Washington Student Achievement Council

# Ten-Year Roadmap Issue Briefing

## Challenge Area:
## *Capturing the Potential of Technology*

## Planning Activity:
*Integrating online learning opportunities into each institution's instructional program and assessing student cost and system capacity implications.*


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**May 2013**


Washington Student Achievement Council
www.wsac.wa.gov

# Executive Summary

This issue briefing discusses one challenge area identified in the Washington Student Achievement Council's 2012 Strategic Action Plan—Capturing the Potential of Technology. The report utilizes national and statewide research and data and includes input from a wide range of stakeholders participating in the Roadmap development workgroups.

Technology is changing the way we live, work, and learn. Washington's colleges and universities are being challenged to respond to the opportunities technology presents to improve the educational achievement of students in many stages of life.

Only limited state-level coordination, collaboration, or planning has existed pertaining to the use of technology for teaching and learning at Washington postsecondary institutions. While some sector-specific activities and participation in regional or national efforts have occurred, there is no unifying entity that encompasses all postsecondary institutions in the state. In spite of that, many of Washington's postsecondary institutions have implemented—or in some cases are leading in the implementation and development of—educational best practices that employ new technologies and address technological issues in various ways.

Exposure to technology in the classroom may produce students who are better prepared to deal with a technology-driven world in the post-Industrial Age. However, technology's more valuable contribution is its ability to advance the broader educational goals the state hopes to achieve.

The fundamental responsibility for educators is to focus on student learning and students' educational experiences. We need to be nimble in the usage of technology, and we must ensure that the learning objectives determine the selection and use of technology. Without clear strategies for optimizing the use of technology to educate students, technology's value as a tool for increasing educational attainment will be diminished.

Specific policy options and recommendations for the Washington Student Achievement Council's consideration will be presented at the July 2013 Council meeting.

# Contents

# Context of the Ten-Year Roadmap

Increasing educational attainment is vital to the well-being of Washington residents and to the health of our state's economy. To this end, the Washington Student Achievement Council is working to propose goals and strategies for increasing educational attainment through a Ten-Year Roadmap and a two-year Strategic Action Plan.

The Council's Strategic Action Plan, adopted in November 2012, identifies five critical challenges to be addressed in the Roadmap. The five challenge areas are:

1. **Student Readiness** (with four planning activities: Early Learning; Outreach and Support; Alignment; Remedial Postsecondary Education)
2. **Affordability**
3. **Institutional Capacity and Student Success** (with two planning activities: Meeting Increased Demand; Assessment of Student Skills and Knowledge)
4. **Capturing the Potential of Technology**
5. **Stable and Accountable Funding**

To inform the Council's work of creating the first Roadmap, workgroups comprising lead Washington Student Achievement Council Members, Council staff, and external workgroup members were formed to research, discuss, and develop issue briefings and policy recommendations for each of these five critical challenge areas.

The Challenge Areas are complex and interrelated. While the Roadmap will recommend actions for each of the Challenge Areas, these recommendations will be integrated into a cohesive plan.

## *Challenge Area: Capturing the Potential of Technology*

This brief provides information on one specific challenge area—*Capturing the Potential of Technology*. This information is intended to assist Council members in their development of the Ten-Year Roadmap to raise educational attainment in Washington.

The purpose of this brief is to: 1) set the context for this work as it relates to the Ten-Year Roadmap; 2) identify policy issues and questions to be explored in the challenge area of capturing the potential of technology for teaching and learning in colleges and universities; 3) highlight best practices; 4) outline emerging trends; and 5) discuss criteria for evaluating which technologies should be used to support teaching and learning in Washington.

# Introduction

Prior to the 1980s, technology use in the classroom was limited. Mimeograph machines, overhead projectors, and similar equipment carted between classrooms represented the extent of technology use. During this period, technology in the classroom was more imposed on students than participatory with students, and local schools made their own technology decisions.

At its earliest inception, educators appropriately focused on technology as a tool to advance teaching practices. Whether it was an overhead projector that allowed students to better "see" an educator's point, or a movie projector that brought the world to the classroom, these tools helped educators instill knowledge by providing students with a context upon which to pin their new understandings. Technology augmented good educational practice. The primary question for educators was, "Does this technology advance teaching and learning in the classroom?"

Then two events led to a revolution in education: the birth of personal computing in the 1980s, which lowered computing costs, and the public release of the World Wide Web in 1994. Since then, technology has evolved at a pace that is difficult to keep up with, although various educational sectors in Washington have made earnest efforts to adapt as—outlined in Appendix A.

Regardless of sector, we must be aware that the desire to "keep up" has the potential to distract us from focusing on properly equipping teachers and students, at all levels, to use technology in ways that support and enhance student learning.

Many students, faculty, policy makers, and the public at large are optimistic about the benefits technology brings to the educational process. Some view technology as a way to provide lower-cost education to more students or as a way to supplement the educational experience through, for example, Massive Open Online Courses (MOOCs).

Students, especially working adults, see technology as a way to access education that better suits their schedules and lifestyles. A national survey found that undergraduate students generally believe technology provides easy access to resources, helps them be more productive and feel connected, and creates engaging, relevant learning experiences.[1] Others see technology's potential to accommodate differences in learning and teaching styles.

But not everyone shares this optimism or this perspective. Some academic leaders are concerned about the quality of the educational experience and the legitimacy of classroom technology, especially as it relates to online and distance education and MOOCs in particular, which have very low completion rates.[2]

Others view technology as potentially limiting access to education among low-income and other at-risk populations.[3] Administrators also maintain that implementing and supporting some forms of technology may not be affordable or sustainable, particularly during economic recessions.

Still, when technology is used properly, it can improve the overall quality of the educational experience—whether in the classroom or at a distance—provided the focus remains on education first and technology second.

> *"The student-centered classroom harnesses the flexibility of new media to provide a diverse range of students with multiple means of representation, expression, and engagement. The student-centered classroom harnesses the flexibility of new media for the teacher, providing a rich set of tools and resources to elevate and differentiate teaching. In that rich environment, the teacher can be both a content provider and the classroom's most experienced and savvy teacher/learner, a model of the kind of expert learner students can emulate."*[4]

# Policy Issues

The primary issue to be addressed by the workgroup is whether Washington could and should more effectively leverage technology to improve teaching and learning at Washington colleges and universities—in ways that reduce the cost of attendance for students and expand system capacity in a cost-effective manner while maintaining quality.

A secondary issue is whether technology could and should be leveraged to address other areas, such as remediation and meeting the needs of returning adults. If so, technology also may have implications for other challenge areas that will be addressed in the Roadmap, such as Student Readiness, and Institutional Capacity and Student Success.

## Questions to be Explored

The following policy questions were used to guide the development of this issue briefing:

1. *How is technology currently being used for teaching and learning at colleges and universities in Washington?*
2. *What are the best practices within and outside of Washington—including institution-based and workplace based models for training and credentialing?*
3. *Which best practices could be applied in Washington? How can they be tailored to meet the unique missions of our institutions?*
4. *What are the appropriate criteria for evaluating the efficacy and the cost and price impact of instructional technology?*
5. *What is the potential demand for using technology for remediation and to meet the needs of returning adults?*

The Best Practices section of the issue briefing addresses the first three questions regarding current uses of technology and best practices. This is followed by an overview of trends and challenges associated with technology in education within the next five years. The final section of the issue briefing addresses the remaining two questions regarding evaluation criteria and technology use for remediation and meeting the needs of returning adults.

# Best Practices

The Technology workgroup discovered considerable overlap during a review of the uses of technology for teaching and learning in Washington and the best practices within and outside of Washington. Though uses and best practices were covered by three separate questions in the work plan, the workgroup determined that all three questions could be addressed simultaneously in a single Best Practices section of this report.

## Instructional Best Practices

Instructional best practices refer to the way in which a course is conducted, the content delivered, and the learning facilitated. They create an engaging learning environment for the students and, according to students in the Capturing the Potential of Technology workgroup, also develop a sense of community among classmates and instructors.

### *Active-Learning Classrooms*

Some colleges and universities are reconfiguring classroom spaces to encourage active learning. These revamped spaces, referred to as active learning classrooms, are "designed to foster interactive, flexible, student-centered learning experiences."[5] In lieu of individual desks all facing a teacher sitting behind a large desk, or standing in front of a white board at the front of the room, active learning classrooms generally feature clusters of tables or pods to accommodate multiple small workgroups.

While many of these classrooms are designed to accommodate various forms of technology—such as multiple projection and whiteboard surfaces and laptop connectivity—the focus is not on the technology but rather an environment that encourages learning and collaboration. Libraries, as they evolve in the 21st century also can serve as active partners in the redefining of skills and knowledge acquisition as we continue to pioneer active learning spaces.

Projects such as SCALE-UP (Student Centered Activities for Large Enrollment Undergraduate Programs) from North Carolina State University, show that these new learning environments may help improve students' problem solving skills, conceptual learning, and retention.[6] Numerous other colleges and universities, such as City University of Seattle, Indiana University, Seattle Pacific University, and The University of Minnesota also currently are using this best practice.

### *"Flipped" Classrooms*

Flipping the classroom moves some content knowledge acquisition (e.g., lectures) outside of the scheduled class time. By creating short video lectures and demonstrations or other online resources—including quizzes, games, and other learning tools—instructors offer students the opportunity to read, listen, and digest information at the student's pace outside of class time. When students arrive in class, they are ready for higher-level learning and the application of knowledge to problems. The increased interactivity between students and the instructors, according to a growing body of research, is more learning.[7]

In “How ‘Flipping the Classroom Can Improve the Traditional Lecture,” Dan Berrett describes the model in this way:

> “Instead they [students] gather the information largely outside of class, by reading, watching recorded lectures, or listening to podcasts. And when they are in class, students do what is typically thought to be homework, solving problems with their professors or peers, and applying what they learn to new contexts. They continue this process on their own outside class.”[8]

In Washington, 10.6 percent of K-12 school districts report that one or more classrooms have implemented a flipped classroom strategy, while 28.3 percent of districts are considering implementing this model.[9] Nationwide, 9 percent of teachers are utilizing flipped classrooms. Math and science represent the most likely subjects where this might occur, as 15 percent of those teachers currently employ this technique.[10]

### *Blended Classrooms*

Blended, or hybrid, models of instruction meld online and face-to-face instruction and can reap the benefits of both. In a study conducted by Ithaka S+R, researchers reported:

> “We find that learning outcomes are essentially the same—that students in the hybrid format "pay no price” for this mode of instruction, in terms of pass rates, final exam scores, and performance on a standardized assessment of statistical literacy. These zero-difference coefficients are precisely estimated. We also conduct speculative cost simulations and find that adopting hybrid models of instruction in large introductory courses have the potential to significantly reduce instructor compensation costs in the long run.”[11]

Students and faculty seem to be in agreement about the benefits. One faculty member who participated in the Council’s listening tour earlier this year stated that “Hybrid courses worked well, I could see what they were getting and what they weren’t. The online part allowed them to work at home, but the in-person part allowed for student-to-student interaction and interaction with the professor.”[12] Undergraduate students also seem to prefer a blended learning environment.[13] This model is employed in a wide variety of postsecondary classrooms.

### *Competency-Based Education*

This delivery model provides content asynchronously within a flexible schedule that allows students to progress at their own rate. Courses are under the direction of course mentors who work one-on-one or in groups with students for content mastery. Formative and summative assessments are standardized, conducted by testing experts to document student learning, and are tested for validity and reliability.

Predictive and diagnostic analytics are used to ensure the alignment among competencies, course content, and assessment and to determine students’ progression. Students are supported by a mentor who is assigned at admission, and stays with the student until graduation, meeting individually weekly or biweekly to assist them to make on-time progress.

While this model shows high satisfaction among students and their employers, many educators challenge whether the learning experience is rich as on a university campus where students are able to engage with other students and many dislike the disaggregation of faculty member's role into specialties, like assessment.

Western Governors University (WGU), which includes WGU Washington, is gaining national prominence for delivering accessible, affordable, accelerated, and flexible education, geared primarily at self-directed, mid-career adults. Washington community and technical colleges recently developed a reverse articulation agreement with WGU Washington as a way to meet the needs of adult students in our state.

Each of the above models provides the instructor with the flexibility to utilize one or more forms of technology based on learner and instructor attributes and the subject matter. Some of the tools currently being used include, but are not limited to, the following: Learning Management Systems (LMS), Personal Learning Environments (PLE), Curriculum Management Systems (CMS), video and web-conferencing, lecture capture systems, Open Educational Resources (OERs), and tablets and mobile computing and the applications that are designed for these devices. More information about these tools is provided in the Glossary.

## Supporting the Instructional Best Practices

Best practices that support implementation of instructional best practices create an environment that promotes high-quality teaching and learning by addressing underlying needs of faculty and students. Following are examples of some of these key dependencies, many of which could be adapted at an institutional, sector, state, or regional level.

### *Train and Support Faculty*

Most technologies cannot simply be handed out with the assumption that faculty have the time or aptitude to learn how to use and implement the technology effectively. Students participating in the Capturing the Potential of Technology workgroup, or in national surveys, report that faculty need to be more confident in their use of technology and that too much class time is consumed with students assisting faculty with technology.[14] Faculty do not need to become technology experts, but they do need to be trained on how technology can advance student learning.

Following are some examples of effective professional development and faculty support models.

- Multimodal Learning Programs, such as the one in place at Central Washington University (CWU). CWU's program includes the following components:
  - Learning teams comprised of instructional technologists, a librarian, faculty fellows supporting faculty in each college, and an online advisor.
  - A 24/7 technical support help desk.
  - Faculty training delivered in-person, via web-conferencing, and online tutorials.
  - Technology training labs.
  - Learning communities.
  - Peer mentors.
  - Instructional design consultants.
  - Online course development grants.

- Learning communities, either formal or informal.
  - One of the learning communities at the University of Washington currently is focused on the flipped classroom model.
  - Seattle Pacific University currently has faculty learning communities on blended learning and active learning. Another learning community focused on online learning will begin this summer.
- Workshops, webinars, peer-to-peer training, and mentoring.
- Teams that include some combination of faculty, instructional technologists, instructional design specialists, videographers, librarians, and information technology staff.
- Learning labs - classrooms set up with instructional technology and supported by IT staff members who can provide just-in-time assistance with infrastructure or equipment issues during actual class time.
- Specialized support units. Washington State University developed an eLearning services unit to support faculty by providing online instructor certification training, facilitating faculty training in-person and online, and conducting research in best practices of eLearning teaching practices.

### *Train and Support Students*

Even the most highly trained and well supported teacher would have a hard time reaching students who lack technology training and support. Technology can be especially frustrating for returning adult and English Language Learner (ELL) students. However, it can also be frustrating for many other students who are not digital natives. According to a national survey, 66 percent of students felt they were prepared to use technology when they entered college, leaving 34 percent feeling unprepared.[15] As one faculty member put it:

> "Despite the surveys that say that students can navigate the technology, they really can't. Students can post on Facebook or send a photo to a friend, but composing a serious email is more difficult, not to mention meeting academic writing and work standards, and maintaining them in an electronic environment Students are not as prepared as you think. They are not technology savvy, and lack the academic preparedness and the required discipline to succeed in an online class."[16]

Following are some examples of effective student support and resource models.

- Student technical support
  - IT help desks, such as Washington State University's.
  - Student technology orientation (in-person, webinar, self-paced tutorial).
  - Pilot online courses that give students online experience prior to taking credit-bearing courses.
  - Short screen-cast videos students can access on-demand to learn how to use technology. City University of Seattle students often say this approach is more effective than text instructions or tutorials.

- Tutoring
  - Face-to-face tutoring
    - Student learning communities
    - Peer tutoring
    - Mentoring
  - Online tutoring
    - WSU Online is a member of the Western eTutoring Consortium, which provides unlimited free online tutoring, including an eWriting Lab, live tutoring via eChat, and answers to questions within 48 hours via eQuestions.
    - The Minnesota State Colleges and Universities system offers online personalized tutoring service (provided by a company called SmartThinking) for each campus.[17]
    - Supplemental instruction tutoring programs for students with special needs, such as developmental English and reading.
  - Library services
    - Florida Virtual Campus (FLVC) provides access to online student-support services, such as advising, as well as library support services, serving as a clearinghouse and resource for prospective and current Florida public college and university online students.[18]
    - Course-integrated instruction on how to use technology to find, evaluate, and use information for specific assignments (for example, City University of Seattle offers program-related information literacy support, teaching students to find and retrieve information, evaluate its relevance and authority, and use it effectively).[19]

### *Shared Resources*

Shared resources, such as **open education resources** (OERs), provide numerous benefits. OERs reduce costs for the education provider and the price for the learner. Preliminary research by SBCTC shows that when faculty attempt to use lower cost materials, students save about $100 per course in textbook costs. Further, students using these lower cost materials have the same success and completion rates as those who use higher cost publisher materials.[20]

Materials obtained from OERs can also be used by individuals interested in self-study or as supplemental materials. Examples of OERs include:

- WashingtonOnline, a cooperative effort by the Washington State Community and Technical Colleges to develop and deliver online, asynchronous courses to students.[21] System colleges can pool enrollment in the shared online courses.
- Washington's Open Course Library, a collection of expertly developed educational materials—including textbooks, syllabi, course activities, readings, and assessments—in 81 high-enrollment college courses managed by the State Board for Community and Technical Colleges.[22]
- Connexions, a place to view and share educational material made of small knowledge chunks called modules that can be organized as courses, books, reports.[23] This project, by Rice University, also now includes open text books (OpenStax).

- MIT OpenCourseWare (OCW), a web-based publication of virtually all MIT course content.[24]
- iTunes U, an app where students can play video or audio lectures, take notes that are synchronized with the lecture, read books, view presentations, and see a list of all the assignments for the course and check them off as they're completed. Central Washington University, Seattle Pacific University and the Office of the Superintendent of Public Instruction are among the hundreds of postsecondary institutions, schools, and education organizations from around the world using this tool.[25]

Utilizing OERs does present some challenges. Currently, it is unclear who is responsible for maintaining the content after it's developed. Users of the content, students in particular, may need help determining the reliability of the resources. Time and resources are necessary in order to develop and revise the content, which may prevent faculty from contributing materials to OERs.

To address these challenges, some institutions have joined statewide, regional, and national **consortia** to share ideas information, resources, and training; and to deliver joint online programs.[26]

Examples of the types of consortia that many of Washington's colleges and universities are currently participating in include the following:

- **The Cooperative for Educational Technologies (WCET).** Founded in 1989 by the Western Interstate Commission for Higher Education (WICHE), the WCET brings together colleges and universities, higher education organizations, and companies to improve the quality and reach of e-learning programs through a shared exchange of resources and services.
- **Actions, Solutions, Growth.** Founded in 2005, the ASG provides innovative, high-quality programs through a partnership of continuing and professional education leaders at large nonprofit and for-profit universities. ASG members, including the University of Washington, currently offer short, online certificate programs in Biotech Project Management, Decision Making for Climate Change, and Web Intelligence.[27]
- **The Western e-Tutoring Consortium.** A multi-state collaboration in existence since January of 2008 and managed by the SBCTC eLearning department, the Western e-Tutoring Consortium provides free, online tutoring for students at participating colleges and universities. The consortium includes 27 Washington community and technology colleges and 17 institutions from six western states. The colleges in the consortium use a common technology platform and share local tutors.[28]
- **The Northwest Academic Computing Consortium (NWACC).** Comprised of 34 colleges and universities, public and private, two-year and four-year – many of which are Washington institutions, two statewide university systems, the Pacific Northwest National Laboratory, and the Western Interstate Commission for Higher Education. NWACC's goals are to foster collaboration on use of technology for instruction, research, and administration efforts. They host workshops and summits covering a range of technology related issues.

- **The Northwest Five Consortium (NW5C).** The five liberal arts non-profit colleges, including University of Puget Sound and Whitman College, participating in NW5C work together under the auspices of the Andrew W. Mellon Foundation. Their goal is to enhance the student experience by creating technology infrastructure and programmatic supports to strengthen collaborative teaching efforts.
- **edX**. A not-for-profit enterprise of the founding partners, the Massachusetts Institute of Technology (MIT) and Harvard University, edX offers online learning by building an open-source online learning platform and hosting an online web portal.
- **Coursera**. Offering free online courses, Coursera is an education company partnering with universities and organizations around the world. A K-12 professional development initiative will launch this summer, along with a cooperative agreement to provide free course materials through Chegg.[29]

### *Utilization of Data*

**Learning Analytics** (LA) applications collect and analyze the "digital breadcrumbs" that students leave as they interact with various computer systems to look for correlations between those activities and learning outcomes. The type of data gathered varies by institution and by application, though common data points include the frequency with which students access online materials, or the results of assessments from student exercises and activities conducted online. Learning analytics tools can track far more data than an instructor can alone and help identify factors associated with student learning and course completion.[30]

Opportunities for individualized instruction increase through digital learning analytics. For example, the Carnegie Mellon Open Learning Initiative (OLI) project provides continuous feedback to students and teachers. Students in OLI courses cover more course material and remember it longer than students in standard courses.[31]

WGU Washington uses learning analytics to predict student success, evaluating such factors as student patterns of engagement, assessment results and time spent on learning materials. Analytics also are used to improve interactive texts and other learning resources in partnership with educational publishers.

Student-specific data, such as that employed in OLI, can now be used to customize online course platforms, course content, and supplemental materials—much in the same way that online businesses tailor advertisements and offerings to consumers. Individualized courses economize student time on materials, increasing students' opportunities for academic growth and pursuits.

### Technology and Employee Education

Many businesses also use technology to train and educate their employees. Though no state level information is available, a national survey conducted by the American Society for Training and Development provides some useful insights into that practice. In 2011, U.S. employers provided an average of 31 hours of education per employee, at a cost of more than $156 billion. Technology-based employee education now accounts for 37.3 percent of all formal training hours.[32]

However, the nature of employee education varies by industry. For example, many healthcare workers must complete continuing education credits. Healthcare organizations, such as Inland Northwest Health Services in Spokane, are increasing their use of learning management systems, video conferencing, tablet, and mobile computing to deliver professional development for staff training.

Online courses work well for nurses and clinical staff with continuing education needs. Video conference technology works well for targeted staff training and courses delivered by practitioners in specialty areas. Technology-enabled simulations use virtual reality or a combination of internet-based case scenarios and realistic programmable mannequins to help healthcare teams learn to work together.

## The Future of Educational Technology

The landscape of educational technology is vast and complex. A wide array of technological tools is available, and more tools are developed all the time. They can be used in many ways to facilitate and enhance student learning. Resources are available that monitor educational technology in the present, with an eye towards the future.

One of the leading international sources of information on emerging trends in educational technology is the New Media Consortium (NMC) Horizon Project. The NMC project is designed to provide an annual review of technology usage in K-12 and postsecondary education. The project is overseen by international advisory boards with representatives from all education sectors as well as other stakeholders. In developing its reports, NMC consults with "technology professionals, campus technologists, faculty leaders from colleges and universities, and representatives of leading corporations to explore and forecast the impact of emerging technologies across all learning sectors."[33] It also reviews a wide variety of articles, research, papers, project examples, and websites.

Each report identifies trends, challenges, and technologies facing education within the next five years. According to the most recent reports available, the following trends and challenges are expected to emerge.[34, 35]

## Trends

The trends below are expected to be key factors in determining the educational technologies that will be implemented in colleges and universities between 2013 and 2018. Many of the trends selected by the NMC Higher Education Advisory Board also were selected by the NMC K-12 Advisory Board.

The trends are in rank order, as determined by the Higher Education Advisory Board, and appear verbatim as described by the board in their report.

- Openness—concepts like open content, open data and open resources, along with notions of transparency and easy access to data and information – is becoming a value.
- Massively open online courses (MOOCs) are being widely explored as alternatives and supplements to traditional university courses.
- The workforce demands skills from college graduates that are more often acquired from informal learning experiences than in universities.
- There is an increasing interest in using new sources of data for personalizing the learning experience and for performance measurement.
- The role of educators continues to change due to the vast resources that are accessible to students via the Internet.
- Education paradigms are shifting to include online learning, hybrid learning, and collaborative models.

## Challenges

The NMC Higher Education Advisory Board also considered challenges and constraints associated with the implementation of new technologies. The challenges listed below apply equally to most or all colleges and universities. The board also noted that "behind them all was a pervasive sense that individual organizational constraints are likely the most important factors in any decision to adopt—or not to adopt—a given technology." Once again, many of the challenges below were also identified as K-12 challenges by that sector's advisory board.

The challenges are in rank order and appear verbatim as described by the board in their report:

- Faculty training still does not acknowledge the fact that digital media literacy continues its rise in importance as a key skill in every discipline and profession.
- The emergence of new scholarly forms of authoring, publishing, and researching outpace sufficient and scalable modes of assessment.
- Too often it is education's own processes and practices that limit broader uptake of new technologies.
- The demand for personalized learning is not adequately supported by current technology or practices.
- New models of education are bringing unprecedented competition to the traditional models of higher education.
- Most academics are not using new technologies for learning and teaching, nor for organizing their own research.

## Evaluating the Efficacy of Instructional Technology

The Technology workgroup reached a consensus that the most important criterion for evaluating instructional technology is the extent to which it facilitates student learning. All technologies used in education are merely communication devices to help transfer ideas between two human beings—the essential element in the development of knowledge and understanding. The efficacy of technology in facilitating this transfer and student learning depends on attributes of the students, faculty, and subject matter.

In order to assess the efficacy of technology, colleges and universities must first know who their students are and what their experience with technology has been. An understanding of student expectations and preferences will help inform decisions about which technologies should be used and how, as well as decisions about support services that students may need to effectively use newer adopted technology.

Student expectations and preferences are influenced by their previous educational and life experiences. Colleges and universities that serve large numbers students who enroll within a few years of graduating from high school should be mindful of the ways in which technology is being used in K-12 (see Appendix A).

Colleges that serve large numbers of returning adult students should consider potential applications for providing remedial education. A report issued by the State Board for Community and Technical College states that 77,133 students enrolled in state-supported remedial math and English classes in 2010-11.[36] The median age for all students enrolled in remedial classes was 23 years. Forty-two (42) percent, or 32,396 students, were 25 years or older.

Many adults returning to colleges and universities may require remedial or brush-up coursework to become ready for college-level curricular content. If the student is returning for “retooling” in a new career, he or she may benefit from placing pre-college coursework into the context of a desired career training program curriculum.

Innovative uses of technology, such as Knewton’s Math Readiness adaptive learning platform in use at Arizona State University, may help reduce the time adults spend on pre-college work, thereby reducing the price for the student and the overall cost for the institution and the state.

In addition to knowing their students, colleges and universities also must know their faculty. As is the case with students, an understanding of faculty expectations, experiences, and preferences will help inform decisions about which technologies should be used and how, as well as decisions about support services that may be needed for faculty to effectively employ newer adopted technology.

Faculty expectations and preferences are strongly influenced by their previous teaching experiences. Some faculty members are tech-savvy innovators willing to take instructional risks. Others are more risk averse and less tech-savvy. However, all are pressed for time and need some form of support, whether it be technical help or release time.

Finally, institutions must understand the subject matter for which new technology may be employed to improve student outcomes. Some subjects are more amenable than others to delivery via some forms of technology. As one medical faculty member put it, "It is hard to replicate the experience of handling a cadaver online."[37] However, simulations are increasing in their sophistication and may be a reasonable alternative to expensive labs in some cases.

For example, the University of California, Irvine is effectively using biology simulations with first-year medical students. However, simulations sometimes work better to complement or prepare for hands-on training, rather than as a substitute. One welding instructor, referring to the use of a simulator, said: "It isn't true to life. It has a role for demo purposes in the classroom, but we're never going to replace the sparks and the heat of real-life experiences."[38]

## Evaluating the Cost and Price Impact of Instructional Technology

In addition to evaluating the benefits of instructional technology in terms of its impact on student learning, cost also must be evaluated. Increasing the use of technology in education is often touted as the most promising way to reduce the cost of postsecondary education and to decrease a student's time-to-degree completion.

A 2012 study completed by the Thomas B. Fordham Institute found that the average cost per-pupil for online education ($6,400) and blended learning ($8,900) are both lower than the average cost for in-class instruction ($10,000).[39] Data included in this study's cost estimate includes student-to-teacher ratios, teacher salaries, professional development, content acquisition and maintenance, technology infrastructure, student training and support, and operational expenses such as facilities, transportation, and testing; however, some Technology workgroup members suggest this is not always the case.

When using data to calculate the average cost per-pupil of education, it is important to look at a complete picture of costs associated with the adoption of educational technology, including costs that extend beyond the price of required hardware and software. For instance, after accounting for the costs of infrastructures and facilities, faculty and curriculum costs are primary determinants in the overall cost of course delivery.

Postsecondary institutions may choose to use existing faculty or hire temporary instructional staff. Regardless, faculty also are limited in the number of students they can effectively teach. That is not to say that technology cannot save costs, but in assessing costs many variables must be considered.

## Specific Evaluation Criteria and Future Evaluation Trends

As the Council continues to examine technology's potential in the Ten-Year Roadmap, it may wish to use specific criteria for evaluating the efficacy, cost, and price impact of specific technologies. These include:

- Student-centered criteria, such as time-to-degree or comparisons of learning outcomes between students pursuing a traditional education and those pursuing technology-enriched or competency-based education.

- Faculty-centered criteria, such as number of faculty adopting open educational resources available through Washington State's Open Course Library or elsewhere.
- Financial criteria, such as the cost of keeping Open Course Library materials up to date; the cost to maintain physical labs and supplies versus licensing for online simulations; the cost to change adopted technologies in a rapidly evolving field; and the cost of recovering from technology breakdowns.

It is important to note that the measurements used for evaluating the efficacy, cost and price impacts of technology in education are changing. Their focus is moving beyond simple "inputs and outputs" (e.g., dollars spent for online education and number of degrees awarded) towards using learning analytics to leverage large amounts of complex data from students using multiple systems. Data from learning analytics shows how specific technologies and practices can improve student learning outcomes and reduce the cost of postsecondary education.

Common data standards and statewide student data systems also are critical for increasing educators' and policy makers' ability to measure and compare the efficiency and effectiveness of educational technology's impact on student learning, access to education, and cost savings at the state and national levels. An example of this type of work is the Education Data Initiative from the U.S. Department of Education's Office of Educational Technology.

Colleges and universities will need state-level help to gather learning data from multiple platforms. They also will need staff with experience in predictive modeling, statistics, and education research to effectively use data to inform the use of technology for teaching and learning.[40]

## Next Steps: Policy Options and Recommendations

The Capturing the Potential of Technology workgroup will identify specific policy options and recommendations for consideration by the Washington Student Achievement Council at the July 2013 Council meeting.

## Appendix A

# Educational Technology in Washington: Sector Efforts

Although no universal definition of educational technology exists, for the purpose of this issue brief it is defined as the use of technology to improve teaching and learning. Educational technology in Washington state is largely decentralized and uncoordinated at the state level. There is very limited coordination, collaboration, and planning across the various types of institutions in Washington—at least where educational technology is concerned.

This appendix describes recent and current state- or system-level coordination and planning activities in postsecondary education and in K-12 that focus on or connect to educational technology.

### Public Postsecondary Education

In Washington, public four-year institutions have considerable autonomy, while public two-year institutions are more centrally governed. This general landscape is mirrored in the area of technology. A decentralized, loosely confederated system of technology governance is in place with varying policies, procedures, data, and standards. No single, formal structure spanning the two- and four-year sectors currently exists, although each sector has its own statewide technology-focused network.

The community and technical colleges' network – the eLearning Council – is comprised of eLearning Directors from the colleges. The public four-year institutions established the Higher Education Technology Consortium (WHETC) made up of Chief Information/Technology Officers from the six public universities and the Deputy Executive Director of Information and Technology from the State Board for Community and Technical Colleges (SBCTC).

Relative to statewide planning, two comprehensive efforts have been undertaken in recent years. In 2007, the SBCTC recognized the need for system-wide educational technology coordination and planning. As a result, it convened a Technology Transformation Taskforce to develop a Strategic Technology Plan for community and technical colleges. The plan called for a centrally coordinated, system-wide approach to meet a single goal: "to mobilize technology to increase student success." Although the approach is centralized, it is designed to allow local experimentation to drive innovation, with the idea of nurturing "an open, system-wide testing environment and support for local innovation."[41]

The Strategic Technology Plan outlines five strategies to meet its goal:

- Create a single, system-wide suite of online teaching and learning tools that provides all Washington students with easy access to "anywhere, anytime" learning.
- Create a seamless P-20 system for personalized online student services including recruitment, retention, advising, course catalog, transfer, and financial aid management.
- Create a system of lifelong learning and change management for faculty, staff and college leadership.

- Use data to drive continuous improvement in both student success and administrative efficiency.
- Treat information technology as a centrally funded, baseline service in the system budget.

The SBCTC Strategic Technology Plan still governs their system eLearning efforts. The community and technical colleges now have system-wide contracts for a learning management system, a lecture capture system, a web conferencing system, research librarian and etutoring consortia, and many opportunities for shared professional development.

The second statewide planning effort occurred in 2009, when the Washington Legislature created a statewide Technology Transformation Taskforce. The purpose of this cross-sector taskforce was to recommend strategies for improving "the efficiency, effectiveness, and quality of public higher education relative to the strategic and operational use of technology in higher education."[42]

The taskforce reported several state-level challenges.

- Washington lacks a statewide, coordinated approach in the support of eLearning systems.
- Many independent instructional applications facilitate learning and achievement; however, most faculty have not received training to take full advantage of them.
- Outside of mandated SBCTC applications and some joint purchase agreements, few institutions leverage opportunities for information technology economies of scale.
- Limited technology support exists to aid in academic planning or facilitate the transfer of students.

Based on its findings, the taskforce recommended a variety of strategies that would better utilize technology, reduce the costs to institutions and the state, and improve the quality of instruction, including:

- Create a well-defined, sustainable framework for system-wide collaboration by establishing the Alliance for Collaborative Technology - a group of representative stakeholders serving as the ongoing center for technology collaboration across the broader postsecondary education community.
- Create a coordinated statewide entity for postsecondary online courses and programs.
- Create a statewide information technology-related professional development portal for faculty and staff.
- Expand statewide postsecondary institution participation in Orbis Cascade Alliance consortium of academic libraries in western states. Currently all of the Washington public baccalaureate institutions are members, as are six private baccalaureate institutions, but Clark College is the only community or technical college member.

The Legislature received the Technology Transformation Taskforce report in December 2010, but since then, there has been no statewide or cross-sector effort to follow through on its recommendations.

## Private Postsecondary Education

Private postsecondary education in Washington is comprised of institutions that vary on several key characteristics: profit status; degree of commitment to online education; age of students; educational mission. Like public four-year institutions, private colleges and universities in Washington operate independently. Private institutions belong to no single consortium or organization and have no technology-specific coordination.

The Independent Colleges of Washington (ICW) is an association of 10 member colleges located in Washington. The ICW colleges collaborate on group purchasing of technology and meet regularly as a group to share best practices.

Several private career schools are members of the Northwest Career Colleges Federation, which serves Washington, Oregon, and Idaho.

Of special note is Western Governors University Washington - a unique private non-profit university operating entirely online supported by tuition and funding from private corporations and foundations. WGU Washington is the only state-endorsed, all-online, competency-based university in Washington. WGU Washington offers a flexible option for earning an accredited college degree. The university's four colleges--Business, Information Technology, Teachers College, and Health Professions (including Nursing)--currently offer more than 50 accredited bachelor's and master's degrees, many with industry-specific certifications.

Despite the lack of current coordination, many of Washington's private institutions have expressed a willingness to contribute to statewide efforts to use educational technology to support and enhance student learning.

## K-12 Education

Though the primary focus of this issue brief is on the use of technology in college and university classrooms, any state conversation about technology in the classroom requires a description of the role of technology and pedagogy in K-12. The K-12 system is key for students' success in postsecondary education, careers, and citizenship. Fortunately, the opportunities to help transition students to their career and college pathways are increasing. Programs such as Running Start, AP, International Baccalaureate, and the senior Launch Year strengthen the alignment between K-12 and postsecondary education and careers. Attention to the use of technology in K-12 will help each college and university align its curriculum to ensure incoming students receive the skills and knowledge necessary to meet the technological demands of 21st century careers.

In many cases, the use of technology will be essential to students' education. Students will utilize multiple technology channels to connect with professors and peers, conduct research and create products. Students underexposed to or uncomfortable with the use of technology may struggle in the learning process as a result. As it stands, the high school diploma is not reflective of student's technology literacy, making it difficult for institutions to predict incoming students' effectiveness in meeting the technology-rich demands of higher learning.

K-12 students are exposed to technology, and therefore the availability of technology is likely not the primarily contributor to the problem.[43, 44]

- Students have Internet connectivity in 99.8 percent of the classrooms.
- Students and teachers have access to document cameras, interactive whiteboards, LCD projectors, portable computers, laptops, net books, and wireless tablet devices.
- In academic year 2010-11, nearly 20,000 students completed at least one online course, a 6.7 percent increase over the previous year, and these students completed a total of 66,048 online courses, down 8.5 percent from the prior year.

Our state also underscores the value of technology by including it in the Essential Academic Learning Requirements (EALRs).[45]

- Integration: students use technology within all content areas to collaborate, communicate, generate innovative ideas, investigate, and solve problems.
- Digital citizenship: students demonstrate a clear understanding of technology systems and operations and practice safe, legal, and ethical behavior.

There is no centralized authority that mandates a baseline for technology proficiency among teachers or students. While 204 districts integrate some version of the technology EALRs into curricula, only 120 of these districts make the standards mandatory. This disparity, resulting in a student population with significant differences in expertise, is likely to continue when students enroll in Washington's colleges and universities.

# Glossary

*NOTE: Many of the definitions below are provided verbatim as they appear in the source document.*

**Active Learning Classroom:** A classroom designed to foster interactive, flexible, student-centered learning experiences.[46]

**Blended or Hybrid Course:** No universally accepted definition currently exists, though individual institutions or groups of institutions establish definitions for reporting or other purposes. Examples include:

- A course with 30 to 79 percent of the course content delivered online, though some institutions or groups of institutions may establish their own definitions for reporting or other purposes.[47]
- A course that displaces some, but not all face-to-face class time with web-based tools.[48]

**Competency-Based Education:** A delivery model that provides content asynchronously within a flexible schedule that allows students to progress at their own rate. Students earn credit by successfully completing assessments that prove their mastery in predetermined competencies or tasks.

**Curriculum Management System (CMS):** An automated system that supports the definition, visualization, analysis, and assessment of an educational institution's desired curriculum.[49] Such systems typically include the following components: content mapping, catalog management, enrollment and timetable functions, student performance portfolio and assessment tracking, and course and faculty performance assessments. K-12 schools and postsecondary institutions alike use CMSs such as Akari Software's Curriculum Solutions Suite, CurricUNET, and eCurriculum. The University of Washington is currently part of a consortium developing CMS tools in KUALI[50] – specifically KUALI Student / Curriculum Management.

**Educational Technology:** There is no universal definition. However, for the purpose of this issue brief, it is defined as the use of technology to improve teaching and learning.

**EDUCAUSE:** A nonprofit association of IT leaders and professionals who lead, manage, and use information technology to shape strategic IT decisions at every level within higher education. They focus on analysis, advocacy, community building, professional development, and knowledge creation to support the transformative role that IT can play in higher education.[51]

**eLearning:** Learning conducted via electronic media, typically on the Internet.[52]

**Flipped Classroom:** Flipping the classroom moves some content knowledge acquisition (e.g., lectures) outside of the scheduled class time. Flipped classroom models do not reduce class time but rather replace teacher-centered activities with learner-centered activities. Technology is generally used to flip the content, assessments, and assignments.

**Instructional Technology:** See educational technology.

**Ithaka S+R:** A research and consulting service that helps academic, cultural, and publishing communities in making the transition to the digital environment and pursues projects in programmatic areas that are critical to the advancement of the academic community.[53]

**Learning Analytics:** The field associated with detecting and deciphering patterns of behavior and learning within data associated with the educational process. In its rudimentary form, learning analytics allows an organization to track its capacity to deliver distance education offerings. In its most extended form learning analytics produces complex predictive modeling to improve student success and retention in postsecondary education.[54]

**Learning Management System (LMS):** An information system that administers instructor-led and e-learning courses and keeps track of student progress.[55] A software application that automates the administration, tracking, and reporting of training events.[56] It should be able to do the following: centralize and automate administration; centralize and automate administration; use self-service and self-guided services; assemble and deliver learning content rapidly; consolidate training initiatives on a scalable web-based platform; support portability and standards; personalize content and enable knowledge reuse. Some of the most commonly used LMSs include Moodle, Canvas, and Blackboard.

**Learning Object Repository (LOR):** An online library for storing, managing, and sharing learning resources (learning objects). A learning object can be a quiz, a presentation, an image, a video, or any other kind of document or file used to create course content and learning materials for online learning.[57] Learning objects may not be open or free, but they are reusable. For example, a video clip could be used in more than one course or lesson. Examples of repository software include Ariadne and Digital Open Object Repository (DOOR).

**Massively Open Online Courses (MOOCs):** Classes that are taught online to large numbers of students, with minimal involvement by professors.[58] Two types of MOOCs are currently in use: cMOOCs focus on knowledge creation and generation whereas xMOOCs focus on knowledge duplication.[59]

**Mobile Computing:** The ability to access computing-like functionality without a network connection and/or a predetermined location.

**Mobile Learning:** Any sort of learning that happens when the learner is not at a fixed, predetermined location, or learning that happens when the learner takes advantage of the learning opportunities offered by mobile technologies.[60]

**Online Course:** No universally accepted definition currently exists, though individual institutions or groups of institutions establish definitions for reporting or other purposes. Examples include:

- A course with more than 80 percent of the course content delivered online.[61]
- A course section in which 75 percent or more of instruction is delivered online using web tools rather than via face-to-face contact between students and an instructor(s).[62]
- A course that uses web-based tools and where 100 percent of the instruction and interaction between instructor and student is done online.[63]

**Open Content:** No universally accepted definition currently exists, though most definitions generally agree that it includes content that provides users with the right to reuse, revise, remix, and redistribute.[64] Where most definitions generally differ is on the issue of whether the content is available at no cost to the user or not.

**Open Educational Resource (OERs):** Teaching, learning, and research resources that reside in the public domain or have been released under an intellectual property license that permits their free use and re-purposing by others. Open educational resources include full courses, course materials, modules, textbooks, streaming videos, tests, software, and any other tools, materials, or techniques used to support access to knowledge.[65]

**Personal Learning Environment (PLE):** Tools, communities, and services that constitute the individual educational platforms that learners use to direct their own learning and pursue educational goals.[66] Students can control their own content and can continue to learn with their professor and peers even after the course is over. PLEs also have the benefit of allowing students to decide which digital learning tools they use. Google + and tablet devices are examples of PLEs.

**Tablet:** A device that blends features of laptops, smartphones, and tablet computers with always-connected Internet and thousands of apps with which to personalize the experience.[67]

**Traditional Course:** Generally defined as a course where no online technology is used. Content is delivered in writing or orally, though some institutions or groups of institutions may establish their own definitions for reporting or other purposes.[68]

**Web-facilitated or Web-enhanced Course:** No universally accepted definition currently exists, though individual institutions or groups of institutions establish definitions for reporting or other purposes. Examples include:

- A course with 1 to 29 percent of the course content delivered online.[69]
- A face-to-face course that does not replace any face-to-face seat time, and access to web-based tools is required.[70]

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## Acknowledgements

The Council would like to thank the following people for their substantive contributions to the Capturing the Potential of Technology Workgroup and to this report:

Chadd Bennett, Independent Colleges of Washington
Connie Broughton, Washington State Board for Community and Technical Colleges
Kenneth Brown, Whitworth University
Jan Carline, University of Washington
David Cillay, Washington State University
Charlie Crawford, Tacoma Community College
Jean Floten, Western Governors University Washington
Chris Gill, Gonzaga University
Bobbie Jo Haggard, student, Walla Walla Community College
Dan Hughes, student, South Puget Sound Community College
Marilyn Levine, Central Washington University
Keith Loeber, Microsoft IT Academy
Mary Mara, City University of Seattle
Ben P. Meredith, Eastern Washington University
Michael Owen, student, South Puget Sound Community College
Dave Rawlinson, Central Washington University
James Reisenauer, student, Eastern Washington University
Cindy Riche, University of Puget Sound
Rich Robinson, Inland Northwest Health Services
Jim Schmidt, Education Research and Data Center
Jane Sherman, Council of Presidents
Dennis Small, Office of the Superintendent of Public Instruction
David Szatmary, University of Washington
David Wicks, Seattle Pacific University
Gena Wickstrom, Northwest Career Colleges Federation
Emily Wood, Pierce College
John Yeung, student, Saint Martin’s University

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