NMC Horizon Project

Technology Outlook
Community, Technical, and Junior Colleges 2013-2018
An NMC Horizon Project Sector Analysis

Technology Outlook for Community, Technical, and Junior Colleges 2013-2018
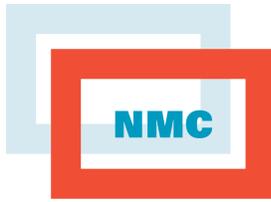
An NMC Horizon Project Sector Analysis

Technology Outlook for Community, Technical, and Junior Colleges 2013-2018
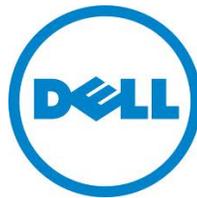*An NMC Horizon Project Sector Analysis*

is a collaboration between

The New Media Consortium

and

The National Institute for Staff and Organizational Development (NISOD).

Made possible via the generous support of Dell and Intel.

© 2013, The New Media Consortium.

Executive Summary

The *Technology Outlook for Community, Technical, and Junior Colleges 2013-2018: An NMC Horizon Project Sector Analysis* reflects a collaborative research effort between the New Media Consortium (NMC), National Institute of Staff and Organizational Development (NISOD), Dell, and Intel to help inform education leaders at community, technical, and junior colleges about significant developments in technologies supporting teaching, learning, and creative inquiry at two-year higher education institutions.

All of the research underpinning the report makes use of the NMC's Delphi-based process for bringing groups of experts to a consensus viewpoint, in this case around the impact of emerging technologies on teaching, learning, or creative inquiry in community, technical, and junior colleges over the next five years. The same process underlies the well-known *NMC Horizon Report* series, which is the most visible product of an on-going research effort begun a decade ago to systematically identify and describe emerging technologies likely to have a large impact on education around the globe.

The *Technology Outlook for Community, Technical, and Junior Colleges 2013-2018* was produced to explore emerging technologies and forecast their potential impact expressly in a two-year education context. In the effort that took place over March and April 2013, a carefully selected group of experts was asked to consider hundreds of relevant articles, news, blog posts, research, and project examples as part of the preparation that ultimately pinpointed the most notable emerging technology topics, trends, and challenges for community, technical, and junior colleges over the next five years.

Known as the 2013 Horizon.CC Advisory Board, that group of experts consists of knowledgeable individuals, all highly regarded in their fields. Collectively, the advisory board represents a range of diverse perspectives across the two-year college sector. The project has been conducted under an open data philosophy, and all of the interim projects, secondary research, discussions, and ranking instrumentation can be viewed at 2year.wiki.nmc.org. The precise research methodology employed in producing the report is detailed in a special section that is located at the end of this report.

Table 1: Comparison of "Final 12" Topics Across Three NMC Horizon Research Projects

NMC Horizon Report 2013 Higher Education Edition	Technology Outlook for Community, Technical, and Junior Colleges 2013-2018	Technology Outlook for STEM+ Education 2012-2017
Time-to-Adoption Horizon: One Year or Less		
Flipped Classroom	BYOD	Cloud Computing
Massive Open Online Courses	Flipped Classroom	Collaborative Environments
Mobile Apps	Online Learning	Mobile Apps
Tablet Computing	Social Media	Social Networking
Time-to-Adoption Horizon: Two to Three Years		
Augmented Reality	Badges	Augmented Reality
Games and Gamification	Games and Gamification	Learning Analytics
The Internet of Things	Learning Analytics	Massive Open Online Courses
Learning Analytics	Next-Generation LMS	Personal Learning Environments
Time-to-Adoption Horizon: Four to Five Years		
3D Printing	The Internet of Things	Collective Intelligence
Flexible Displays	Natural User Interfaces	The Internet of Things
Next-Generation Batteries	Virtual Assistants	Natural User Interfaces
Wearable Technology	Virtual and Remote Laboratories	Wearable Technology

The 12 "technologies to watch" presented in the body of this report reflect our experts' opinions as to which of the more than 40 technologies considered will be most important to community, technical, and junior colleges over the five years following the publication of the report. As Table 1 above illustrates, the choices of our experts overlap in interesting ways with those who contributed to the *NMC Horizon Report > 2013 Higher Education Edition,* which looked at technology uptake from a global perspective, and the *Technology Outlook for STEM+ Education 2012-2017*, which explored the impact of technology specifically across science, technology, engineering, and mathematics in higher education.

All three of these projects' advisory boards — a group of 139 acknowledged experts — strongly agree that mobile learning, in some form, will likely tip into mainstream use within the next year — a trend that spans higher education across much of the world. They are also in consensus about learning analytics being positioned two to three years away from widespread adoption; however, that is where the commonalities stop between the three advisory boards. The Horizon.CC and Horizon.STEM Advisory Boards see the Internet of Things in the far-term, while the global Higher Ed group viewed the technology as more imminent, at around two to three years. Current concrete examples of the Internet of Things are mainly taking place in research departments at four-year universities.

Table 2: Top-Ranked Trends Across Three NMC Horizon Research Projects

NMC Horizon Report 2013 Higher Education Edition	Technology Outlook for Community, Technical, and Junior Colleges 2013-2018	Technology Outlook for STEM+ Education 2012-2017
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.	People expect to be able to work, learn, and study whenever and wherever they want.	Teaching paradigms across all sectors are shifting to include online learning, hybrid learning, and much more teamwork and collaboration.
Massive open online courses are being widely explored as alternatives and supplements to traditional university courses.	There is a growing interest in using new sources of data for personalizing the learning experience and for performance measurement.	Massive open online courses are proliferating, especially in STEM disciplines.
The workforce demands skills from college graduates that are more often acquired from informal learning experiences than in universities.	As technology becomes more capable of processing information and providing analysis, community college efforts will focus on teaching students to make use of critical thinking, creativity, and other soft skills.	The abundance of resources and relationships made easily accessible via the Internet is increasingly challenging us to revisit our roles as educators.

While the Horizon.CC and global Higher Ed experts believe games and gamification have clear implications for teaching and learning, the Horizon.STEM group did not place any emphasis on the topic. The two advisory boards also differ from the Horizon.STEM in their agreement that online learning, whether in the form of massive open online courses or other opportunities, is poised on the near-term horizon — which makes sense as the Horizon.STEM advisory board convened in 2012, and since then, MOOCs have proliferated. Online degree programs and learning platforms are indeed growing rapidly in popularity at two-year colleges, with institutions such as Maricopa Community College leading the way. In the past year, two-year colleges have begun to partner with fast-growing MOOC providers, such as MIT's edX. There is a clear and mounting emphasis on online learning and more pervasive access to learning opportunities at two-year institutions.

A number of unique choices distinguished the viewpoints expressed by the 2013 Horizon.CC Advisory Board from their counterparts in other sectors: BYOD, social media, badges, next-generation LMS, virtual assistants, and virtual and remote online laboratories, although mostly considered by other recent panels, were seen as likely developments for two-year institutions over the next five years. As online learning gains more traction, community, technical, and junior colleges are looking for ways to recognize student accomplishments and skill acquisition, and badges pose a compelling solution. Meanwhile, virtual and remote laboratories are taking the pressure off of colleges to purchase and maintain expensive, high quality lab equipment, and allowing learners to conduct experiments with greater flexibility.

The nuances of the technologies and their associated adoption horizons featured in this report are specific to two-year education, even if there are commonalities with other reports. Likewise, the key trends (Table 2 and pages 17-18) and significant challenges (Table 3 and pages 19-20) selected by the 2013 Horizon.CC Advisory Board distinctly reflect the current drivers and obstacles facing community, technical, and junior colleges over the coming five years. For example, the advisory board agreed that learners should have the freedom to work and study from any location and on any device they choose, making access a key trend. This emphasis on ubiquitous learning is fueling the rise of mobile learning and social media in two-year institutions, and educators are determined to develop systems that make the learning experiences feel more personal.

Table 3: Top-Ranked Challenges Across Three NMC Horizon Research Projects

NMC Horizon Report 2013 Higher Education Edition	Technology Outlook for Community, Technical, and Junior Colleges 2013-2018	Technology Outlook for STEM+ Education 2012-2017
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.	Trying to prepare the ever-increasing number of students who enter college placing in developmental courses is a challenge.	Economic pressures and new models of education are bringing unprecedented competition to the traditional models of higher education.
The emergence of new scholarly forms of authoring, publishing, and researching outpace sufficient and scalable modes of assessment.	Critical campus infrastructures are under-resourced.	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.
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.	The demand for personalized learning is not adequately supported by current technology or practices.

The experts spent a fair amount of time researching and discussing relevant trends and challenges in the context of teaching, learning, and creative inquiry in two-year programs. Horizon Project advisory boards in general have agreed that trends like these are clear drivers of technology adoption; the 2013 Horizon.CC group especially saw such a linkage. At the same time, these panels of experts also agree that technology adoption is often hindered by both local and systemic challenges. Many challenges impacting technology uptake are grounded in everyday realities that often make it difficult to learn about, much less adopt, new tools and approaches.

The 2013 Horizon.CC Advisory Board agreed with the Horizon.STEM group that current technology and pedagogies cannot adequately support personalized learning. There is a need for learning platforms that are easily customizable and even adapt to the students as they complete various activities. This major challenge is underscored by the widespread belief that most institutions are under-resourced and do not have the time or ability to seamlessly integrate the services and tools necessary to make personalized learning a reality. More than ever, students are using ICT and always-connected mobiles outside of the classroom to explore subjects that interest them. Institutions need to leverage and promote these informal learning experiences while integrating them with on-campus learning.

Unique to the top of the list of challenges facing community, technical, and junior colleges is the act of adequately preparing the large number of students who require developmental courses. A discussion unfolded on the wiki between the experts on the panel, surrounding the lack of strategies for working with the plethora of learners who enroll in the two-year programs without the motivation or discipline it takes to succeed at the institution. There is a concern that simply addressing this obstacle by increasing technology use will not solve the problem in its entirety.

These points and comparisons provide an important context for the main body of the report that follows this summary. There, 12 key technologies are profiled, each on a single page that describes and defines a technology ranked as very important for community, technical, and junior colleges over the next year, two to three years, and four to five years. Each page opens with a carefully crafted definition of the highlighted technology, outlines its educational relevance, points to several real life examples of its current use, and ends with a short list of additional readings for those who wish to learn more. Following those discussions are sections that detail the advisory board's top ranked trends and challenges and articulate why they are seen as highly influential factors in the adoption of any of these technologies over the coming five years.

Those key sections, and this report in general, constitute a reference and straightforward technology-planning guide for educators, researchers, administrators, policymakers, and technologists. It is our hope that this research will help to inform the choices that institutions are making about technology to improve, support, or extend teaching, learning, and creative inquiry at community, technical, and junior colleges. Educators and administrators worldwide look to the NMC Horizon Project and both its global and regional reports as key strategic technology planning references, and it is for that purpose that the *Technology for Outlook Community, Technical, and Junior Colleges 2013-2018* is presented.

Time-to-Adoption: One Year or Less

BYOD

The term BYOD, which stands for "Bring Your Own Device," refers to the practice of students bringing their own laptops, tablets, smartphones, or other mobile devices with them to class. Intel coined the term in 2009, when the company observed that an increasing number of its employees were using their own devices and connecting them to the corporate network. Since then, this type of activity has become commonplace in workplaces all over the globe. The BYOD movement in education institutions is being driven by a major challenge that many institutions face — a lack of funds to support one-to-one learning, which is a systemic solution in which every student is provided a laptop or mobile device that can be used to support learning in and outside of the classroom. BYOD makes one-to-one easier by simply leveraging the devices that students already have, or those their parents could buy for them. In practice, it has proven important to provide funds to support students in financial need, and to standardize on a small set of devices and software packages. Often the institution will negotiate advantageous pricing for students to reduce their costs. In early studies, the act of a student using his or her own device for learning has proven to increase productivity and engagement. Tablet computing has accelerated the pace of BYOD, especially in educational institutions, where these smaller, less-expensive devices are seen as a better option than traditional laptops. With their ever-growing capabilities, tablets (which now include an expanding set of choices, such as the iPad, Galaxy, Nexus, and Surface,) are well positioned for BYOD environments.

Relevance for Teaching, Learning, or Creative Inquiry

- Because BYOD allows students access to the same devices on campus and at home, it can extend learning opportunities to times and places outside of the classroom.
- BYOD policies allow students to work with technology with which they are already comfortable and familiar.
- BYOD programs eliminate the support and other burdens from campuses that go along with paying for and maintaining institution-provided devices.

BYOD in Practice

- King's College London implemented a private cloud platform that allows students and faculty from 150 countries to use their own devices to access a virtual desktop: go.nmc.org/kin.
- Parkland Community College is upgrading to a new wireless network and LMS so that students and faculty can securely connect with any devices they choose: go.nmc.org/par.
- The University of Wisconsin-Oshkosh has deployed virtual desktop infrastructure to support learners who bring their own devices to the campus: go.nmc.org/vdi.

For Further Reading

BYOD: Bring Your Own Devices to Campus
go.nmc.org/byo
> (Bob Violino, *Community College Times*, 21 August 2012.) Prince George's Community College, Lansing Community College, and Northern Virginia Community College are launching BYOD programs. This article discusses some challenges, including wireless support and security.

Is BYOT Just a Bridge to 1-to-1?
go.nmc.org/bridge
> (Christopher Piehler, *The Journal*, 28 January 2013.) The director of the Kennesaw State University iTeach Center provides insights into the BYOD/BYOT movement.

Time-to-Adoption: One Year or Less

Flipped Classroom

The flipped classroom refers to a model of learning that rearranges how time is spent both in and out of class to shift the ownership of learning from the educators to the students. After class, students manage the content they use, the pace and style of learning, and the ways in which they demonstrate their knowledge, and the teacher becomes the guide, adapting instructional approaches to suit their learning needs and supporting their personal learning journeys. Rather than the teacher using class time to push new topics and information out to students, in a flipped classroom that work is pulled down by students outside of class, and could take the form of watching video lectures, listening to podcasts, perusing enhanced e-book content, engaging in guided research, and more. Students can access this content any time they need it. The valuable class time freed up is devoted to more active, project-based learning where students work together to apply what they have learned, often to solve local or global challenges, or other real-world applications to gain a deeper understanding of the subject. The goal is for students to learn more authentically by doing, with the teacher guiding the way; the lecture is no longer the expected driver of concept mastery. The flipped classroom model is part of a larger pedagogical movement that overlaps with blended learning, inquiry-based learning, and other instructional approaches and tools that are meant to be flexible, active, and more engaging for students. It has the potential to better enable educators to design unique and quality learning opportunities, curriculum, and assessments that are more personal and relevant to students' lives.

Relevance for Teaching, Learning, or Creative Inquiry

- Flipped classroom concepts and the idea of providing the student with a more diverse set of learning resources can support self-directed learning.
- More active learning is an important component of the flipped classroom: lectures can be watched with ensuing online discussions unfolding at home, professors can use class time for hands-on activities or trips outside of the building.

Flipped Classroom in Practice

- College instructors in universities and colleges throughout Washington state are recording lectures and placing them online to flip learning experiences: go.nmc.org/flippingWA.
- Grand Rapids Community College is embracing the flipped classroom model by equipping faculty with technology that enables ubiquitous learning for students: go.nmc.org/grandrapids.
- Lassen Community College is adopting a flipped classroom model that includes independent study, distance and virtual learning, and one-to-one tutoring: go.nmc.org/act.

For Further Reading

The Flipped Classroom: It's Got to be Done Right
go.nmc.org/flippedcrdr
> (Matthew Frydenberg, *Huffington Post*, 14 December 2012.) Best practices for the flipped classroom are addressed, along with examples of how flipping the curriculum fosters a richer learning experience inside and outside of the classroom.

Flipped Classrooms Promote Personalization in Higher Education
go.nmc.org/atlantic
> (Amy Southerland, *The Atlantic*, 29 May 2012.) This article discusses why flipped learning is a successful way to personalize learning experiences. With technology integrated into learning, students have opportunities to acquire new skills.

Time-to-Adoption: One Year or Less

Online Learning

Online learning is not new. What has made the topic new is the recent and unprecedented focus on providing learning via the Internet that has been stimulated by the tremendous interest in massive open online courses (MOOCs). What is new in this space is that online learning has "come of age;" the design of online learning is (more and more) specifically intended to encompass the latest research, the most promising developments, and new emerging business models in the online learning environment. At many institutions, because of the rush of the world's most elite institutions into MOOCs and other forms of online learning, the entire Internet learning arena is an area newly ripe for experimentation — some would argue it is undergoing a sea change, with every dimension of the process open for reconceptualization. On campuses around the globe, virtually every aspect of how students connect with institutions and each other to learn online is being reworked, rethought, and redone — and considerable attention is being given to proven approaches like hybrid and blended learning.

Relevance for Teaching, Learning, or Creative Inquiry

- As new pedagogies emphasize personalized learning, there is a growing demand for learner-centered online opportunities. Online learning environments, when designed effectively, have the potential to scale globally.
- Online learning environments can make creative use of several educational technologies and emerging instructional approaches, including blended learning, video lectures, and badges.
- When placed online, a diverse set of learning resources is easily accessible to students and can support self-directed learning.

Online Learning in Practice

- Bossier Parish Community College offers an online degree program in which students can do a majority or all of their coursework online. The online instruction involves presentations, video tutorials, discussion boards, and other learning activities: go.nmc.org/bpc.
- Bunker Hill and MassBay Community College partnered with MIT's edX to offer MOOCs to their students. They are the first two-year colleges to work with the popular MOOC provider: go.nmc.org/edXMA.
- Colorado Technical College developed an online learning platform called MUSE (My Unique Student Experience), which caters to students' varying learning styles: go.nmc.org/muse.
- Maricopa Community College offers 600 online courses via a cohort of ten community colleges, and serves nearly 70,000 students each year: go.nmc.org/maricopa.

For Further Reading

Adaptability to Online Learning: Differences Across Types of Students and Academic Subject Areas
go.nmc.org/adapt
> (Di Xu, Community College Research Center, February 2013.) A comparison study examines student success in an online environment.

Colleges Adapt Online Courses to Ease Burden
go.nmc.org/ease
> (Tamar Lewin, *The New York Times*, 29 April 2013.) Nearly half of all undergraduates in the U.S. arrive on campus needing more work before they can begin regular classes for credit. Colleges are beginning to experiment with online versions, which allow students to take these initial courses easily and cheaply.

Time-to-Adoption: One Year or Less

Social Media

Today's web users are prolific creators of content, and they upload photographs, audio, and video to cloud-based social media sites, such as Facebook, Pinterest, Twitter, YouTube, Flickr, and many others by the billions. While the initial emphasis of social media was placed on producing and uploading media to these popular sharing sites, as the notion of social media has evolved it has ultimately become more about the conversations started and relationships formed via this media. When users log in to Facebook and Twitter, two of the sites that have the most subscribers and daily traffic, they are there to see what their family, friends, and favorite brands and organizations are doing and who is talking about what. For educational institutions, social media enables two-way dialogues between students, prospective students, educators, and the institution that are less formal than with other media. New tools, such as Facebook's social search engine, promise to mine these interactions using a concept known as the social graph. A person's social graph represents the sum of all of a person's online social connections (who he or she is friends with, who likes the things she or her friends are interested in, who among those connections is where, etc.) and provides a means to search and navigate those connections. Social graphs can be visualized in a variety of interesting ways, but far more interesting is the information embedded within the social graph and what it can tell us.

Relevance for Teaching, Learning, or Creative Inquiry

- Engagement in social media, either as producers of content, or consumers, or aggregators of user-generated content, will allow universities to more deeply connect with audiences.
- Social media outlets allow university staff and students to create powerful personal learning networks to direct and focus their own learning.
- Video platforms including YouTube and Vimeo enable educators to upload and share recorded lectures and other instructional videos that students can watch anywhere.

Social Media in Practice

- After Hurricane Sandy, Atlantic Cape's foundation organized a social media campaign and raised $40,000 for recovering Atlantic Cape Community College students: go.nmc.org/funds.
- As part of their professional development, faculty at Northwest Mississippi Community College received training for facilitating aspects of their courses using various social media tools, including Facebook, Twitter, Instagram, Storify, and YouTube: go.nmc.org/nwsm.
- Rochester Community and Technical College in Minnesota launched the Social Media Strategist Certification Program, which will teach future social media managers how to leverage social media in order to increase visibility for their employers: go.nmc.org/roch.

For Further Reading

Meeting the Demand for Workers with Social Media Skills
go.nmc.org/ccomm
> (Ellen Ullman, *Community College Times*, 3 January 2012) This article highlights several community colleges that are designing and launching social media certification programs.

Using Social Media in the Classroom: A Community College Perspective
go.nmc.org/asa
> (Chad M. Gesser, *Footnotes*, January 2013) In a publication by the American Sociological Association, a sociology professor at Owensboro Community and Technical College describes his use of social media to organize his courses and discuss complex sociological concepts.

Time-to-Adoption: Two to Three Years

Badges

Badges are seen as a way to grant certification for informal learning in the form of micro-credits. A key aspect of gamification is to build in easy-to-reach incentives, and badges are a simple way to bring that idea to learning. The concept behind badging draws on longstanding ways learning has been documented in other settings, such as the personal skills and achievement when a Boy or Girl Scout earns a merit badge. The approach is being used in learning environments like the Khan Academy, with promising results. People watch videos on specific subjects and earn new badges by doing so. Mozilla has published an open specification for badging — the Open Badge Initiative (OBI) — that enables providers and users alike to easily display their achievements on the web. Badges can be used as a way to incorporate some of the advantages of game mechanics as participants work through various levels or stages to achieve credentials. While badges are not by any means pervasive in education systems, they appeal to many educators because they are considered to be more authentic signs of knowledge comprehension and skill acquisition than standard tests, grades, or course credits.

Relevance for Teaching, Learning, or Creative Inquiry

- Badges gamify the learning process, incentivizing learners to participate in projects and activities that publicly demonstrate their knowledge in order to achieve recognition.
- Badges challenge the authority of tertiary education institutions as the sole providers of learning certification, as any organization can become a badge issuer.
- With their flexibility to provide institutional as well as peer- and self-accreditation and validation, badges acknowledge skill acquisitions of all kinds.

Badges in Practice

- BadgeOS is an open source initiative that certifies and recognizes the informal learning that happens in communities, museums, extracurricular activities, and more. The platform allows badges to be earned, managed, and shared by learners virtually anywhere on the web: go.nmc.org/badgeos.
- In partnership with the MacArthur Foundation, Mozilla sponsored a competition for the development of digital open badges. UC Davis' sustainable-agriculture program's badging system was among the winners, and was designed to organize evidence of both formal and informal learning: go.nmc.org/futu.
- A professor at Quinnipiac University implemented a badging system in place of a traditional grading scale to evaluate his students, which has led to more interaction through a peer-review process: go.nmc.org/digib.

For Further Reading

Badges Lend Gravitas To Free Education Revolution
go.nmc.org/gravitas
> (James Marshall Crotty, *Forbes,* 25 February 2013.) Over the past year, badges have evolved from demonstrating general competencies to showcasing the depths of specific skills.

Not Just for MOOCs Anymore: Integrating Badges on Campus
go.nmc.org/ucd
> (Courtney Bell, *Edcetera*, 27 March 2013.) Several higher education institutions are using badges to recognize accomplishments that their traditional credit system does not cover, including extracurricular activities and participation in career fairs.

Time-to-Adoption: Two to Three Years

Games and Gamification

The games culture has grown to include a substantial proportion of the world's population, with the age of the average gamer increasing with each passing year. A 2012 survey conducted by the Entertainment Software Association showed that the age demographic of game players in the U.S. is split in almost equal thirds with people ages 18-35 representing 31% of gamers, along with roughly equal proportions among those younger than 18 and those older than 35. As tablets and smartphones have proliferated, desktop and laptop computers, television sets, and gaming consoles are no longer the only way to connect with competitors online, making game-play a portable activity that can happen in a diverse array of settings. Gameplay has long moved on from simply recreation and has found considerable traction in the worlds of commerce, productivity, and education as a useful training and motivation tool. While a growing number of educational institutions and programs are experimenting with game-play, there has also been increased attention surrounding gamification — the integration of gaming elements, mechanics, and frameworks into non-game situations and scenarios. Businesses have embraced gamification as a way to design incentive programs that engage employees through rewards, leader boards, and badges, often with a mobile component. Although more nascent than in military or industry settings, the gamification of education is gaining support among researchers and educators who recognize that it is well established that effectively designed games can stimulate large gains in productivity and creativity among learners.

Relevance for Teaching, Learning, or Creative Inquiry

- Discovery-based and goal-oriented learning are often inherent in educational games, fostering opportunities for collaboration and the development of teambuilding skills.
- Educational games can be used to teach cross-curricular concepts that touch on many subjects in a more engaging way than traditional methods.
- Simulations and role-playing games allow students to re-enact difficult situations to try new responses or pose creative solutions.

Games and Gamification in Practice

- Cuyahoga Community College launched a project called Edugaming Positively Impacting College Completion and established the Gaming Incubation Group to create games and encourage their use in both face-to-face and online learning: go.nmc.org/games2.
- In their Myndworks series, Jamestown Community College educators developed games that help students implement strategies to become better learners: go.nmc.org/mynd.
- Northern Essex Community College has a club where students play recreational and educational games, including one that illustrates chemistry concepts: go.nmc.org/nes.

For Further Reading

Motivating Students and the Gamification of Learning
go.nmc.org/gamhie
> (Shantanu Sinha, *The Huffington Post*, 14 February 2012.) The president of the Khan Academy shares best practices and explores effective ways to gamify learning experiences.

What is Gamification, Really?
go.nmc.org/really
> (Michael Wu, *Lithosphere*, 7 September 2012.) The author provides an overview of gamification and explores the use of game mechanics to bolster engagement in a variety of settings.

Time-to-Adoption: Two to Three Years

Learning Analytics

Learning analytics is education's approach to "big data," a science that was originally leveraged by businesses to analyze consumer activities, identify consumer trends, and predict consumer behavior. The rise of the Internet drove research into big data and metrics as well as the proliferation of web tracking tools, enabling companies to build vast reserves of information they could study and leverage in their marketing campaigns. Education is embarking on a similar pursuit into data science with the aim of improving student retention and providing a high quality, personalized experience for learners. Learning analytics research uses data analysis to inform decisions made on every tier of the educational system. Whereas analysts in business use consumer data to target potential customers and personalize advertising, learning analytics leverages student data to build better pedagogies, target at-risk student populations, and to assess whether programs designed to improve retention have been effective and should be sustained. For educators and researchers, learning analytics has been crucial to gaining insights about student interaction with online texts and courseware. Students are beginning to experience the benefits of learning analytics as they engage with platforms that use student-specific data to design systems that suit their learning needs.

Relevance for Teaching, Learning, or Creative Inquiry

- If used effectively, learning analytics can help surface early signals that indicate a student is struggling, allowing teachers and schools to address issues quickly.
- The promise of learning analytics is that it will enable teachers to more precisely identify students' learning needs and tailor instruction appropriately.

Learning Analytics in Practice

- Southwest Virginia Community College is using adaptive courseware in introductory psychology courses to increase student retention and success rates: go.nmc.org/adaptc.
- Supported by the Bill and Melinda Gates Foundation, PAR is a collaborative data mining project between 16 universities and community colleges: go.nmc.org/parf.
- Using tools such as Ellucian Colleague and Career Coach, data has become an integral part of learning and decision-making at Montgomery County Community College: go.nmc.org/mccc.

For Further Reading

Enhancing Teaching and Learning Through Educational Data Mining and Learning Analytics
go.nmc.org/enh
> (Marie Bienkowski et al., U.S. Department of Education, October 2012.) Data analytics mining is established in the commercial world and similar techniques can be applied in education.

Number Crunchers
go.nmc.org/numb
> (Paul Bradley, *Community College Week*, 1 April 2013.) A leader from the League for Innovation in the Community College led a discussion about how analytics can impact each student's learning pathway.

Real-Time Jobs Data Show Community College What Employers Need Now
go.nmc.org/realda
> (Jennifer Gonzalez, *Chronicle of Higher Education*, 13 August 2012.) Community colleges in New York are using data mining software to learn more about hiring trends and job requirements of employers. With this information, instructors can design courses and training programs that better equip students for their entrance into the workforce.

Time-to-Adoption: Two to Three Years

Next-Generation LMS

Learning management systems (LMS) are software applications or online environments where educators and students organize, deliver, and interact with online course materials. Traditional LMS generally contain the same basic set of features, including portals for uploading and sharing documents, managing calendars and assignment logs, and simplifying class rosters, and gradebooks. The emergence of technologies such as social media, cloud-based services, and mobile learning are pushing LMS providers to adapt their systems to new tools and services in a simpler, easier fashion, and to work responsively across the range of student and faculty devices. The vision is LMS platforms that operate as complex ecosystems, cooperating with other online environments, especially collaborative spaces like Google Apps, digital media collections like YouTube, and social networks like Facebook and Twitter. Next-generation LMS will make it far easier to collect information on how students are using these disparate resources and tools, and will incorporate learning analytics to understand and interpret those data streams. The integration of tracking and analytics tools such as Tin Can and xAPI has increased the value of these platforms by enabling professors to monitor student behaviors and use the data to gain insights about the effectiveness of the course materials. While next-generation LMS are still more vision than reality, interest in these sorts of capabilities is already driving development, and colleges can expect to begin to see them being implemented broadly within two-to-three years.

Relevance for Teaching, Learning, or Creative Inquiry

- Learning that incorporates resources and activities across a wide range of websites can be accumulated in one place via next-generation LMS.
- Next-generation LMS integrate social networks that learners are already using to help facilitate class discussions and send alerts to students about assignments or schedule changes.
- Updated LMS can include data visualization so educators can instantly glean a better understanding of student performance and adapt course materials accordingly.

Next-Generation LMS in Practice

- Moodle became the strategic alternative to Blackboard LMS at Thomas Edison State College, primarily for its ease of navigation and integration of Google Apps: go.nmc.org/mood.
- The University of New Mexico transitioned from WebCT Vista to Blackboard 9.1, citing that it offered a more customizable course menu and dynamic dashboard: go.nmc.org/unmlms.
- University of South Florida System Learning Management Committee evaluated several LMS options and selected Canvas because it was mobile-friendly and intuitive: go.nmc.org/ngolm.

For Further Reading

Beyond the LMS – Lore, the Next-Gen Social Network for Education
go.nmc.org/lore
> (Kirsten Winkler, *Fractus Learning*, 17 July 2012.) Lore, formerly known as Coursekit, developed an LMS featuring an enhanced social networking component that allows instructors and students to create more dynamic profiles, akin to Google+ and LinkedIn.

Why Aren't There Any Next Gen Learning Platforms?
go.nmc.org/negelearn
> (Tom Vander Ark, *Edcetera*, 9 July 2012.) The author describes the challenges inherent in developing next-generation learning management systems that successfully blend online and onsite education while supporting personalized, competency-based learning.

Time-to-Adoption: Four to Five Years

The Internet of Things

The Internet of Things conveys information communicated by network aware objects that connect the physical world with the world of information through the web. It does so through TCP/IP, the set of standards that enables network connections and specifies how information finds its way to and from the myriad of connections it contains. TCP/IP was formulated in the 1970s by Vinton Cerf and Robert E. Kahn. The advent of TCP/IP v6, launched in 2006, added enormous new addressing capabilities to the Internet, and enabled objects and the information they might carry in attached sensors or devices to be addressable and searchable across the web. This expanded address space is particularly useful for tracking objects that monitor sensitive equipment or materials, point-of-sale purchases, passport tracking, inventory management, identification, and similar applications. Embedded chips, sensors, or tiny processors attached to an object allow helpful information about the object, such as cost, age, temperature, color, pressure, or humidity to be transmitted over the Internet. This simple connection allows remote management, status monitoring, tracking, and even alerts if the objects they are attached to are in danger of being damaged or spoiled. Traditional web tools allow objects to be annotated with descriptions, instructions, warranties, tutorials, photographs, connections to other objects, and any other kind of contextual information. The Internet of Things makes access to these data as easy as it is to use the web.

Relevance for Teaching, Learning, or Creative Inquiry

- Attached to scientific samples, TCP/IP-enabled smart objects already are alerting scientists and researchers to conditions that may impair the quality or utility of the samples.

- Pill-shaped microcameras are used in medical diagnostics and teaching to traverse the human digestive tract and send back thousands of images to pinpoint sources of illness.

- TCP/IP enabled sensors and information stores make it possible for geology and anthropology departments to monitor or share the status and history of even the tiniest artifact in their collections of specimens from anywhere to anyone with an Internet connection.

Internet of Things in Practice

- By using tiny sensors installed in an apartment complex, Linköping University hopes to improve energy efficiency by showing residents their consumption impact: go.nmc.org/saven.

- Ubi is a device with sensors that monitor temperature, air pressure, and ambient light and also contains a microphone and speakers so users can listen for commands: go.nmc.org/ubi.

- In a partnership between the UK Maker community and Falmouth University's Academy of Innovation and Research, formal residencies will enable designers to invent Internet of Things-enabled objects, such as a music memory box for Alzheimer's patients: go.nmc.org/threecon.

For Further Reading

10 Things You Should Know About the Internet of Things
go.nmc.org/10things
> (Patrick Gray, *TechRepublic,* 10 January 2013.) A helpful list of relevant ideas related to the Internet of Things is provided, which includes descriptions of its uses and business values.

Futurist's Cheat Sheet: Internet of Things
go.nmc.org/cpfez
> (Dan Rowinski, *Read Write Web*, 31 August 2012.) The author explores a world where objects have their own IP addresses and can communicate with each other via WiFi or cellular networks.

Time-to-Adoption: Four to Five Years

Natural User Interfaces

It is already common to interact with a new class of devices entirely by using natural movements and gestures. The iPad, iPhone and iPod Touch, Xbox Kinect, Nintendo Wii, the new class of "smart TVs," and a growing list of other devices built with natural user interfaces accept input in the form of taps, swipes, and other ways of touching; hand and arm motions; body movement; and increasingly, natural language. These are the first in a growing array of alternative input devices that allow computers to recognize and interpret natural physical gestures as a means of control. Natural user interfaces (NUIs) allow users to engage in virtual activities with movements similar to what they would use in the real world, manipulating content intuitively. The idea of being able to have a completely natural interaction with your device is not new, but neither has its full potential been realized. What makes natural user interfaces especially interesting this year is the burgeoning high fidelity of systems that understand gestures, facial expressions, and their nuances, as well as the convergence of gesture-sensing technology with voice recognition, which allows users to interact in an almost natural fashion, with gesture, expression, and voice communicating their intentions to devices.

Relevance for Teaching, Learning, or Creative Inquiry

- As the ability of NUIs to read subtle changes in facial expressions and user reactions improves, software will be able to "sense" when a student is struggling or frustrated with material.

- NUIs make devices seem easier to use and more accessible; interactions are far more intuitive, which promotes exploration and engagement.

- Science students increasingly rely on simulators employing natural user interfaces to practice precise manipulations, such as catheter insertions, that would be far less productive if they had to try to simulate sensitive movements with a mouse and keyboard.

Natural User Interfaces in Practice

- An instructor at Uppingham Community College uses Kinect in his classroom and has created a vast library of Kinect resources that other educators can use freely: go.nmc.org/kinap.

- Johnson County Community College updated two of their computer labs with Dell touchscreen computers and provided special training workshops: go.nmc.org/jccc.

- University of Hawaii Community Colleges unveiled interactive career exploration touchscreen kiosks at all of their campuses across the state to help students define and pursue their career goals: go.nmc.org/uhedu.

For Further Reading

The Human Voice, as Game Changer
go.nmc.org/voice
> (Natasha Singer, *The New York Times*, 31 March 2012.) This article paints a picture of how the voice-enabled future will materialize as we begin to interact in new ways with everyday objects, such as refrigerators, thermostats, alarm systems, and other devices.

Natural User Interfaces
go.nmc.org/cvtqw
> (Charles Xie, *The Advanced Educational Modeling Laboratory*, 21 August 2012.) The head of the Mixed Reality Labs project funded by the National Science Foundation explains Natural Learning Interfaces (NLI), natural user interfaces that allow users to interact with simulations on a computer.

Time-to-Adoption: Four to Five Years

Virtual Assistants

As voice recognition and gesture-based technologies advance and more recently, converge, we are moving away from the notion of interaction with our devices via a pointer and keyboard. Virtual assistants are a credible outcome from work being done with natural user interfaces (NUI). The concept builds on developments in interfaces across the spectrum of engineering, computer science, and biometrics. A new class of smart televisions will be among the first devices to make comprehensive use of the idea. While crude versions of virtual assistants have been around for some time, we have yet to achieve the level of interactivity seen in Apple's classic video, Knowledge Navigator. The Apple iPhone's Siri and Android's Jellybean are recent mobile-based examples, and allow users to control all the functions of the phone, participate in lifelike conversations with the virtual assistant, and more. Virtual assistants for learning are clearly in the long-term horizon, but the potential of the technology to add substance to informal modes of learning is compelling.

Relevance for Teaching, Learning, or Creative Inquiry

- Accessible through natural user interfaces, virtual assistants can be designed specifically to aid blind, deaf, and otherwise disabled learners.

- Over time, virtual assistants can potentially function as real-time translators, increasing the scope and depth of collaboration between institutions globally.

- Virtual assistants can access information from email accounts, personal calendars, and LMS to help students and faculty better manage their time and coordinate their work.

Virtual Assistants in Practice

- Carnegie Mellon University created an open source toolkit for speech recognition on Kindle devices called VAGUE, which allows users to navigate the reader, launch various tools, and prompt more actions by writing a new script: go.nmc.org/sphinx.

- Designed by the University of Cambridge, Zoe is a virtual assistant avatar that can express a full range of emotions. Current research efforts involve using this technology to work with autistic and deaf children: go.nmc.org/zoe.

- The University of Virginia Health System selected M*Modal, a speech recognition engine, to facilitate the creation, management, and sharing of electronic medical records: go.nmc.org/mmodal.

- Wintermute is a mobile personal assistant platform that follows users from device to device, and is informed by their daily actions and preferences: go.nmc.org/nuance.

For Further Reading

Finally: Real Virtual Assistants
go.nmc.org/realv
> (Mike Elgan, *Computerworld*, 15 December 2012.) This article compares Apple's Siri with three available apps, EasilyDo, Google Now, and Grokr, which the author believes reveal the future of intuitive human-machine interaction.

A Personal Assistant Created from the Crowd by Smart Software
go.nmc.org/crowd
> (Tom Simonite, *MIT Technology Review*, 7 December 2012.) A new alternative to virtual personal assistants has emerged with the introduction of Premier, a crowdsourcing tool that connects users with a network of individuals who help carry out complex tasks.

Time-to-Adoption: Four to Five Years

Virtual and Remote Laboratories

Virtual and remote laboratories reflect a movement among education institutions to make the equipment and elements of a physical science laboratory more easily available to learners from any location, via the web. Virtual laboratories are web applications that emulate the operation of real laboratories and enable students to practice in a "safe" environment before using real, physical components. Examples include an optical networking virtual lab and a virtual lab for programmable logic controllers. Students can typically access virtual labs 24/7, from wherever they are, and run the same experiments over and over again. Some emerging virtual lab platforms also incorporate reporting templates that populate with the results of the experiments so that students and teachers can easily review the outcomes. Remote laboratories provide a virtual interface to a real, physical laboratory. Institutions that do not have access to certain high-caliber lab equipment can run experiments and perform lab work online, accessing the tools from a central location. Users are able to manipulate the equipment and watch the activities unfold via a webcam on a computer or mobile device. This provides students with a realistic view of system behavior and allows them access to professional laboratory tools from anywhere, whenever they need. Additionally, remote labs alleviate some financial burden from institutions as they can forgo purchasing specific equipment and instead use the remote tools that are at their disposal.

Relevance for Teaching, Learning, or Creative Inquiry

- Because virtual laboratories do not involve real equipment or chemicals, students can feel more comfortable making mistakes and running experiments as often as they like.
- Educators can play back videos of the experiments students have run online, pinpoint areas of improvement, and acknowledge students who have excelled.
- Virtual and remote laboratories increase access to science tools, allowing learners from all over the world to use them via wireless or cellular networks; laboratory work is no longer limited to spaces on physical campuses.

Virtual and Remote Laboratories in Practice

- The Colorado Community College System's remote physics, chemistry, and biology labs allow students to control the equipment online and download experiment data: go.nmc.org/dgddo.
- LiLa is an initiative of eight European colleges and universities to provide access to virtual laboratories and remote experiments: go.nmc.org/lil.
- Northwestern University's remote online lab, iLab Central, gives science teachers and learners access to high-caliber equipment housed at the University of Queensland: go.nmc.org/ilab.

For Further Reading

Flipping Lab Science with Remote Labs
go.nmc.org/flipsci
> (Jim Vanides, *Guide2DigitalLearning*, accessed 19 March 2013.) The author explores the role of remote science labs in the flipped classroom model. Students have more time to explore the material and run more iterations of an experiment.

Now, Virtual Classrooms
go.nmc.org/virtclass
> (*The Pioneer*, 26 March 2013.) This article describes the Virtual Classroom Centre in which students complete lab work via tablets in satellite classroom locations throughout India.

Top Ten Trends Impacting Technology Decisions

The technologies featured in the NMC Horizon Project are embedded within a contemporary context that reflects the realities of the time, both in the sphere of education and in the world at large. To assure this perspective, each advisory board researches, identifies, and ranks key trends that are currently affecting the practice of teaching, learning, or creative inquiry in education, and uses these as a lens for its work in predicting the uptake of emerging technologies in whatever sector or region is their focus.

These trends are surfaced through an extensive review of current articles, interviews, papers, and new research. Once identified, the list of trends is ranked according to how significant of an impact they are likely to have on education in the next five years. The following ten trends have been identified as key drivers of technology adoptions in community, technical, and junior colleges for the period of 2013 through 2018; they are listed here in the order they were ranked by the advisory board.

1) People expect to be able to work, learn, and study whenever and wherever they want. Life in a busy world where learners must balance demands from home, work, school, and family poses a host of logistical challenges with which today's ever more mobile students must cope. Work and learning are often two sides of the same coin, and people want easy and timely access not only to the information on the network, but also to tools, resources, and up-to-the-moment analysis and commentary. These needs, as well as the increasingly essential access to social media and networks, have risen to the level of expectations. The opportunities for informal learning in the modern world are abundant and diverse, and greatly expand on earlier notions like "just-in-time" or "found" learning.

2) There is a growing interest in using new sources of data for personalizing the learning experience and for performance measurement. As learners participate in online activities, they leave a clear trail of analytics data that can be mined for insights. Learning analytics experiments and demonstration projects are currently examining ways to use data for enrichment. Dashboards filter this information so that student progress can be monitored in real time. As the field of learning analytics matures, the hope is that this information will enable continual improvement of learning outcomes.

3) As technology becomes more capable of processing information and providing analysis, community college efforts will focus on teaching students to make use of critical thinking, creativity, and other soft skills. Over the years, technology has replaced manual labor and specialized tasks previously done by humans, and all signs indicate that this movement will continue at a rapid pace. It is no longer necessary for students, for example, to make calculations by hand or to read a print map for directions. As a result, there is a shift in the skills learners need to be successful in the workforce and in life. Communication, creativity, critical thinking, and other less tangible skills are highly valued, as technology has not yet superseded the need for those talents.

4) Education paradigms are shifting to include online learning, hybrid learning, and collaborative models. Students already spend much of their free time on the Internet, learning and exchanging new information — often via their social networks. Institutions that embrace face-to-face/online hybrid learning models have the potential to leverage the online skills learners have already developed independent of academia. Online learning environments can offer different affordances than physical campuses, including opportunities for increased collaboration while equipping students with stronger digital skills. Hybrid models, when designed and implemented successfully, enable students to travel to campus for some activities, while using the network for others, taking advantage of the best of both environments.

5) As the abundance of resources and relationships made easily accessible via the Internet grows, we are ever more challenged to revisit our roles as educators. Institutions must consider the unique value that schools add to a world in which information is everywhere, and generally free. In such a world, sense-making and the ability to assess the credibility of information are paramount. Mentoring and preparing students for the world in which they will live and work is again at the forefront. K-12 institutions have always been seen as critical paths to educational credentialing, but challenges from competing sources are redefining what these paths can look like.

6) 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. As authoritative sources lose their importance, there is need for more curation and other forms of validation to generate meaning in information and media. "Open" has become a term often applied in very different contexts. Open education advocates are working towards a common vision that defines "open" broadly — not just free in economic terms, but educational materials that are freely copiable, freely remixable, and free of barriers to access, sharing, and educational use.

7) Mobilization, specifically mobile devices and apps, provides another avenue for delivering education on demand and within one's hand. Tablets, smartphones, and mobile apps have become too capable, too ubiquitous, and too useful to ignore, and their distribution defies traditional patterns of adoption, both by consumers, where even economically disadvantaged families find ways to make use of mobile technology, and at education institutions, where the tide of opinion has dramatically shifted when it comes to mobiles. Because of their portability, flexibility, and natural, intuitive interfaces, a growing number of colleges see tablets especially as a cost-effective strategy.

8) The workforce demands skills from university graduates that are more often acquired from informal learning experiences than in universities. Informal learning generally refers to any learning that takes place outside of a formal school setting, but a more practical definition may be learning that is self-directed and aligns with the student's own personal learning goals. Online or other modern environments are trying to leverage both formal and informal learning experiences by allowing for more open-ended, unstructured time where students are encouraged to experiment, play, and explore topics based on their own motivations. This type of learning will become more and more important in learning environments of all kinds.

9) Increasingly, students want to use their own technology for learning. As new technologies are developed at a more rapid pace and at a higher quality, there is a wide variety of different devices, gadgets, and tools from which to choose. Utilizing a specific device has become something very personal — an extension of someone's personality and learning style — for example, the iPhone vs. the Android. There is comfort in giving a presentation or performing research with tools that are more familiar and productive at the individual level. And, with handheld technology becoming mass produced and more affordable, students are more likely to have access to advanced equipment in their personal lives than at school.

10) Learning analytics, tacit intelligence, and natural gesture-based interfaces continue to make a big impact on two-year colleges. As the level and depth of the information provided by learning analytic systems becomes more detailed, this information is being used to identify specific areas in content and content delivery that may need to be adjusted to improve student learning. Combined with information and insights that may be gained from identifying patterns of behavior in students, both data sets can be used to help facilitate personalized learning. Gesture-based technology, especially in the form of natural user interfaces, augments these experiences, enabling more intuitive interactions between the user and the learning material.

Top Ten Most Significant Challenges

Along with the trends discussed in the preceding section, the advisory board noted a number of important challenges faced in two-year higher education institutions. Like the trends, the challenges described below were drawn from a careful analysis of current events, papers, articles, and similar sources, as well as from the personal experience of the advisory board members in their roles as leaders in education and technology. The ten challenges ranked as most significant in terms of their impact on teaching, learning, or creative inquiry in community, technical, and junior colleges in the coming five years are listed here, in the order of importance assigned them by the advisory board.

1) Trying to prepare the ever-increasing number of students who enter college placing in developmental courses is a challenge. This ongoing issue is precipitated by a general lack of motivation and discipline among students who enroll in two-year institutions and require remedial intervention. There is a need for colleges to develop and deploy new strategies that address low engagement levels without lowering the standards of course curriculum. In many countries across the world, there is an emphasis on completion rates, encouraging educators to push students through their coursework without spending sufficient time to reform developmental courses.

2) Critical campus infrastructures are under-resourced. Rather than encouraging researchers to build on and extend core resources, leverage shared file systems, and open accessible service APIs, institutions are narrowing their focus to what they perceive as the minimal subset of enterprise services they can afford to sustain. As a result, educators are often trying to design new, innovative learning models that must be integrated with outdated, pre-existing technology and learning management systems.

3) The demand for personalized learning is not adequately supported by current technology or practices. The increasing demand for education that is customized to each student's unique needs is driving the development of new technologies that provide more learner choice and control and allow for differentiated instruction. It has become clear that one-size-fits-all teaching methods are neither effective nor acceptable for today's diverse students. Technology can and should support individual choices about access to materials and expertise, amount and type of educational content, and methods of teaching. The biggest barrier to personalized learning, however, is that scientific, data-driven approaches to effectively facilitate personalization have only recently begun to emerge; learning analytics, for example, is still in the very nascent stage of implementation and adoption within higher education — especially for two-year institutions.

4) Too often it is education's own processes and practices that limit broader uptake of new technologies. Much resistance to change simply reflects comfort with the status quo. In many cases, experimentation with or piloting of innovative applications of technologies are often seen as outside the role of teacher or school leader, and thus discouraged. Changing these processes will require major shifts in attitudes as much as they will in policy.

5) 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. Despite the widespread agreement on the importance of digital media literacy, training in the supporting skills and techniques is rare in teacher education and non-existent in the preparation of faculty. As lecturers and professors begin to realize that they are limiting their students by not helping them to develop and use digital media literacy skills across the curriculum, the lack of formal training is being offset through professional development or informal learning, but we are far from seeing digital media literacy as a

norm. This challenge is exacerbated by the fact that digital literacy is less about tools and more about thinking, and thus skills and standards based on tools and platforms have proven to be somewhat ephemeral.

6) Most academics are not using new and compelling technologies for learning and teaching, nor for organizing their own research. Many researchers have not had training in basic digitally supported teaching techniques, and most do not participate in the sorts of professional development opportunities that would provide them. This is due to several factors, including a lack of time and a lack of expectations that they should. Many think a cultural shift will be required before we see widespread use of more innovative organizational technology. Some educators are apprehensive about working with new technologies, as they fear the tools and devices have become more of a focus than the learning. Adoption of progressive pedagogies, however, is often enabled through the exploration of emerging technologies, and thus a change in attitude among academics is imperative.

7) The digital divide remains an issue, particularly given the socioeconomic diversity of the community college population. Emerging technologies alone are not equalizers for rural and urban populations. Students who live in rural areas, for example, cannot always connect to cellular networks and are more likely to have no cable or high-speed Internet connectivity at home. Furthermore, educational content does not necessarily render properly on all mobile devices. As a result, these students may need more resources and more attention from instructors to be able to reach the same standards as students in other locales. On the other hand, many technologies are providing opportunities for personalization. Adaptive programs and self-paced online courses all contribute to an environment in which learners from all over the globe can be challenged at the appropriate level; it is just a matter of educators guiding them through these types of resources so they can better direct their learning and understand what tools they need to stay on track.

8) The global drive to increase the number of students participating in undergraduate education is placing pressure across the system. The off-cited relationship between earning potential and educational attainment, plus the clear impact of an educated society on the growth of the middle class is pushing many countries to encourage more and more students to enter universities and colleges. However, the population of students prepared for undergraduate study is already enrolled — expanding access means extending it to students who may not have the academic background to be successful without additional support. Many in universities feel that these institutions do not have sufficient time and resources to help this set of students.

9) The impact of mobile devices and apps for workforce development and technical training is increasing. In technical professions especially, employers are looking to recruit people who have experience with mobile technology — especially apps. More and more, training programs and opportunities are taking place via mobile apps. Furthermore, there is the expectation that prospective employees will enter the workforce with knowledge of app development and design.

10) New models of education are bringing unprecedented competition to the traditional models of tertiary education. Across the board, institutions are looking for ways to provide a high quality of service and more learning opportunities. MOOCs are at the forefront of these discussions, enabling students to supplement their education and experiences at brick-and-mortar institutions with increasingly rich, and often free, online offerings. As these new platforms emerge, however, there is a need to frankly evaluate the models and determine how to best support collaboration, interaction, and assessment at scale. Simply capitalizing on new technology is not enough; the new models must use these tools and services to engage students on a deeper level.

Methodology

The process used to research and create the *Technology Outlook for Community, Technical, and Junior Colleges 2013-2018: An NMC Horizon Project Sector Analysis* is very much rooted in the methods used throughout the NMC Horizon Project. All publications of the NMC's Horizon Project are produced using a carefully constructed process that is informed by both primary and secondary research. Dozens of technologies, meaningful trends, and critical challenges are examined for possible inclusion in the report for each edition. Every report draws on the considerable expertise of an internationally renowned advisory board that first considers a broad set of important emerging technologies, challenges, and trends, and then examines each of them in progressively more detail, reducing the set until the final listing of technologies, trends, and challenges is selected.

Much of the process takes place online, where it is captured and placed in the NMC Horizon Project wiki. This wiki, which has grown into a resource of hundreds of pages, is intended to be a completely transparent window onto the work of the project, and contains the entire record of the research for each of the various editions. The section of the wiki used for the *Technology Outlook for Community, Technical, and Junior Colleges 2013-2018* can be found at 2year.wiki.nmc.org.

The procedures for selecting the topics that are in this report include a modified Delphi process now refined over years of producing the *NMC Horizon Report* series, and it began with the assembly of the advisory board. The board as a whole was intended to represent a wide range of backgrounds and interests, yet with each member bringing a particularly relevant expertise. To date, hundreds of internationally recognized practitioners and experts have participated in the NMC Horizon Project Advisory Boards; in any given year, a third of advisory board members are new, ensuring a flow of fresh perspectives each year.

Once the advisory board for a particular edition is constituted, their work begins with a systematic review of the literature — press clippings, reports, essays, and other materials — that pertains to emerging technology. Advisory board members are provided with an extensive set of background materials when the project begins, and are then asked to comment on them, identify those that seem especially worthwhile, and add to the set. The group discusses existing applications of emerging technology and brainstorms new ones. A key criterion for the inclusion of a topic is the potential relevance of the topic to teaching, learning, or creative inquiry. A carefully selected set of RSS feeds from dozens of relevant publications ensures that background resources stay current as the project progresses. They are used to inform the thinking of the participants throughout the process.

Following the review of the literature, the advisory board engages in the central focus of the research — the research questions that are at the core of the NMC Horizon Project. These questions are designed to elicit a comprehensive listing of interesting technologies, challenges, and trends from the advisory board:

1. *Which of these key technologies will be most important to community, technical, and junior colleges within the next five years?*
2. *What key technologies are missing from our list? Consider these related questions:*
   a. *What would you list among the established technologies that some community, technical, and junior colleges and programs are using today that arguably ALL institutions and programs should be using broadly to support or enhance teaching, learning, or creative inquiry?*

    b. *What technologies that have a solid user base in consumer, entertainment, or other industries should community, technical, and junior colleges and programs be actively looking for ways to apply?*

    c. *What are the key emerging technologies you see developing to the point that community, technical, and junior colleges and programs should begin to take notice during the next four to five years?*

3. *What trends do you expect to have a significant impact on the ways in which community, technical, and junior colleges and programs approach our core missions of teaching, learning, and creative inquiry?*

4. *What do you see as the key challenges related to teaching, learning, and creative inquiry that community, technical, and junior colleges and programs will face during the next five years?*

One of the advisory board's most important tasks is to answer these questions as systematically and broadly as possible, so as to ensure that the range of relevant topics is considered. Once this work is done, a process that moves quickly over just a few days, the advisory board participates in a unique consensus-building activity based on an iterative Delphi-based methodology.

The responses to the research questions are systematically ranked and placed into adoption horizons by each advisory board member using a multi-vote system that allows members to weight their selections. Each member is asked to also identify the timeframe during which they feel the technology would enter mainstream use — defined for the purpose of the project as about 20% of institutions adopting it within the period discussed. (This figure is based on the research of Geoffrey A. Moore and refers to the critical mass of adoptions needed for a technology to have a chance of entering broad use.) These rankings are compiled into a collective set of responses, and inevitably, the ones around which there is the most agreement are quickly apparent.

For additional detail on the project methodology or to review the instrumentation, the ranking, and the interim products behind the report, please visit the project wiki, which can be found at <u>2year.wiki.nmc.org</u>.

—————— ℰℛ ——————