide explicit marketing messages regarding the attractiveness of IS careers to their school's current students primarily through first- and second-year courses required of all business majors. These messages often attempt to counter misperceptions and to convey a positive message regarding IS career opportunities and starting salaries.

Various vehicles are used for these messages. At one large state university, the IS department is devoting over $9,000 to a marketing initiative; posters have been placed on university buses, an article has been placed in the university's student newspaper, a video clip has been delivered to dorm rooms over the campus television network, and letters have been sent to students.

At another large state university, a campaign titled "Think Outside the Cube" driven by a marketing consultancy that was paid by their IS advisory board - shows students that IS careers are no longer relegated to a "cube" (such as a cubicle). Using postcard-sized handouts and longer brochures, the marketing program highlights both the exciting (and largely non-programming) nature of current IS careers as well as the high demand for graduates. This IS department also held a "speed dating" event, in which a number of hiring companies each had a table of representatives in a large room; and in small groups students spoke to each company for a few minutes.

Increasingly, marketing is accomplished through direct and personal interchanges with students – interchanges that are designed to generate excitement about the prospect of an IS degree. For example, one state university now assigns faculty mentors to prospective IS students so that they receive one-on-one encouragement and guidance. At a mid-sized private university, the IS department is now speaking to all incoming freshmen in a session on "myth-busting" related to IS. At another mid-sized private university, a CIO speaks to all core IS classes (sophomore year), and recent IS graduates return to campus to discuss their jobs. And, at several schools, core IS courses – from which many IS majors are drawn – are taught by the most engaging faculty members.

Five of the schools engage in *external* marketing by reaching out to audiences that extend beyond the school's current students. This might include potential students (usually in high school), parents, and high school counselors. Informational letters and brochures are common vehicles for these messages.

Associated with these external marketing efforts, but of a somewhat different nature, are IS advisory boards. Twelve of the 32 schools have such boards, which provide input regarding curriculum, involvement with students, and (in some but not all cases) financial support for IS initiatives.

Implications

It is clear that some progress is being made in addressing IS industry needs. Nonetheless, two important gaps remain: skills and numbers. Neither academics nor industry executives can close these gaps by themselves. A coordinated effort is required.

Table 3. Percent Change in Total IS Graduates[b]

	Percent increase in total graduation numbers between 2006 and 2007
Recent industry-driven change in the curriculum	
None (N = 8)	- 6%
Some (N = 13)	19%
Increased flexibility in the curriculum	
None (N = 14)	3%
Some (N = 7)	23%
Marketing activities	
None (N = 3)	4%
Some (N=18)	12%

Note: 21 of the 32 schools provided complete graduation information.

b Although visually significant, the reported differences are not statistically significant due to the limited sample size in each category.

With respect to the skills gap, a substantial minority (12 of the 32 schools) continue to offer a more technical IS curriculum as of 2007. All observers agree that IS graduates need a solid base of technical understanding, if for no other reason than to maintain their credibility as leaders within an IS community. But caution is warranted, as it is possible to infuse technical proficiency at the expense of valued managerial skills such as project/knowledge management and an understanding of the linkage between IS and strategy, both of which are highly valued by employers.

It is widely accepted that purely technical work (especially including that which is programming-related) is likely to be outsourced even more in the future[1,5,8,10,12] meaning that graduates who are prepared for largely technical careers will be at a distinct disadvantage. Graduates will be best prepared for upward career movement if they are able to manage the process of IS portfolio design and project management. Their relative advantage will rely not in their personal ability to deliver code but, rather, in their ability to organize and manage processes so that others deliver the appropriate code.

Thus, we recommend that IS curricula be reformatted so that they provide a functional level of key technical literacy – including enough programming experience so that graduates have "felt the pain" of programming. Beyond that point, however, the IS students' time will be best spent on study of organizational and managerial topics, including a deep understanding of organizational process flow. They should be well-versed in strategic implications of IS, and project management knowledge will be crucial.

IS executives can assist in this transition by carefully considering the nature of their forthcoming needs. If they are in need of specific technical skills, they may find that their hiring plans would be better targeted to computer science departments than to IS departments. IS executives can provide great assistance to IS departments by offering their input regarding IS managerial career paths and by assisting in student recruitment.

In a larger initiative, both IS academics and practitioners can address the larger societal issue of reduced student interest in IS. Already, some organizations, such as the Society for Information Management (SIM), are attempting to influence high school students as they begin to make career decisions. A coordinated effort between academics and practitioners could go a long way in helping students and parents understand the IS discipline and the promising U.S.-based job outlook. It must be realized that some families are already forming conclusions about career viability while prospective college students are still in high school. They need to receive a clear message promptly: there are lots of IS jobs available in the U.S. for the foreseeable future, they pay well, and they involve much more than sitting in a "cube" all day. Target audiences for this message include high school students, counselors, and teachers. It may also be helpful to consider the factors that motivate students to choose majors in IS-related fields.[3]

In summary, although some IS curricula are being updated to conform to industry's emerging needs, there is reason to believe that the gap between supply and demand will widen over the coming decade. The solution is a coupling of curricular changes with marketing efforts. Eventually, these efforts must extend to the high school level, but critical short-term initiatives are needed in U.S. business schools now. Existing and prospective business students must be made aware of the exciting and lucrative jobs in IS.

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Educational Master Plan

Information Submission Form

1) Title: Partnering with Business Amplifies Students' Career Opportunities

2) Author: Ernie Friend

3) Source: www.techdirections.com

4) Taxonomy Area:

- [ ] Society
- [ ] Technology
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6) Page / Section: 19-21

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Partnering with Business Amplifies Students' Career Opportunities

By Ernie Friend
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IT'S becoming common for schools and community colleges to join with leaders of the business and industry community to create public-private partnerships to create new and enhanced opportunities for both parties. By creating a public-private partnership between schools, the local business community, and organizations like Cisco, Florida State College at Jacksonville (FSCJ) has boosted credibility for its students' information technology (IT) education and helped them improve their employability prospects. I hope through this article to offer useful information for other educational institutions that want to establish effective partnerships with business and industry.

Florida State's Experience

Cisco Networking Academy, Cisco's largest corporate social responsibility program, provides access to equipment and curriculum to give students valuable networking and IT skills, and it sets up mentorship programs to help solidify the relationship between learning institutions and the local business community. At Florida State College, more than 1,500 students take Cisco Networking Academy-related courses every year. The courses provide current, market relevant IT curriculum aligned to industry-recognized career certifications. Everyone who graduates from the program who wants a career finds placement, and some are employed even before they graduate.

"In a fast-moving global economy, the knowledge and skills people learn must be relevant, purposeful, and quickly adaptable," says Jim Simpson, associate vice president of Workforce Development, Florida State College at Jacksonville. Simpson thinks that for an educational institution to become market responsive and offer a breadth of opportunities to its students, it must develop interconnected and mutually supporting characteristics including:

FSCJ increases students' job prospects through partnerships with business.

- Having leadership committed to the market-responsive mission of the school. Elements include allocating resources to develop programs, reaching out to local businesses and other organizations, and having internal response mechanisms that allow for rapid development and deployment of training curriculum to meet changing workforce demands.

To meet changing workforce demands, schools need to respond promptly to changes in local economic conditions and training needs, create a division to address local employment demands, and develop for-credit programs based on local workforce needs.

- Partnering with local businesses and workforce and educational organizations to develop appropriate training and academic curricula. This includes collaborating with local businesses, seeking employer input on curriculum development, and recruiting faculty from local experts in the field. It also requires an understanding of local workforce needs and being able to detect and respond to changes plus partnering with other local educational institutions to deliver comprehensive training.

Florida State College at Jacksonville has created a program with a highly successful graduate placement rate. Accomplishing this required positive outreach to the local business and industry community;

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a sound strategy; and real-world, relevant curriculum. At our Advanced Technology Center, we target students who have specific goals in mind. Students seeking technology-associated degrees see us as the critical stepping-stone to employment. Consequently, our programs must connect students with the local business and industry.

A Cisco Networking Academy instructor demonstrates equipment.

In some cases, instructors and faculty members don't consider it their job to make that connection. Our approach is different, because we realize that teaching is just three-quarters of the equation. It is our responsibility not only to enable students to obtain certification but also to help them find a job or secure a better one.

Best Practices

There are several ways to make that happen. To create successful public-private partnerships, educators and administrators need to make time for outreach to the local community because—especially in this economy—it should be a part of every educator's role. Following are some best practices we use to tighten public-private partnerships that benefit the school, local business and industry, and our students.

1. Start in the classroom by asking students for the names of their employers, if they have a job. If you are proud of what you are teaching a student, his or her employer should know that. Contact the employer and ask for feedback on the technology education program and if they are seeing positive results in the student. Invite the employer to visit the school and get their buy-in by making a personal connection.

2. Read the business section of the local newspaper, looking for promotions or new companies coming into town. That has paid off for us as we contact people who may be in search of talent but are not aware of who we are and how we can help them fill their talent pipeline.

3. Call new businesses or expanding companies that might be looking for new people, connect with the technology manager, and invite him or her to visit your school and see students in action. I do the same for technical folks who have been promoted. I call, congratulate them, talk about their needs, and invite them to the school to speak with students.

4. Work with your school's purchasing department. This may sound like an unusual approach, but every school puts out requests for bids, and companies are constantly seeking a spot on that bid list. This can become a great database of local technology companies that want to do business with the school, but that may not be aware of your technology department and the resources and talent it has to offer.

5. Personally meet with the technical and hiring managers at the top 30 companies in your area. Whenever I meet with these folks, I tell them student success stories. Human-interest stories always win people over.

6. Host open houses for the public. Our college reaches out to employers, high schools, and people

on our contact lists. You want people to come to the department and see that it is not just dented chairs and a chalkboard. Seeing labs in action can quickly changes perceptions about the value and depth of technical education.

7. Host seminars. We find interesting people who are willing to volunteer to discuss a specific hot topic. For example, we recently had the Florida Department of Law Enforcement, the FBI, and local data forensic professionals visit the school and talk about data security. More than 80 people showed up and I was able to share with them information about cyber security education and career opportunities.

8. Host a technology user group to meet new business contacts. For example, there are groups that focus on data security, IP telephony, and so on. Contact such groups and volunteer to host one of their meetings at your facility. As the host, spend five minutes talking about your program and then let them have their meeting. Afterward, offer a tour and answer specific questions. It's a great way to have new contacts come to you and network—and for them to see the talent and resources that are available through your program.

9. Get in touch with other relevant local groups and host one of their meetings. They can become an excellent resource for information on who is hiring and what jobs are available.

10. Create business advisory groups. In Florida, every degree program has to have an associated business advisory group. Although mandatory, the advisory group is not always used to its highest potential. We invite people from the business community to join and tell us about their needs, the training they view as critical, and how technical skills must evolve.

11. Host Chamber of Commerce meetings. This is another great way to get a view into what is going on with companies in the community.

12. Contact staffing agencies, since many companies don't hire directly. We use job-staffing agencies to give students information on what is available and for feedback on the changing interviewing and hiring processes. Agencies can also be a great resource to educate your class about do's or don't's of resumes and interviews. Students really pay attention when it is someone other than their instructor telling them about the reality of the hiring scene.

13. Nobody gets away for free. When I meet someone, my goal is to connect sufficiently so that they will look to me when they are thinking about hiring someone. Collect business cards and start building your database.

Persistence Pays

Realistically, no single action described in this article will make a huge impact. It's a sustained practice of doing many things as often as possible that will increase success in building effective public-private partnerships and amplify career opportunities for your students.

As a result of efforts at my school, we get two or three emails per week from companies looking for skilled individuals for positions that are not even advertised. Creating a new generation of technical professionals is critical to the success of our future economy. Making personal connections is what makes the difference for your students. Reach out to local business and industry leaders and let them see what your school and your students are all about!

Educational Master Plan

Information Submission Form

1) Title: How Miami students can get a free college education

2) Author: Stacy Teicher Khadaroo

3) Source: The Christian Science Monitor (Thu Mar 24,)

4) Taxonomy Area:

- [ ] Society
- [ ] Technology
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5) Relevance: financial aid

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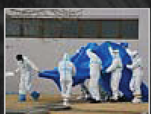
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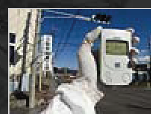
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How Miami students can get a free college education

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By Stacy Teicher Khadaroo – Thu Mar 24, 6:41 pm ET

College tuition is going up and financial aid is on the chopping block in many states, but in the Miami area, one college is offering successful high school graduates a price tag that's hard to refuse: free.

Miami Dade College – the largest institution of higher education in America, serving more than 170,000 students on eight campuses – announced its American Dream Scholarship on Wednesday. It will cover 60 credits at a value of about $6,500 – enough to earn a two-year degree or start in on one of the four-year programs offered by the community college.

This spring's high school graduates in Miami-Dade County will be the first to benefit from the "free college" offer. To qualify for the new scholarship, students must have a 3.0 grade-point average and score well enough on entry tests to show they don't need remedial math or reading courses. Normally, about a third of the college's entering students pass at that level.

RELATED: Five mistakes to avoid on your college application

Funded primarily by private donations, the scholarship has the goal of giving families "the opportunity to send their children to college and not have to worry about having to bear such great financial debt," says Miami Dade College President Eduardo Padrón. "We want our city to be a city of the future ... and the only way we are going to do that is by preparing young people for the jobs that are being created in the knowledge-based economy of the 21st century."

Itâ€™s one of the many efforts under way nationwide to encourage more students to earn a postsecondary degree or work-related credential. President Obamaâ€™s goal is for the United States to be No. 1 in the world by 2020 in the proportion of young adults who have college degrees. To get there, the nation needs an additional 8 million graduates.

Florida would need to produce more than half a million additional college grads to do its share, according to state projections released this week by the US Department of Education and Vice President Joe Biden, who has made college accessibility a priority as chairman of the Middle Class Task Force.

Getting students in the door is the first step. Community colleges are often thought of as particularly affordable, but for the neediest students, that is often no longer the case. Eighty percent of community-college students with financial need still have some unmet needs after receiving aid, if broader expenses such as books and food are taken into account, according to the Institute for College Access & Success in Oakland, Calif.

Although the Miami Dade scholarship covers only tuition, it is nevertheless "a great new story for a lot of students who were perhaps wondering about their futures," says Walter Bumphus, president and CEO of the American Association of Community Colleges in Washington.

As part of Mr. Obama's goal, community colleges have been challenged to produce 5 million new graduates by 2020, he says, and in the states he has visited, educators and policymakers are working hard to improve their students' success rates.

More than 40 percent of all degree-seeking students are enrolled in community colleges, and about 60 percent have to take at least one remedial course. Of those, less than a quarter complete a degree or certificate, the US Department of Education reports.

By requiring scholarship recipients to show that they don't need remedial courses, Miami Dade College is hoping to motivate more students to start college on a sound footing and thus be more likely to complete a degree.

"Families are going to put a lot of pressure on students, not just saying, 'You have to graduate [from high school],' but, 'You have to do better' " in order to earn the scholarship, Mr. Padrón says.

The new program will at the same time open the door to many students who may not think of themselves as academic-scholarship material, local educators say.

By using a weighted GPA, it gives students credit for trying more challenging courses that that they might get a C or B in, instead of an easy A, says Verena Cabrera, principal of Hialeah Senior High School.

Students at Hialeah who can meet the criteria are already thinking about college, she says, but because of financial concerns, "they might be thinking of starting later ... and postponing can mean the risk of not going, because they get caught up in life," she says. But the scholarship will be an opportunity many will want to seize. It "will increase the numbers we get into college right away after high school," she says.

Local public-private partnerships like the Miami Dade scholarship "can send a really positive signal to students in that community that college is possible," says Lauren Asher, president of the Institute for College Access & Success.

But in the broader picture, Ms. Asher adds, they don't solve the "larger-scale problem of strains on state budgets just when families most need help."

State budgets are the biggest factor influencing tuition and fees at public colleges and universities.

In Florida, where legislators are considering taking a $320 million bite out of the higher-education budget, one possible trim would come from the state's merit scholarship program.

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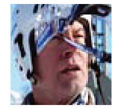

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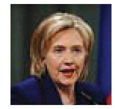

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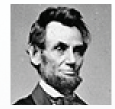

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Educational Master Plan

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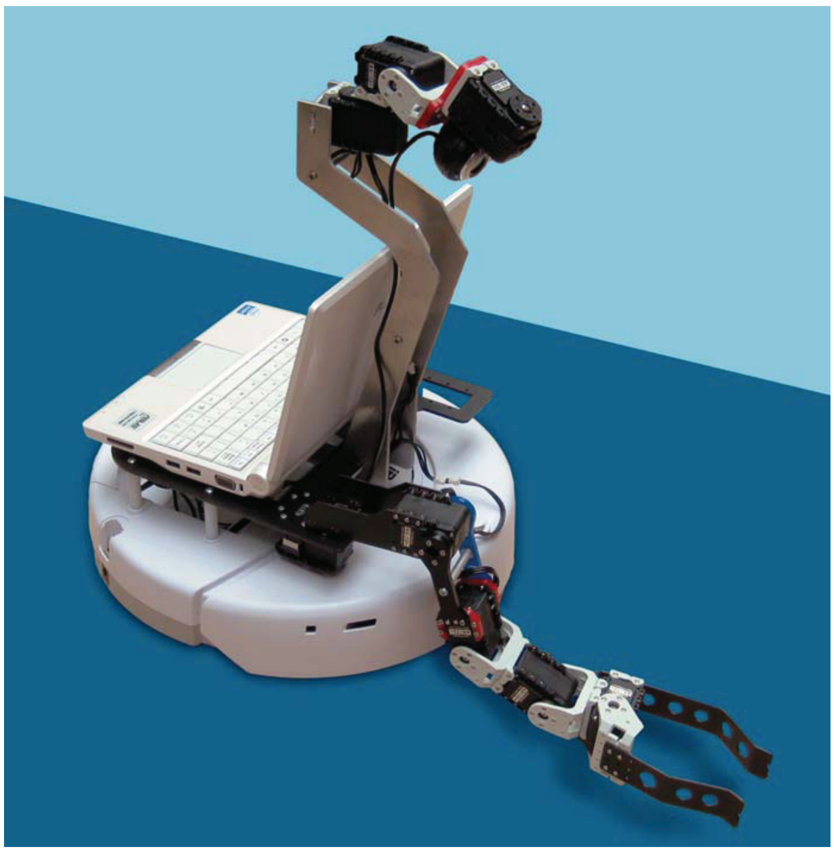
David S. Touretzky

Education

Preparing Computer Science Students for the Robotics Revolution

Robotics will inspire dramatic changes in the CS curriculum.

Beginning in the 1970s, a series of technological advances in computing has repeatedly reshaped the undergraduate computer science curriculum. Affordable bitmapped displays brought GUI interfaces into widespread use, gave us the new field of human-computer interaction, and led CS departments to introduce courses in computer graphics and HCI. The maturation of networking technology that led to the Internet and the Web also spawned a whole spectrum of new courses, from the nuts and bolts of network protocols to the social impacts of online communities. The microprocessor that launched the personal and then wearable computer revolutions, and in conjunction with the growth of wireless networks, produced new types of platforms that are always on and always with us, has led to courses targeting smartphones and PDAs instead of conventional computers. And when inexpensive graphics processors and sound cards grew electronic gaming into a multibillion-dollar business with revenues comparable to the film and music industries,[a] CS departments responded by introducing a variety of multidisciplinary courses in game design.[9]



Calliope: A prototype Create/ASUS robot with a pan/tilt camera and gripper arm.

PHOTOGRAPH BY ETHAN J. TIRA-THOMPSON/CARNEGIE MELLON

Robotics is the leading candidate for the next dramatic change in the CS curriculum. Advances in sensing, actuator, and power technologies are fueling an explosion in robotics comparable to what microprocessors did for computing three decades ago. In a 2007 *Scientific American* article, Bill Gates drew a parallel between today's robotics industry and the computing

a Estimated 2008 revenues from Hoovers.com: motion pictures $33 billion; music $15 billion; computer and electronic games $12 billion.

industry at the start of the PC revolution.[2] He compared today's state-of-the-art industrial robots—priced at tens to hundreds of thousands of dollars—to 1970s era mainframes, while consumer robots resemble 1970s microcomputers: crude, underpowered, and of interest mainly to hobbyists who enjoy tinkering with technology for its own sake. Today's consumer robots include a variety of kits (Lego Mindstorms, VEX Pro, Robotis Bioloid), limited but intriguing toys (WowWee's Robosapien, Pleo from Innvo Labs, Penbo from Bossa Nova Robotics, and a dozen others; many more in Japan), and one astonishingly successful vacuum cleaner: the Roomba; more than five million Roombas have been sold.

Advances in robotics are reported weekly at technology news sites such as Robots.net, while the popular magazines *Robot* and *Servo* are energizing the robotics hobbyist community the way *Byte* and *Dr. Dobbs' Journal* once nurtured amateur computing enthusiasts. Meanwhile, more than 40 nations now have military robotics programs.[3]

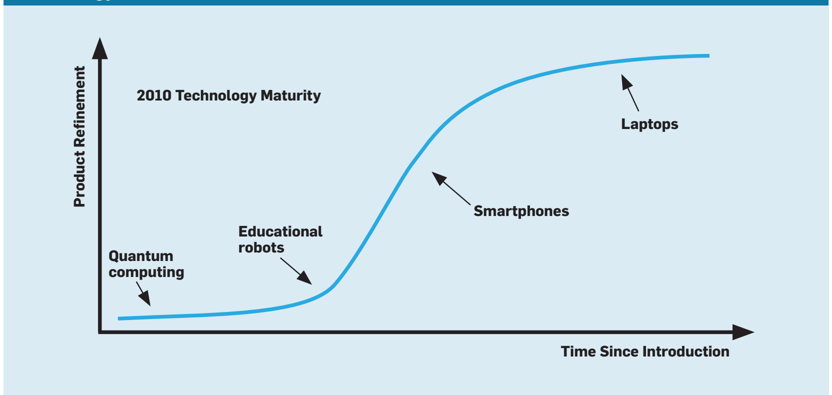
We see glimmers of our robotic future in today's self-parking cars, cameras that recognize human smiles, and flying devices ranging from micro-scale robot bees to the airliner-size Eitan UAV. But the robotics revolution will be farther ranging—and a lot more weird—than most of us can envision now. Who in 1971 would have looked at the first Intel microprocessor and predicted eBay, Wikipedia, Google Earth, or "sexting"?

Impediments to Progress

We can help speed the revolution by introducing our undergraduates to state-of-the-art robotics hardware and software. But three factors have stymied progress in robotics education for computer scientists. The first is misconceptions held by some about the nature of the subject. Robotics cannot be taught in CS1. The use of simple robots to teach basic programming concepts dates back to Papert's Logo turtle of the 1970s[5] and Pattis' Karel the (simulated) Robot in the 1980s.[4] More recent examples include a Python-based programming course using the Parallax Scribbler,[1] and a variant of Alice (http://www.alice.org) that can both simulate an iRobot Create and teleoperate a real one via a bluetooth dongle.[8] CS educators must understand that while it might be a good idea to use simple robots to teach students about variables, procedure calls, and while loops, this is not the same as teaching them robotics, any more than making a penguin move around in Alice counts as teaching computer graphics.

Real robotics involves deep, computationally demanding algorithms.

Technology maturation curve.



High school robotics contests such as US FIRST, which emphasize the mechanical engineering aspects of the field at the expense of computer science, are another source of misconceptions. The public doesn't always appreciate that the elaborate hardware platforms students construct must be primarily teleoperated because students aren't being taught the kind of software that would allow their robots to act autonomously.

Real robotics involves deep, computationally demanding algorithms. Machine vision, probabilistic localization and navigation, kinematics calculations, grasp and path planning, multi-robot coordination, and human-robot interaction (face tracking, speech and gesture recognition) are core technologies. Today these are found mainly in advanced research labs and graduate-level robotics courses, but they can be made accessible to undergraduates. The time to do that is now.

The second impediment to be overcome is the lack of suitable robot platforms for undergraduate instruction. The devices used in CS1 courses typically have no camera and can't even drive in a straight line without drifting. The Lego Mindstorms kits used in many current college courses are no better. On the other hand, the groundbreaking Sony AIBO robot dog was an excellent instructional platform due to its powerful MIPS processor, rich sensor suite (including a color camera, stereo microphones, and multiple IR range finders and accelerometers), and sophisticated servos with position and force feedback. The AIBO's $2,000 price tag was comparable to high-end laptops of its day. But when Sony abruptly exited the robotics market in 2006, the AIBO had not yet caught on as a teaching platform, and that market niche has yet to be filled.

In 2007 the RoboCup Federation, which oversees robotic soccer competitions worldwide, selected the Nao humanoid from Aldebaran Robotics to replace the AIBO in the Standard Platform League. A few schools are now teaching robotics courses using Naos, but at a retail cost of approximately $16,000, the Nao will remain out of reach for most educators. There are some who believe that educational robots should cost no more than a Lego Mindstorms kit: only a few hundred dollars. They're right, but it will be a while before the economies of mass production can do for AIBO- or Nao-type robots what they've already done for laptops and smartphones. Meanwhile, Mindstorms' widespread and growing use in high schools and even middle schools underscores my point that undergraduates require something better. They need robots that can see, with processors that can run the sophisticated algorithms computer scientists should be studying.

As illustrated in the figure on the preceding page, educational robotics is entering the unstable region of the technology maturation curve. For just a few more years, computer scientists will build their own platforms for education and research. In less than a decade this will become infeasible, for the same reason that no individual today builds their own laptop or cellphone. But since highly capable robots are not yet mass-produced consumer products, today's educators must innovate. Several colleagues in the U.S.[b] have found a good solution by mounting a laptop or netbook atop an iRobot Create. The Create—a Roomba without the vacuum—provides an inexpensive mobile base with a few simple sensors, while the laptop provides a Webcam for vision, a WiFi connection, a speaker, and plenty of computing power. The total parts cost can be as low as $600. Anyone who thinks these platforms are too expensive should recall what schools were paying for workstations a few years ago. Readers who would like to put one of these robots together themselves, or purchase a pre-assembled version from a commercial vendor, can find all the necessary information at http://www.Chiara-Robot.org/Create. An enhanced version with a pan/tilt camera and an arm with gripper is presently under development (see the image on the first page of this column).

The final impediment to be overcome is the lack of easy-to-use software. The three major open source frameworks for robotics application development are Player/Stage (http://playerstage.sourceforge.net), ROS (http://www.ros.org), and Tekkotsu (http://www.tekkotsu.org). Player/Stage and ROS have similar philosophies. Both provide a general communication framework for a collection of independent software modules responsible for controlling various types of hardware or providing services such as localization. Both support a wide variety of platforms and devices. And both are designed primarily for research, although Player/Stage in particular has been widely used for education. Modules can be written in any of several languages; the frameworks themselves make no assumptions about representation.

b Jeff Forbes at Duke University, Chad Jenkins at Brown University, Monica Anderson at the University of Alabama, and Zach Dodds at Harvey Mudd College have been at the forefront of this work.

Who in 1971 would have looked at the first Intel microprocessor and predicted eBay, Wikipedia, Google Earth, or "sexting."

Another Approach

Tekkotsu, developed with Ethan Tira-Thompson in my lab at Carnegie Mellon University, takes a different approach. It is implemented in C++ and makes heavy use of abstraction facilities such as templates, multiple inheritance, polymorphism, functors, and namespaces. It offers a common representation scheme for vision, navigation, and manipulation tasks.[6,7] The idea is to provide a unified framework that undergraduates can master in two-thirds of a semester and then move on to working on an interesting final project. Tekkotsu does not strive for universal hardware coverage; instead it provides well-tuned primitives for a small number of educational platforms, including the AIBO and the Create. Other groups are developing Tekkotsu support for additional platforms, including the Nao and various robot arms. But for all three frameworks, more work remains to be done to make advanced robotics technologies easy for non-experts to use.

Our Robotic Future

To predict the future of robot software, look at the history of graphics software. Early graphics programming was done by turning pixels on and off, just as early robot programming was done by turning motors on and off. But graphics has developed into a wonderfully rich field that includes specialties such as Web design, game design, and scientific visualization, where the focus is on principles of visual aesthetics or the graphical presentation of information, not low-level details of rendering algorithms or GPU programming. Web and game designers rely on computer scientists for the tools of their trade, but they have different skill sets and are not themselves computer scientists. The applications of computer graphics have outgrown the confines of a single discipline.

I believe our notions about robot programming will likewise broaden in the coming years. Our students will create the technologies that make this possible. Better algorithms for perception and manipulation, and high-level frameworks for robot instruction will enable robotics application development by a diverse population of users and innovators, some of whose job descriptions are as unforeseeable today as "Web designer" was in 1971. That will be one unmistakable sign that the robotics revolution has arrived. Let's get started.

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Educational Master Plan

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Higher education sub-cultures and open source adoption

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A B S T R A C T

Successful adoption of new teaching and learning technologies in higher education requires the consensus of two sub-cultures, namely the technologist sub-culture and the academic sub-culture. This paper examines trends in adoption of open source software (OSS) for teaching and learning by comparing the results of a 2009 survey of 285 Chief Academic Officers and Chief Information Officers with the 2006 administration of the same survey. Results indicate that while the key drivers of OSS adoption continue to differ for the academic and technologist sub-cultures, both sub-cultures converge in deeming total cost of ownership as the most important metric for making a go/no go adoption decision.

1. Introduction

The economic downturn's impact on U.S. higher education has been well documented, starting with the nation's governors' first round of cuts in January 2009 (Kelderman, 2009) to professional associations describing creative ways of using scarce technology resources to support teaching, learning, and research (Bayne, 2009). The resource squeeze is exacerbated by the changing dynamics of the labor market in which unemployed or underemployed adults seek to reinvent themselves with additional education and training, often through online courses from higher education institutions. For example, in its sixth annual report on the state of online learning in U.S. higher education, the Sloan Consortium reports that more than three quarters of all public institutions in the U.S. are engaged in offering education online and that future enrollment growth will be fueled by adults seeking to switch or advance careers in a changing labor market (Allen & Seaman, 2008). Additionally, technology expectations of students who were born digital (Caruso & Salaway, 2008; Palfrey & Gasser, 2008) are forcing institutions to improve efficiencies and enhance organizational performance while adopting new technologies to remain competitive.

One way that organizations have approached technology cost control has been to deploy Open Source Software (OSS). With origins in the Free Software movement founded by Richard Stallman (GNU Operating System, 2010), the open source concept has expanded beyond the availability of source code to include the freedom to run, modify, and distribute copies of a program either free of charge or for a fee. The Open Source Initiative (OSI), an organization dedicated to managing the open source campaign and its certification mark, specifies what is permissible in a software license for that software to be referred to as open source: Free redistribution; source code access; distribution of modifications/derived works; integrity of author's source code; no discrimination against persons or groups; distribution of license; license not specific to a product; license non-restrictive of other software, and; license is technology neutral – established by the Open Source Initiative (Open Source Initiative, 2006). It is the OSI definition that was used in this research and to which this paper refers.

2. The appeal of open source

Arguments favoring OSS have been well documented in the literature. Common themes cited by proponents include OSS as (a) an example of technology for the common good (Coleman, 2004), (b) a new software development paradigm with security and risk management benefits (Raymond, 2001), and (c) a means of eliminating vendor license fees (Williams van Rooij, 2009). Examples of popular OSS applications include the Linux Operating System, Apache for Web servers, and OpenOffice suite. In U.S. higher education, the discussion

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about OSS for teaching and learning has centered around course management/learning management systems (CMS/LMS). What began in the 1990s as stand-alone Web-based course management systems intended as administrative support for classroom instruction, have since evolved into enterprise-wide LMSs that also include social software tools such as blogs and wikis, as well as interfaces to an institution's student information and financial administrative systems. The leading OSS LMS products are Moodle (http://www.moodle.org), originally developed in Australia, but currently with a global user base that includes nearly 30,000 registerd sites, one million courses, and available to anyone for downloading, and; Sakai (http://www.sakaiproject.org), a platform developed by a group of U.S. institutions that includes generic collaboration tools along with teaching and portfolio tools available under an Education Community License. Moodle is built on OSS technologies such as PHP, while Sakai is largely Java-based. Other OSS LMS products include Claroline (http://www.claroline.net), available in more than 35 languages and used in 80 countries; LRN (http://www.dotlrn.com), a system that has e-commerce and project management applications built in; ATutor (http://www.atutor.ca), developed in Canada and includes more than 17,000 registered user sites, and; Bodington (http://www.bodington.org), developed in the U.K. and implemented at the University of Leeds and the University of Oxford.

LMSs have become mission-critical services for U.S. colleges and universities. Nearly all (97.5%) U.S. institutions of higher education have deployed at least one LMS campus-wide (Green, 2008), enabling them to maximize the use of technology investments to support multiple instructional models. Further, more than 3 in 4 (76.9%) have standardized on a single LMS enterprise-wide, primarily a commercial vendor product (EDUCAUSE CORE Data Service, 2007). However, over the past ten years, the number of commercial LMSs has declined from several dozen to just a few. This has caused many in higher education to become concerned about a possible monopoly in the commercial LMS marketplace. Moreover, proprietary systems do not allow users to modify or access the database, making it difficult to produce targeted usage reports, to integrate the system with other campus technologies such as student information and financial systems, or to customize the system for a particular campus environment (Collins & Committee, 2009). Open source has been touted as a hedge against commercial marketplace fluctuations (Lambert, 2005; Villano, 2006; Wheeler, 2007).

In international education, adoption of OSS teaching and learning applications is relatively mainstream. Results of a periodic survey of open and closed source software conducted among more than 450 further and higher education institutions in the U.K. (Cornelius, 2006) indicate that the use of open source is on the rise at U.K. institutions, with 77% of U.K. further and higher educational institutions considering open source in the software selection process and 25% mentioning open source in institutional policy. With respect to survey questions about virtual learning environments and LMSs, open source dominates, with Moodle adoption at 39%, followed by Blackboard (19%) and WebCT (9%). The 2008 survey indicates an increase in these adoption trends (Canas, 2009). Consistent with European goals for free software development, deployment and collaborative research, and the European Union's desire to maintain its lead in the open source arena, the University of Maastricht in The Netherlands and the University of Cambridge in the U.K. established a consortium focused on open source projects, including the single largest knowledge base on open source usage and development worldwide (Ghosh, 2006).

In the U.S., however, campus-wide adoption of OSS LMS products is relatively limited, despite the use of selected OSS applications by individual faculty or departments (Williams van Rooij, 2007a; Green, 2008). To explore the gap between the advocacy for OSS LMSs and the enterprise-wide deployment of OSS LMSs, this research draws on the fields of organizational management and information systems. Specifically, this research is grounded in the stream of organizational management theory that focuses on the relationship between organizational culture, organizational sub-cultures, and technology adoption. The incidence of campus-wide adoption of OSS LMSs can be viewed as a reflection of the divergent perspectives of two organizational sub-cultures in higher education: The technologist sub-culture and the academic sub-culture.

3. Higher education culture, sub-cultures, and OSS adoption

Within the organizational management literature, there is a well-established body of knowledge addressing the relationship between organizational culture and technology adoption. Adoption of new technologies requires change, placing pressure on organizational culture – the values, symbols, beliefs, stories, heroes, rites and shared assumptions that have special meaning for the organization's employees (Hill & Jones, 2001; Hofstede, 1980; Parker, 2000; Schein, 1985). Organizational cultures are composed of discrete sub-cultures or clusters of ideologies, cultural forms and practices, the most distinctive sources of which are people's occupations. Centered around defined, interrelated tasks that create self-definitions and self-perceptions as well as perceptions of relationships to other sub-cultures, occupational sub-cultures can serve as potential sources of conflict concerning decisions about such issues as the allocation of resources, future goals, changes in practices, and criteria used to evaluate performance (Trice & Beyer, 1993).

In his case study of a state college, Tierney (1988) noted that like in the private sector, higher education decision-making is influenced by organizational culture and sub-cultures, with an institution's specific mission contributing to the intensity of that institution's belief system. Understanding the culture and various sub-cultures provides administrators with information about how to increase performance and decrease conflict in particular groups. Smart and St. John (1996) examined the linkage between organizational culture type, culture strength – the degree of congruence between espoused beliefs and actual practices – and institutional effectiveness based on Cameron and Ettington's (1988) typology of higher education cultures. Analyzing 334 institutions across the U.S., Smart and St. John concluded that the clan culture, characterized by a mentor/facilitator leadership style, bonding mechanisms emphasizing loyalty and tradition, and a strategic emphasis on human resources and cohesion, was the most prevalent, but that regardless of culture type, institutions with the strongest cultures – i.e., those with congruence between espoused beliefs and actual practices – were the best performers.

These early studies tend to view higher education culture and sub-cultures as static, almost monolithic constructs. Recent studies recognize that organizational cultures and sub-cultures are affected by changes in the environment in which the organization operates (Moon & Bretschneiber, 2002). Consequently, higher education culture and sub-cultures are affected by a myriad of changes that have taken place over the past decade, ranging from changes in student demographics and changes in the expectations of external stakeholders, to changes in the technology choice set available for remaining competitive and achieving an institution's mission.

The technology decision-making process in higher education provides some insights as to which institutional sub-cultures play important roles in the adoption of new technologies. Consistent with higher education's tradition of shared governance – i.e., responsibility for the governance of higher education institutions is shared by faculty, administrators, and trustees (American Association of Univeristy Professors, 2009) – the decision to acquire and/or support enterprise-wide academic software systems such as LMSs is made by the

Chief Information Officer (CIO)/Chief Technology Officer (CTO) and his/her staff (Green, 2004). Other function titles (e.g., Director, Dean, Vice President) may apply, depending on the size and type of institution. The Higher Education Directory (2009) lists a total of 2695 named individuals performing CIO/CTO roles. The Chief Academic Officer (CAO), department chairs, and faculty work collaboratively with the CIO with respect to the selection of enterprise-wide software applications for teaching and learning, although the final decision and funding for hardware and software that is to be supported campus-wide usually resides with the CIOs office. As the administrator responsible for the institution's instruction and research affairs, the CAO assesses the extent to which a particular technology meets or does not meet pedagogical needs. Depending on the size and type of institution, the CAO functional title may be the Provost, Vice President, Dean, or some other similar title. The Higher Education Directory (2009) lists a total of 3422 named individuals performing the CAO role. These two stakeholder groups conform with Trice and Beyer's (1993) description of occupational sub-culture's that can be labeled the technologist sub-culture and the academic sub-culture respectively.

Members of the academic sub-culture include faculty, non-technical instructional and research support staff (e.g., instructional designers, library staff), and other non-technical staff under the Chief Academic Officer (CAO). Although institutional characteristics (Carnegie classification, number of students, public vs. private, for-profit vs. non-profit, etc.), culture, discipline, and other factors provide the context in which the academic sub-culture exists, concepts basic to this sub-culture include the pursuit and dissemination of knowledge through teaching and research, academic honesty, and academic freedom (Umbach, 2007; American Association of Univeristy Professors (AAUP), 2009). Commitment to these basic concepts means understanding the impact of technology on the processes of teaching and learning, on the role of sub-culture members, particularly the faculty, and on how student performance is assessed (Williams van Rooij, 2011).

Members of the technologist sub-culture include the institution's information technology (IT) staff, academic computing as well as administrative computing, and the technical instructional and research support staff under the Chief Information Officer (CIO). As with the academic sub-culture, the technologist sub-culture operates within the context of its institution. As the pace of technological innovation has increased, the essence of this sub-culture, i.e., what it means to be a technologist, is also changing. Keeping abreast of emerging technologies means that there is more to think about and process, more perspectives to consider, more complexity to IT as an occupation and contributor to the education experience (Alexander, 2009).

The impact of culture and sub-cultures on technology adoption has been richly explored. In their review of the literature on information technology and culture, Leidner and Kayworth (2006) conclude that cultural values play a role in determing patterns of technology development, adoption, usage, and outcomes. The occupational sub-culture of technologists must be perceived as possessing the knowledge necessary to deploy and maintain a new technology. For the academic sub-culture, the ability to capitalize on the maximum learning affordances offered by various technologies based on solid pedagogy as well as on awareness of available technologies (Dabbagh & Bannan-Ritland, 2005) is a key input to adoption.

The different and sometimes competing perspectives of the technologist and academic sub-cultures have only begun to be explored. For example, Smith (2006) examines the impact of the faculty sub-culture on the adoption of technology in the classroom of a large mid-Western public university. Drawing on Rogers' diffusion of innovations theory (1995), Smith notes that the academic sub-culture, of which the faculty is a part, tends to support a conservative diffusion of technology unless it is essential to the content of the course or it is supported financially by the administration. In depth research on the relationship between the academic and technology sub-cultures in the context of OSS adoption is limited, however.

4. Research questions

Examining the effects of the academic and technologist sub-cultures on OSS adoption for teaching and learning first requires a clear identification of the penetration of OSS for teaching and learning campus-wide. This paper presents the 2009 results of a Web-based survey designed to track trends in the adoption of OSS for teaching and learning among U.S. institutions of higher education. A baseline administration of the survey was conducted in 2006, a starting point against which to measure current and future adoption trends. The specific research questions were:

- To what extent has the U.S. adoption landscape changed over the past three years?
- Among institutions that have adopted or are considering adopting OSS for teaching and learning, what specific applications are being deployed, particularly learning management systems (LMSs)?
- What are the key drivers for OSS adoption from the perspectives of the academic and technologist sub-cultures?
- What policies, processes and procedures are institutions putting place to support the adoption of OSS for teaching and learning?

5. Method

5.1. The 2006 baseline survey

Examining the effects of organizational sub-cultures on OSS adoption for teaching and learning first requires an examination of the extent to which institutions are adopting open source software. In 2006, the author conducted a web-based survey (Williams van Rooij, 2007a) of 772 Chief Information Officers (CIOs), representing the technologist sub-culture, and Chief Academic Officers (CAOs), representing the academic sub-culture. The purpose of that survey was to identify patterns of deployment, the relative importance of specific selection criteria, and specific metrics and processes used in adoption decision-making using a combination of closed-ended and open-ended questions. Question areas included awareness of open source; adoption stages of specific academic and administrative open source software applications, ranging from full deployment at one end of the spectrum, to pre-decision consideration at the other end of the spectrum; reasons for (not) selecting open source; metrics for open source software selection decision-making, and; formal policies and procedures for adopting new technologies.

Survey results indicated that Carnegie classification, a set of categories set down by the Carnegie Commission on Higher Education (The Carnegie Foundation for the Advancement of Teaching, n.d.) to group like institutions (e.g., Doctoral/Research institutions, Associate institutions), was a critical differentiator of adoption, and that perceived cost of ownership (financial and human resources required to install and maintain software) was a key driver in the decision to (not) adopt open source for teaching and learning. The 2006 survey serves as the baseline against which the author can track trends in OSS penetration over time.

5.2. The 2009 survey: sampling frame

As in 2006, the target respondents for the 2009 survey were Chief Information Officers (CIOs), representing the technologist sub-culture, and Chief Academic Officers (CAOs), representing the academic sub-culture. The sample also had to be representative of each of the Carnegie types and of the distribution of public, private non-profit, and private, for-profit institutions in the U.S. To that end, the same sampling method – stratified random sampling – used in 2006 was again used in 2009. Stratified random sampling involves dividing the population into groups/strata that share a particular characteristic (e.g., Carnegie classification), then sampling randomly within the group and the number of groups selected for the sample reflects the relative numbers in the population as a whole (Robson, 2002). With this approach, institutions would be selected at random from the various Carnegie classifications in proportion to the actual size of the class in the population.

A list of 450 CAO and 450 CIO names and e-mail addressed drawn via stratified random sampling of the various Carnegie classifications was purchased from Higher Education Publications, Inc. (HEP), publisher of the Higher Education Directory (Higher Education Directory, 2009).

5.3. 2009 Instrument and measures

The questionnaire used in 2006 remained largely intact for the 2009 survey administration (see Appendix B). The survey was designed to address the four research questions cited earlier in this paper: Changes in the OSS adoption landscape in U.S. higher education over the past three years; specific OSS learning management systems (LMSs) deployed; technologist sub-culture vs. academic sub-culture perspectives on the key drivers of OSS adoption, and; institutional policies and procedures supporting OSS adoption for teaching and learning.

Consistent with pilot test results used to finalize the survey instrument in 2006, the survey tool's SKIP/BRANCH logic, whereby the response to a specific question determines the next question asked of the respondent, was again used so that items related to open source's impact on teaching and learning were asked only of CAOs and items related to the financial impact of open source were asked only of CIOs (Williams van Rooij, 2007a). New questions intended to differentiate institutions that are actively deploying OSS specifically for teaching and learning versus those deploying OSS for infrastructure (e.g., operating systems, databases) were introduced in 2009 based on content reviews by the author's colleagues in the higher education software industry. Further, the software industry-standard scale used to measure the degree of OSS adoption of specific applications was expanded to capture any differences at the enterprise level versus the unit/department level. For testing the significance of 2006 vs. 2009 adoption, all data was mapped to the original 2006 scale. The revised scalar questions were subjected to an item reliability analysis via Cronbach's Alpha. Item reliability analysis measures the extent to which items are related to each other and provides an overall index of the internal consistency of a scale (Creswell, 2002). Cronbach's Alpha coefficients of .7 or higher are considered to be sound indicators of item reliability. The Cronbach's Alpha coefficient for the 2009 survey administration was .934, on a par with that obtained in 2006 (.914) and considerably higher than the Social Sciences norm of .700.

5.4. 2009 Procedures and data collection

Using the lists of names purchased from HEP, each CAO and CIO was sent an e-mail invitation (see Appendix A) to participate in the survey on July 10, 2009. Embedded in the e-mail was a hyperlink to the URL address of a secured third party server hosting the questionnaire. Because the security set-up allowed access only to specific e-mail addresses, invitations could not be passed on to anyone else at the institution. If a respondent wanted a deputy or colleague to complete the survey in his/her stead, the respondent was required to e-mail the researcher with that request and include the name, function title and e-mail address of the designated individual. That individual was then sent an e-mail invitation that contained the hyperlink to the survey.

On August 1, the same e-mail invitation was sent to those respondents who had either not yet accessed the survey or who had not declined to participate in the survey by clicking on the *Unsubscribe* link at the bottom of the e-mail invitation. This process was repeated on September 1 to those who had not responded. Additionally, the text of the invitation was posted on the EDUCAUSE web site to generate additional interest in participation. On September 30, the field period ended and the survey hyperlink was deactivated.

5.5. 2009 Survey sample and response rate

The total number of completed surveys was 285. The 2009 sample is smaller than that obtained in 2006 due to lower response rates (16.1% vs. 28.3% in 2006). This may reflect the overall decline in survey response rates among higher education senior administrators over the past few years. For example, the 2009 administration of the annual Campus Computing Survey, an industry research project with a 19 year history, reports a 10% decline in response rate (Green, 2009). Similarly, response rates for the 2009 EDUCAUSE Current Issues Survey (Scrivner Agee, Yang, & Committee, 2009) slipped from 2008 to 2007 levels (28% vs. 32% and 33% respectively).

Nevertheless, there is some evidence that response rate is not the primary indicator of survey quality, particularly in light of (a) declining response rates across all modes of survey administration (b) studies comparing survey estimates to benchmark data from the U.S. Census or large governmental sample surveys, and (c) experimental comparisons showing few significant differences between estimates from surveys with low response rates and short field periods and surveys with high response rates and long field periods (AAPOR, n.d.). A better indicator of whether non-response bias may have affected the 2009 results is the profile of 2009 vs. 2006 respondents. As shown in Table 1, the 2009 sample demographics are nearly identical to those of 2006. The overrepresentation of Doctoral/Research institutions in 2009 is also

Table 1
Respondent demographics, 2006 vs. 2009.

	2006 ($n = 772$)	2009 ($n = 285$)	% Total HEP Population (2009)
Carnegie Classification			
Associates	24.5%	28.9%	40.5%
Baccalaureate and Baccalaureate/Associates	23.1%	19.8%	18.2%
Masters	23.8%	24.7%	15.7%
Doctoral/Research	23.1%	23.6%	7.0%
Specialized Institutions	4.7%	3.0%	17.8%
Other/Unclassified	0.8%	0.0%	0.5%
Governance (2008 Digest of Education Statistics)			
Public	54.3%	50.2%	38.7%
Private, Non-profit	42.3%	44.9%	37.3%
Private, For-profit	3.4%	4.9%	24.0%

consistent with 2006, reflecting the first-mover role that Doctoral/Research institutions have traditionally assumed in OSS higher education projects, such as Sakai, a platform for teaching, learning, and research (The Sakai Project, 2009) and Kuali, an administrative software system exclusively for higher education (The Kuali Foundation, 2009).

Another check against response bias is the extent to which the survey results conform to other research findings (AAPOR, n.d.). Consequently, the results of the 2009 administration of the survey will be compared with other empirical studies as well as with the 2006 survey results.

5.6. 2009 Data analysis and statistical methods

Data validation was conducted to test for the presence of data anomalies such as outliers or missing values. Frequency distributions and crosstabs were run to obtain descriptive statistics about respondent characteristics based on the size and type of institution, as well as deployment of specific OSS applications. The majority of the survey consists of nominal data where the order of the categories is arbitrary (e.g., 1 = public, non-profit institution, 2 = private, non-profit institution, etc.) and of ordinal data where items are placed on a scale representing the relative rank order, but not relative size or degree of difference between the items measured (e.g., influence of specific adoption drivers where 5 = strong positive influence and 1 = strong negative influence). Consequently, Chi-square testing was used to identify statistically significant relationships among the variables at an alpha level or "*p*-value" of .05 as the requirement for reaching statistical significance. All analyses were performed using the Statistical Package for the Social Sciences (SPSS version 18.0).

6. Findings

6.1. The 2009 adoption landscape

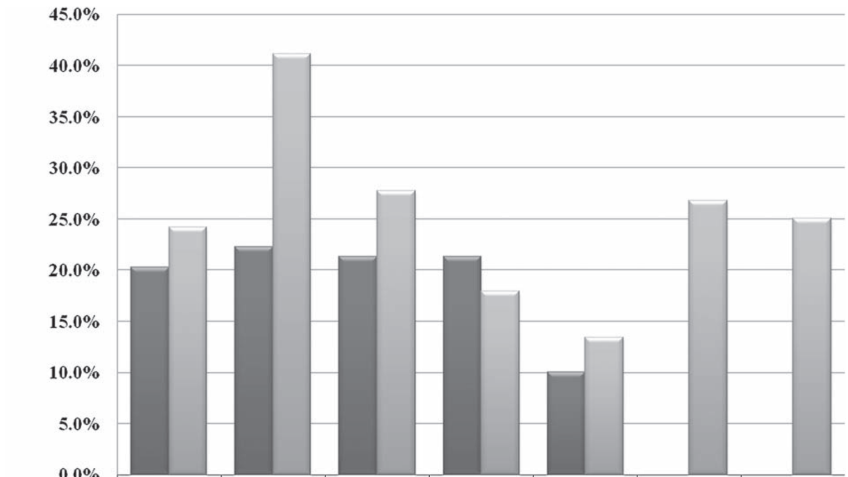
Awareness of OSS is nearly universal (86.4%), increasing slightly from the already high levels observed in 2006 (82.6%). This increase is largely due to a rise in CAO awareness levels (80.5% vs. 68.5% in 2006), which Chi-Square testing confirms as being significantly higher than in 2006, χ^2 (1, $n = 551$) = 7.4027, $p = .01$.

To identify potential trends in OSS adoption for teaching and learning versus adoption at the technical infrastructure level, CAOs who are aware of OSS were presented with a list of teaching and learning applications and technologies and asked to indicate the extent to which their institution has implemented OSS in each area using the expanded software industry-standard scale where "1" means "deployed campus-wide"; "2" means "deployed in some units/departments"; "3" means "piloting campus-wide"; "4" means "piloting in some units/departments"; "5" means "considering campus-wide"; "6" means "considering in some units/departments; "7" means "not planned", and; "8" means "don't know", with "2" and "4" being additions to the original 2006 scale. Fig. 1 illustrates the overall growth in the proportion of CAOs reporting deployment or piloting of OSS. Course management/learning management systems show the most dramatic growth (41.1% vs. 22.3% in 2006), which Chi-Square testing confirms as statistically significant, χ^2 (5, $n = 395$) = 23.830, $p = .001$. Further, 2009 adoption of OSS course management/learning management systems tends to be campus-wide rather than at the individual department/unit level. One in four CAOs also report adopting OSS testing/assessment tools (26.8%) and computer-aided instruction (CAI) tools (25.0%), two applications introduced in the 2009 survey administration.

CIOs were also presented with a list of technologies and asked to indicate whether their institution has implemented OSS (see Fig. 2). As with the CAOs, CIO-reported adoption levels of course management/learning management systems have increased significantly (40.5% vs. 25.8% in 2006), $\chi^2(5, n = 486) = 29.9593$, $p = .001$, as has adoption of digital repositories (32.4% vs. 19.9%), $\chi^2(5, n = 486) = 18.5815$, $p = .01$. Adoption of OSS infrastructure applications (computer operating systems, portals) remains relatively unchanged.

6.2. OSS teaching and learning applications deployed

The second research question focuses on OSS adoption specifically for teaching and learning, a question area introduced in the 2009 administration of the survey. More than half (52.9%) of all 2009 respondents state that they are deploying/planning to deploy OSS teaching and learning applications. When presented with a list of OSS teaching and learning applications and asked to identify which of those applications are in active or pending deployment, more than 2 in 3 (67.7%) mention Moodle, while 1 in 3 (33.0%) mention Sakai. Further, Sakai deployments are more likely in Doctoral/Research institutions than in institutions in other Carnegie classifications (see Fig. 3). This finding is consistent with the fact that Sakai was designed as a platform for research as well as for teaching and learning. Other OSS teaching and learning applications (e.g., ATutor, ClassWeb, Claroline) each generated fewer than 4% of total mentions.

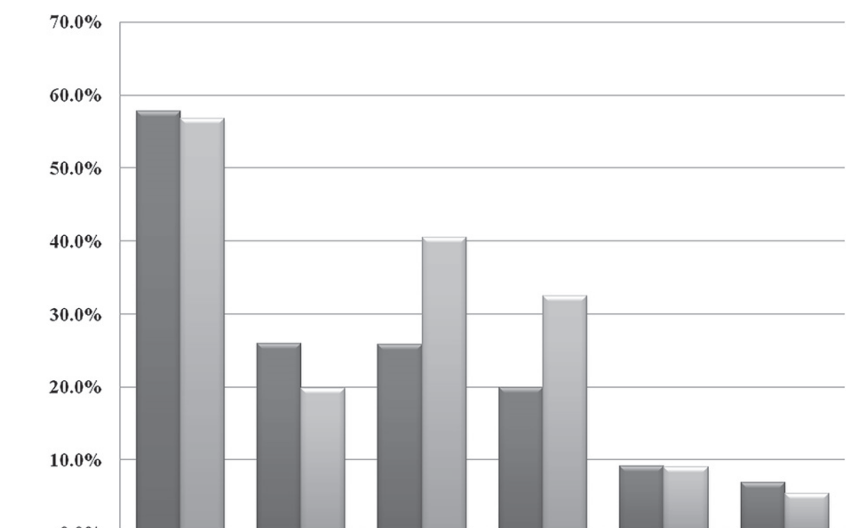


	Authoring Tools	CMS/LMS	Online Collabora-tive Teams/ CoPs	Student Portfolios	Faculty Portfolios	Testing/ Assessment Tools	CAI Tools
2006 (n=271)	20.3%	22.3%	21.3%	21.3%	10.0%	0.0%	0.0%
2009 (n=124)	24.2%	41.1%	27.7%	17.9%	13.4%	26.8%	25.0%

Fig. 1. OSS adoption among CAOs.

6.3. Key drivers of OSS adoption

The third research question focuses on the key drivers of OSS adoption. To differentiate adoption drivers related to teaching and learning from those related to technical efficiency, CAOs and CIOs were asked to evaluate potential adoption drivers specific to their areas of responsibility and expertise, which is the same process used in the 2006 administration of the survey. To assess the impact of pedagogical needs on the extent to which their institutions are evaluating OSS, the CAO respondents were presented with a list of ten attributes, nine of which were also asked in 2006 and one new attribute to begin measuring faculty commitment to OSS. The CAOs were asked to rate the relative importance of each attribute to OSS adoption using a 5-point comparative rating scale, where “5” means “strong positive influence”



	Campus Operating Systems	Campus Portals	CMS/LMS	Digital Repositories	Library Systems	Administra-tive/ERP Systems
2006 (n=364)	57.7%	25.9%	25.8%	19.9%	9.1%	6.9%
2009 (n=122)	56.8%	19.8%	40.5%	32.4%	9.0%	5.4%

Fig. 2. OSS adoption among CIOs.

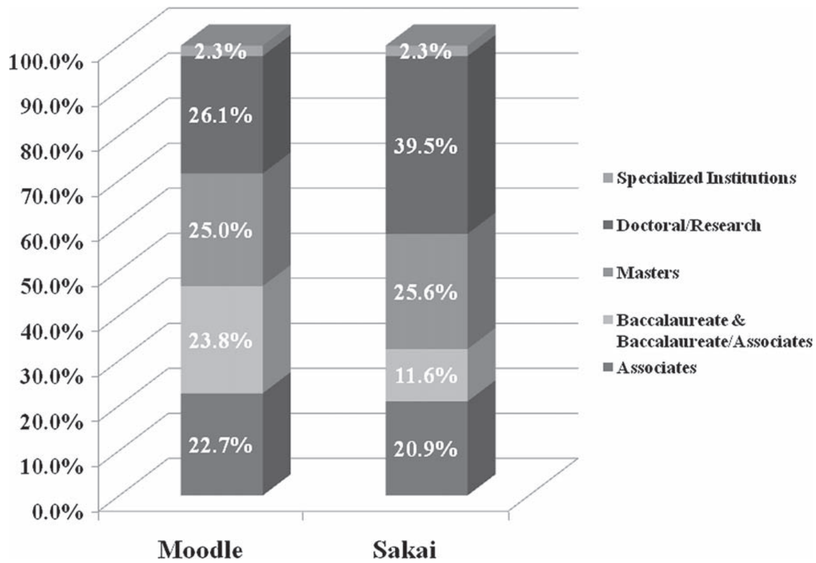


Fig. 3. Moodle and Sakai deployment by Carnegie classification.

and “1” means “strong negative influence”. Respondents were also given the option of indicating that an attribute was not a factor in OSS adoption. Using this same scale, CIOs rated attributes associated with institutional efficiency needs.

Although Chi-square testing shows no significant differences in CAO 2006 vs. 2009 ratings, there are some interesting directional changes, as shown in Table 2. In the 2009 survey administration, the strongest positive influence on CAO consideration of OSS for teaching and learning is the ability of open source to support engaged learning, to create a high-challenge, low-threat environment (47.9% stating “strong positive/positive influence”). This is a modest increase from 2006 (43.0%) and slightly displaces the ability to support active learning, to involve students in real-world tasks, practice, reinforcement, as the top adoption driver (46.9% stating “strong positive/positive influence” vs. 52.6% in 2006). A modest increase in the positive impact of OSS’ ability to support the need to share instructional content with other institutions also differentiates the 2009 respondents. At the other end of the spectrum, nearly one-third of CAO respondents state that some of the teaching and learning attributes were not a factor in OSS adoption, which is similar to 2006 results. More than one in four (27.8%) state that a push for open source from faculty was a strong positive/positive influence on OSS adoption.

Looking at the ratings in Table 3, the largest single influence on CIO consideration of OSS remains the desire to reduce or eliminate software license fees, with 3 in 4 (71.0% in 2009 and 75.7% in 2006) CIO respondents stating that this attribute was a “strong positive/positive influence”. The second largest influence in 2009 is the experiences of other institutions (48.5%), an increase from 2006 (42.3%) and displacing the need for application functionality as the second largest influence (40.0% vs. 47.3% in 2006). Further, Chi-square test results confirm significant differences between 2006 and 2009 on four of the ten influence attributes:

- Need for application functionality not available in commercial software, $\chi^2(5, n = 486) = 18.5542$, $p = .01$;
- Negotiate license agreements with commercial vendors, $\chi^2(5, n = 486) = 13.7386$, $p = .05$;
- Integrate academic & administrative technology services, $\chi^2(5, n = 486) = 34.4826$, $p = .001$;
- Establish/maintain campus-wide standard for software, $\chi^2(5, n = 486) = 18.6723$, $p = .01$.

As a cross-check on the key drivers of OSS for teaching and learning, respondents in the 2009 survey administration were presented with a list of seven institutional metrics and asked to indicate the most important metrics that their institutions use to make a go/no go decision on OSS for teaching and learning by ranking each metric from “1/most important” to “7/least important”.

As illustrated by the mean rankings in Fig. 4, the most important metrics for making a go/no go decision on adopting OSS for teaching and learning are the total cost of ownership (3.03) and faculty satisfaction (3.10), followed by return on investment/value on investment (3.40) and student academic performance (3.62). Further, there are no significant differences in mean rankings between CIO and CAO rankings.

6.4. Processes/procedures to support OSS adoption

The last research question addressed in the survey concerns processes and procedures for regulatory compliance and security of OSS applications. To provide context for understanding the extent to which OSS adoption is aligned with institutional strategies, respondents were asked if OSS is formally reviewed against contribution toward their institution’s strategic objectives. More than half (57.1%) of all respondents in the 2009 survey administration state that OSS is not formally reviewed against contribution toward the institution’s strategic objectives. These results are nearly identical to those of the 2006 survey administration (59.2%). Further, CIOs remain more likely than CAOs to claim no formal review process.

In both the 2006 and 2009 survey administrations, CIO respondents were presented with a list of policy areas and asked whether their institutions have a formal policy or process in each of those areas. Table 4 shows that there has been considerable progress in establishing

Table 2
Key drivers of OSS adoption among CAOs, 2006 vs. 2009.

Key Drivers	2006 (%) ($n = 271$)	2009 (%) ($n = 124$)
Support active learning		
Strong positive/positive influence	52.6	46.9
Neutral	16.7	20.8
Strong negative/negative influence	2.2	6.2
Not a factor	28.5	26.1
Support ownership of learning		
Strong positive/positive influence	49.4	38.1
Neutral	18.2	24.7
Strong negative/negative influence	2.6	6.2
Not a factor	29.8	31.0
Support contextual learning		
Strong positive/positive influence	45.1	35.8
Neutral	20.9	27.4
Strong negative/negative influence	3.4	6.3
Not a factor	30.6	30.5
Experiences of other institutions		
Strong positive/positive influence	44.1	44.2
Neutral	22.6	31.6
Strong negative/negative influence	6.7	8.4
Not a factor	26.6	15.8
Support engaged learning		
Strong positive/positive influence	43.0	47.9
Neutral	21.5	18.8
Strong negative/negative influence	1.9	7.3
Not a factor	33.6	26.0
Support social learning		
Strong positive/positive influence	39.2	37.1
Neutral	23.9	20.6
Strong negative/negative influence	5.6	7.2
Not a factor	31.3	35.1
Push for open source from IT staff		
Strong positive/positive influence	27.7	22.3
Neutral	25.6	24.5
Strong negative/negative influence	14.5	16.0
Not a factor	32.2	37.2

formal policies and procedures in most policy areas over the past 3 years, with more than half of CIO respondents stating that they have a formal plan in place.

To obtain a better understanding of policies around faculty recognition and reward, CAO respondents in the 2009 administration were presented with the same list of policy areas as CIO respondents. Fig. 5 shows almost no difference between the CAO and CIO responses, Not surprisingly, however, CAO respondents are more likely than CIO respondents to state that their institution has a plan in place for recognition/reward for the use of technology as part of the faculty professional development process ($\chi^2(3, n = 246) = 13.252$, $p = .004$) and for recognition/reward for the use of technology as part of the faculty recruitment, retention, & tenure processes ($\chi^2(3, n = 246) = 11.025$, $p = .012$). This difference in perspectives on faculty recognition/reward for the use of technology is consistent with the CAOs focus on instructional and research affairs vs. the CIOs focus on the institution's technology infrastructure (Green, 2008; Umbach, 2007; Williams van Rooij, 2007b).

6.5. Summary of findings

- Adoption of OSS for teaching and learning is gaining traction, with dramatic increases in awareness and in campus-wide deployment of OSS LMSs over the past three years.
- Although Moodle and Sakai are the leading OSS teaching and learning systems in U.S. higher education, Carnegie classification is a key differentiator of Sakai adoption.
- Student engagement and the support of active learning continue to be the dominant drivers of OSS adoption among CAOs, while CIOs continue to focus on reducing software license fees and on gauging the experiences of other institutions who have adopted OSS. Nevertheless, both CAOs and CIOs deem total cost of ownership as the number one metric for making a go/no go decision about OSS adoption.
- Institutions have made great strides in developing formal policies and procedures around the adoption of new technologies, particularly in the areas of security, compliance with the appropriate Federal and state regulations (e.g., FERPA, Section 508), and around ownership of intellectual property developed by faculty.

7. Discussion

7.1. The expanding landscape

The results of the 2009 survey reveal dramatic growth in the campus-wide deployment of OSS teaching and learning applications at U.S. institutions of higher education. These results are consistent with the latest administration of the Campus Computing survey (Green, 2009),

Table 3
Key drivers of OSS adoption among CIOs, 2006 vs. 2009.

Key Drivers	2006 (%) ($n = 364$)	2009 (%) ($n = 122$)
Reduce/eliminate software license fees		
Strong positive/positive influence	75.7	71.0
Neutral	12.5	10.0
Strong negative/negative influence	3.4	4.0
Not a factor	8.4	15.0
Need for application functionality not available in commercial software		
Strong positive/positive influence	47.3	40.0
Neutral	29.9	21.1
Strong negative/negative influence	10.6	9.5
Not a factor	12.2	29.4
Negotiate license agreements with commercial vendors		
Strong positive/positive influence	43.6	34.0
Neutral	28.3	24.7
Strong negative/negative influence	11.9	10.3
Not a factor	16.2	31.0
Experiences of other institutions		
Strong positive/positive influence	42.3	48.5
Neutral	32.3	27.8
Strong negative/negative influence	9.3	7.2
Not a factor	16.1	16.5
Push for open source from IT staff		
Strong positive/positive influence	29.2	29.2
Neutral	32.0	29.2
Strong negative/negative influence	17.7	11.5
Not a factor	21.1	30.1
Establish/maintain campus-wide standard for software		
Strong positive/positive influence	29.1	37.8
Neutral	33.9	19.4
Strong negative/negative influence	17.9	10.2
Not a factor	19.1	32.6
Integrate academic & administrative technology services		
Strong positive/positive influence	21.9	29.8
Neutral	34.7	17.0
Strong negative/negative influence	19.1	7.4
Not a factor	24.3	45.8
Recruit/retain IT staff in a competitive market		
Strong positive/positive influence	17.1	14.4
Neutral	36.8	28.9
Strong negative/negative influence	21.8	14.4
Not a factor	24.3	42.3
Push for open source from institution leadership		
Strong positive/positive influence	10.0	15.5
Neutral	30.8	15.4
Strong negative/negative influence	25.5	15.5
Not a factor	33.7	53.6
Push for open source from faculty[a]		
Strong positive/positive influence		17.5
Neutral		21.6
Strong negative/negative influence		21.6
Not a factor		43.3

[a] Not rated in 2006.

which indicates that OSS LMS penetration has increased from about 5% of all U.S. institutions in 2007 to nearly 30% in 2009, with the highest adoption rates among 4-year institutions. Nevertheless, Blackboard remains the single campus standard at more than half of the institutions participating in the 2009 Campus Computing survey.

Barriers to campus-wide OSS adoption for teaching and learning explored in the literature over the past three years include (a) the difficulty in calculating the true cost of ownership of OSS LMSs, (b) the lack of formal support mechanisms, (c) the need for highly skilled and highly motivated technical personnel, (d) the lack of efficient tools for migrating from commercial LMSs, and (e) the lack of interoperability with other campus systems (EDUCAUSE Constituent Group, 2008; Molina & Committee, 2006; Williams van Rooij, 2007b). Since the original 2006 administration of this survey, however, there has also been some discussion of how to overcome those barriers. For example, there are two well-known published guidelines to assist institutions in conducting OSS assessments. The Business Readiness Rating (2006) provides a framework advanced by developers from education and industry to assess the organizational fit of OSS based on seven weighted criteria: Functionality, including communication, collaboration, learner assessment, and instructional management tools; usability, particularly the ease with which faculty and students can become proficient in using the software; the availability and quality of user-maintained documentation for system administrators, faculty, and students; the size and activity level of the developer community, as measured by the e-mail forums and number of people contributing code; the number and severity of security alerts and the speed with which they are addressed; the amount and quality of volunteer and commercial support available, and; the number and size of current installations at other institutions. The Open Source Maturity Model (Navica, 2008) is another published guideline that enables organizations to self-identify as to how they rate themselves in terms of overall maturity in information technology adoption. Based on where they fall in the maturity

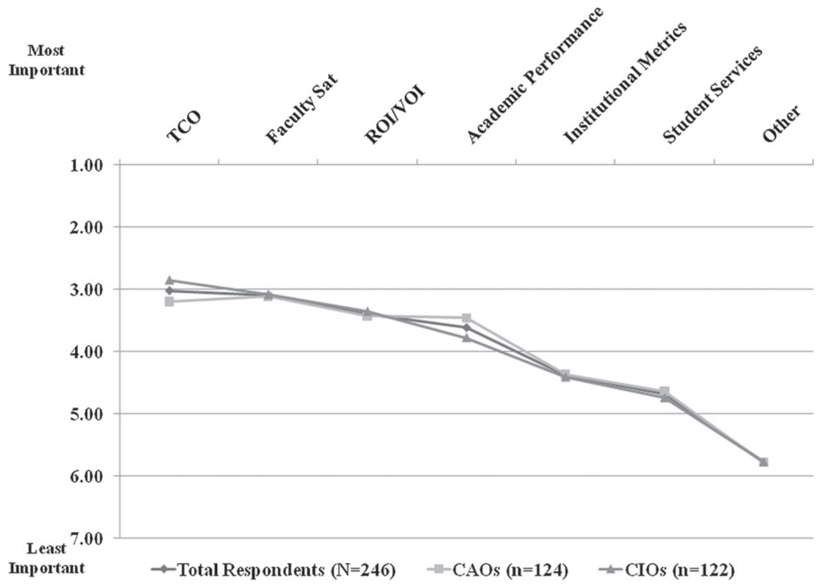


Fig. 4. Metrics for go/no go decision-making: 2009 mean rankings.

rankings, organizations then assess OSS systems on features/functions, support, documentation, training, product integration, and available professional services.

Individual institutions have also done a better job of placing their own OSS assessment models and migration experiences in the public domain (Chao, 2008; O'Laughlin & Borkowski, 2008; Uys & Morton-Allen, 2007). Live case studies with best practices for selection and implementation have been published by institutions from a variety of Carnegie classifications and include information about total cost of ownership of OSS vs. commercial software applications, as well as strategies for faculty support (Lakhan & Jhunjhunwala, 2008; Oakland

Table 4
Formal institutional policies/procedures among CIOs, 2006 vs. 2009.

Policies/Procedures	2006 (%) ($n = 364$)	2009 (%) ($n = 122$)
Ownership of Intellectual Property Developed by Faculty		
Yes, we have a plan	50.0	60.4
No, but we are currently preparing a plan	10.8	15.4
No	34.4	16.5
Don't know	4.8	7.7
Recognition/Reward for the Use of Technology as Part of the Faculty Professional Development Process		
Yes, we have a plan	22.0	20.9
No, but we are currently preparing a plan	13.4	16.5
No	56.9	50.5
Don't know	7.7	12.1
Security of New Technologies		
Yes, we have a plan	21.2	67.0
No, but we are currently preparing a plan	17.3	17.6
No	59.9	14.3
Don't know	1.6	1.1
Recognition/Reward for the Use of Technology as Part of the Faculty Recruitment, Retention, & Tenure Processes		
Yes, we have a plan	15.9	15.4
No, but we are currently preparing a plan	11.5	12.1
No	61.5	57.1
Don't know	11.1	15.4
Compliance of New Technologies with the Appropriate Federal or State Regulations (e.g., *FERPA, Section 508*)		
Yes, we have a plan	14.1	64.8
No, but we are currently preparing a plan	13.7	13.2
No	67.1	18.7
Don't know	5.1	3.3
Evaluation of the Acquisition, Implementation & Maintenance Costs of New Technologies		
Yes, we have a plan	12.1	56.0
No, but we are currently preparing a plan	12.7	12.1
No	74.2	28.6
Don't know	11.0	3.3
Adoption of New Technologies		
Yes, we have a plan	9.9	52.7
No, but we are currently preparing a plan	11.8	11.0
No	78.0	31.9
Don't know	0.3	4.4

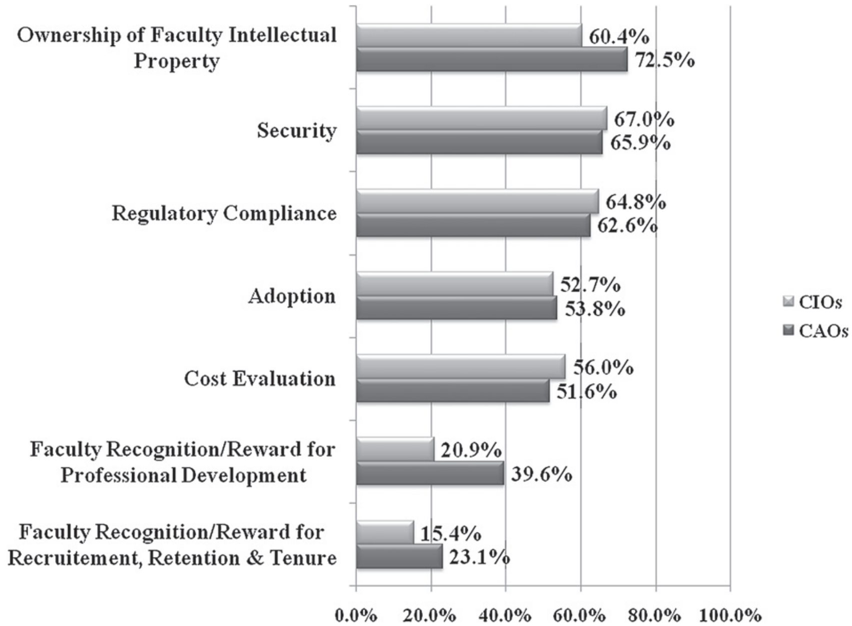


Fig. 5. Formal institutional policies and procedures, 2009: CAOs vs. CIOs.

University, 2009; Trappler, 2009). As more institutions share what they have learned about both the process and the impact of OSS selection, OSS adoption for teaching and learning should continue to gain traction.

7.2. The academic vs. technologist sub-cultures

Adoption patterns and key drivers as reported by the CAOs and CIO indicate a shift from the strong dichotomy seen in the 2006 survey administration to some meeting of the minds in 2009. In 2006, CAO engagement with OSS lagged far behind that of CIOs, consistent with what the software engineering literature identified as the gap between the technologist who is the end-user of infrastructure-level software and the non-technologist who is the end-user of business or academic application-level software, and the need for mutual understanding between users and developers (Behlendorf, 1999; Courant & Griffiths, 2006; Evans, 2002; Glass, 2003). Although CAO focus remains on technology in the service of pedagogy, the 2009 data indicate that CAOs are beginning to recognize total cost of ownership as a critical factor in OSS adoption decision-making. In the same vein, CIOs are beginning to recognize the importance of faculty satisfaction and support, along with technical efficiencies and cost effectiveness. Consequently, it could be argued that economics is the great equalizer and that the current economic climate has pushed cost of ownership into the minds of both academics and technologists (Green, 2009; Claffey, 2009). In addition, there is now considerable evidence that OSS teaching and learning applications, particularly Moodle and Sakai, have evolved into sustainable communities that provide support mechanisms as well as technical expertise, reducing traditional barriers to widespread OSS adoption (Collins & Committee, 2009; McDonald, 2009). Consequently, the Mellon Foundation's recent cessation of grant funding to Sakai and other OSS projects is not expected to be fatal to Sakai adoption (Parry, 2010).

Evidence of success is important to the academic sub-culture, particularly for faculty transitioning from commercial systems to OSS teaching and learning applications (Sclater, 2008), but also for non-technical support staff seeking to build their own best practices inventory. The academic sub-culture responds favorably to OSS for teaching and learning when, like any technological change, it is (a) evident, so that there is an awareness of OSS and of how OSS is being used, (b) easy to use, without having to choose from a host of features, functions, and complex user interfaces, and (c) essential, so that the what's-in-it-for-me (WIFM) is clear, rather than being a mandate from above (Haymes, 2008).

8. Conclusions

The purpose of this research is to track trends in the adoption of OSS for teaching and learning among U.S. institutions of higher education and to explore those trends through the lenses of the academic and technologist sub-cultures. Although the research currently has only two waves of measurement – 2006 and 2009 – it offers some insights into the pace and patterns of OSS adoption for teaching and learning in the U.S. Nevertheless, there are two key limitations to this research that need to be considered. First, the lower response rate compared with the 2006 baseline survey prevents the results from being representative of and projectible to the total population of U.S. institutions. The relatively low participation rates of Associate institutions (28.9% of the sample vs. 40.6% of total U.S. institutions) (Higher Education Directory, 2009) remains challenging when seeking to draw conclusions about the total higher education sector. One way to address this in future administrations of this survey would be to oversample for Associate institutions to, for example, 60% of the contacts purchased from HEP. Other steps to improve survey response rates would be to shift the survey period from the summer months, the peak vacation times, to the fall months when the semester has begun.

A second limitation of this research is that it represents only a snapshot in time. Changes in the current mix of commercially-available products, the threat of failure or the documented success of a highly visible OSS project, or the introduction of a new and potentially disruptive technology would alter the context in which institutions evaluate OSS and thus, alter the direction and pace of adoption. One way to address this limitation would be to conduct longitudinal case studies of institutions who are considering OSS for teaching and learning and tracking the entire decision-making process through to the go/no go decision. Another approach would be to track the same set of institutions over time to create a truly longitudinal study.

One opportunity for further research currently underway by this author is to utilize the 2009 survey data to construct and validate a predictive model of the key drivers contributing to a go/no go decision for open source LMS selection using binary logistic regression. Additionally, the author plans to continue administering the current survey questionnaire, with the next wave of measurement scheduled for 2010, to continue "snapshoting" the OSS landscape and to link future snapshots with any changes in the higher education environment. Other research opportunity areas worthy of exploration include, but are not limited to(a) the relationship between the incidence of OSS adoption and the number of institutional case studies in the public domain, (b) the continued erosion of adoption barriers through evidence-based models that also include data from institutions that utilize third party commercial vendors for OSS implementation and maintenance services, as well as institutions utilizing in-house talent and resources, and (c) the pace of OSS adoption in the U.S. versus that of the international postsecondary community.

Even when the economic environment improves, there will continue to be a need to maximize technology investments while providing quality postsecondary education. To achieve this requires an ongoing effort to recognize the different perspectives of the academic and technologist sub-cultures and striking a balance in which the drivers of one sub-culture are not realized at the expense of the other sub-culture.

Appendix. Supplementary data

Supplementary data associated with this article can be found in online version at doi:10.1016/j.compedu.2011.01.006.

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Educational Master Plan

Information Submission Form

1) Title: How to Make Progress in Computing Education

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Cameron Wilson and Mark Guzdial

Education

How to Make Progress in Computing Education

Improving the research base for computing education requires securing competitive funding commitments.

EDUCATION IS THE economic issue of the 21st century. Driven by global trade and a technologically connected, always-on global work force, countries understand they must innovate to succeed in the new business environment. A winning innovation policy is tricky to define, but it is clear it starts with education—and it starts early.

In the U.S., policymakers seem to have heard the message. There is a national urgency to improve K–12 education, and, in particular, ensure students have a strong grasp of science, technology, engineering, and mathematics (STEM) education. The Department of Education is pouring an unprecedented hundreds of billions of dollars into states to improve schools, help teachers, and support students. They want to know this money is helping. If you listen closely, you hear leaders from the Secretary of the Education to members of Congress talking about the need for "evidence-based" reforms. Where does this evidence come from? Largely, it comes from measurement tools developed by education researchers.

At the same time, the computing community sees a national urgency to reform K–12 computer science education. As computing transforms society for the digital age, students need to be able to think computationally about the world to succeed in life. How do students really learn rigorous computing concepts? We need research to tell us.

PHOTOGRAPH BY DAVE BRADLEY PHOTOGRAPHY/GETTY IMAGES

Computing is a relatively new discipline with a small education research base and limited assessments. Those responsible for making policy decisions in K–12 are interested in adopting curriculum in schools where you can assess how it is improving student learning. They are also interested in focusing resources on the "core" that students must know. Rigorous computing courses, if they exist, aren't typically in the "core." This leads to a chicken-and-egg problem for K–12 computer science, where you can't really measure how students learn without putting it in schools, but schools aren't interested in it until you can measure it.

We need to break this cycle and one aspect is improving the research base for computing education.

It isn't enough to rely on general education research. We need research specific to computing—a form of *domain-specific education research*. General education research helps us understand (for example) how students learn and how schools best facilitate learning. Domain-specific education research answers questions that are unique to the domain. Mathematics education researchers help us determine what preschoolers ought to know so they succeed later at multidigit arithmetic (and how to remediate missing skills early, before they impede students' progress). Physics education researchers know why students have trouble understanding velocity and acceleration, and they have identified the visualizations and activities that can enhance learning.

Computing education research is necessary for us to improve our teaching of computer science. Researchers in computing education can tell us how students understand parallel algorithms, what kind of visualizations help with understanding data structures (and how to use them), and how to measure understanding about computing that goes beyond any single language. Computing education researchers help us understand why students do not pursue computing as a career, and how to recruit, engage, and motivate more (and more diverse) students.

But we are the new kids on the school block. The National Council of Teachers of Mathematics was founded in 1920. The National Association for Research in Science Teaching started in 1928. In comparison, ACM's Special Interest Group in CS Education (SIGCSE) is only 40 years old, and ACM started the Computer Science Teachers Association (CSTA) six years ago. SIGCSE's research conference, International Computing Education Research (ICER) Workshop, is only in its fifth year.

Being relatively new puts us at a disadvantage when seeking competitive funding. Imagine that you are seeking funding in a general education research program, in competition with proposals in mathematics education and science education.

- Which proposals have great evaluation plans that will demonstrate the value for the investment? Mathematics and science education can point to scores of reliable, valid measures of learning that they can use. In computing education, there is no reliable, valid measure of introductory learning that isn't tied to a specific programming language. Overall, there are few standard measures of computing learning.
- Which proposals will lead to more students achieving learning objectives, identified by standards at the state or national level? Such standards and objectives exist for mathematics and science, but rarely for computer science in the U.S.

Some countries *do* fund research in computing education. There are strong research programs in computing education in Israel (Technion and Open University), England (at the University of Kent at Canterbury, for example), Germany (Free University Berlin), Sweden (Uppsala University), and Finland (at University of Joensuu). These research programs are investments in IT competitiveness in those countries.

Results of NSF "Fastlane" abstracts summary analysis.

Program	CS participation rate	Number of CS hits	Number of Proposals
ITEST	9%	18	202
Grad Teaching Fellows K–12	6%	20	316
Gender in Sci/Engineering	4%	8	187
Research and Evaluation on Education in Science and Engineering (REESE)	3%	11	413
DR K–12	2%	6	289
Robert Noyce* Teacher Scholarship Program	1%	4	282
Math and Science Partnerships (MSP)	0%	0	150
Total	4%	67	1839

* Noyce is not a research program; rather it is a program that prepares K–12 teachers in specific STEM disciplines. Computing may do poorly in this program because of serious teacher certification issues for computer science teachers, which have been explored in a report by the Computer Science Teachers Association: http://csta.acm.org/ComputerScienceTeacherCertification/sub/TeacherCertificationRequi.html

The State of Computing Education Research Funding in the U.S.

How about in the U.S.? Things are much more dismal, particularly for the K–12 level. The National Science Foundation (NSF) is primarily responsible for funding education *research*,[a] which comes two directorates: Computer and Information Sciences and Engineering (CISE) and Education and Human Resources (EHR). We examine CISE first.

CISE has had two programs—CISE Pathways to Revitalized Undergraduate Computing Education (CPATH) and Broadening Participation in Computing (BPC)—with a focus on education. However, as of this writing CISE announced that it is combining these programs into a broader program. This new vision would look at the entire pipeline but with special focus in two areas:

- moving earlier into the pipeline with specific engagements in middle/high school to bring computational thinking/computer science concepts into this space; and
- widening the program to be inclusive for all populations, built around a theme that "computing is for everyone."

It would also add a specific education research component that would seek to build education research capacity at the university level and to provide a greater understanding of how children come to understand computing concepts. No one knows exactly what this new program will look like until the solicitation comes out, which CISE is saying will happen in the summer of 2010. It is expected the new program will be funded at about $20 million, which is similar to the combined amount for CPATH and BPC.

a We did not do a detailed review of grants from the Department of Education's research arm—The Institute of Education Science—as this institute appears to be focused on general education research. A cursory review did not find any grants focused specifically on computing research. Further, other programs run by the Department of Education are primarily focused on funding state and local education agencies to put resources directly into the schools.

These are likely positive steps toward addressing clear gaps in the field. But it will likely be a series of small steps until the community can start leveraging other parts of NSF. Compared to the relatively small CISE budget for education, EHR has over $850 million for education research, which is where we need to turn our attention. Not all of this funding goes into education research, but in looking where Congress is investing federal education research money, it is clear they are looking to EHR for those answers. EHR funds both higher education and K–12 research programs through various programs.

The program that probably does the most for higher-education computer science is the Course, Curriculum, and Laboratory Improvement (CCLI) program. It seeks to improve undergraduate education across STEM through proposals on how interventions work and how they get disseminated, and funds the development of new assessment techniques and instruments. It funds applied research that informs interventions, and doesn't fund computing education research that helps us develop new theory about how people come to understand computing.

The state of computing education research and teacher support at the K–12 level is more complicated. There are several relevant EHR funding programs. ACM staff analyzed abstract summaries from NSF's "Fastlane" within EHR to better understand where computer science education research is funded or where computer science teacher support existed. The scope of EHR programs was limited to: *funded* proposals that had a significant K–12 focus, or those that prepared or continually trained K–12 teachers. Abstracts are only a brief representation of the plan, so the analysis tended to be more inclusive—"close" was good enough. However, the analysis specifically excluded grants that were primarily focused on getting computing into the classroom or getting teachers prepared to use computing in the classroom.

The results of the analysis appear in the table here. Of the 1,839 proposals funded across seven programs, only 67 (4%) had an explicit computer science component. Our analysis of abstracts could not tell us which of these projects had any kind of research component, nor where the research informed our understanding of learning computing specifically.

It isn't enough to rely on general education research. We need research specific to computing—a form of *domain-specific education research*.

Regardless of the limitation of the analysis, it is clear—there is far too little computing research or teacher support being done by the key agency charged by the federal government for understanding how to improve STEM education.

Making Progress in Computing Education

Funding is important. Funding allows researchers to make progress on problems that are a priority. Funding is recognition that a particular discipline or strategy is worthwhile. Funding can create a virtuous circle, where funded work attracts more funded work. Lack of funding creates a vicious circle, when the lack of theory and of assessment prevents other projects from being funded.

The computing education research is concerned with how to sustain interest and progress in the research community. Few of the U.S.-based presenters at the International Computing Education Research Workshop have NSF funding to work in computing education research. Those that have received NSF funding do the computing education research component on the side. Few Ph.D. students focus on computing education, and those that do focus on this area rarely obtain faculty slots in research institutions. Working in an area without explicit funding programs is dangerous for an untenured assistant professor at a research institution.

Funding is particularly important to bootstrap a field. Computing education research seems to be in a vicious cycle. As a community we need to take some basic steps to break the cycle:

- Learn what NSF programs are available and aggressively go after funding. NSF CCLI Program Officers regularly offer SIGCSE workshops walking through the various NSF programs that are available for education research to catalyze proposals.
- Sit on NSF review panels when asked, *particularly* in EHR. There should be a computing voice at these review panels. The best way to learn what gets funded (and how to write a fundable proposal) is to sit on these panels.
- Encourage fundamental research in computing education. As teachers of computing, we want to know what language, IDE, book, and curriculum works best in our classroom. We also need the theory that helps us make these choices, and the assessment that gives us data on what works best. We want students to start successfully and to develop expertise and skill.
- Look for opportunities to work with other domain-specific education groups. Mathematics education, for example, has funding sources, and computing education research could grow in combined projects.
- We must stand together. Reform proposals supported by many institutions carry weight. Shared goals and strategies lead to proposals that reviewers can support.

Computing education research is an important investment in innovation and competitiveness. If the U.S. wants to remain the world leader in computing, it ought to be making that investment and the community needs to aggressively go after funding. Other countries are making that investment. Growing computing education research in the U.S. would improve teaching and learning in computing nationally and inform the research community internationally.

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