NMC Horizon Report Interim Results > 2015 K-12 Edition

The NMC Horizon Report Interim Results provide summaries of each of the upcoming edition’s initial findings, laying out the draft definitions to inform the final round of voting for the expert panel.

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Long-Term Trends: Driving K-12 Ed Tech adoption for five or more years

Advancing Cultures of Change and Innovation

Many thought leaders have long believed that schools can play a major role in the growth of national economies. In order to breed innovation and adapt to economic needs, schools must be structured in ways that allow for flexibility, and spur creativity and entrepreneurial thinking. There is a growing consensus among many thought leaders that school leadership and curricula could benefit from agile startup models. Educators are working to develop new approaches and programs based on these models that stimulate top-down change and can be implemented across a broad range of institutional settings. In the business realm, the Lean Startup movement uses technology as a catalyst for promoting a culture of innovation in a more widespread, cost-effective manner, and provides compelling models for school leaders to consider.

Rethinking How Schools Work

There is a focused movement to reinvent the traditional classroom paradigm and rearrange the entire school experience — a trend that is largely being driven by the influence of innovative learning approaches. Methods such as project- and challenge-based learning call for school structures that enable students to move from one learning activity to another more organically, removing the limitations of the traditional bell schedule. Century-old practices in which students learn subject by subject are perceived by many as an antiquated approach to teaching and learning. The multidisciplinary nature of contemporary approaches has brought attention to innovative designs of the school atmosphere that link each class and subject matter. As learning becomes more fluid and student-centered, some teachers and administrators believe that schedules should be more flexible to allow opportunities for authentic learning to take place and ample room for independent study.

Shift to Deeper Learning Approaches

There is a new emphasis in the classroom on deeper learning approaches, defined by the Alliance for Excellent Education as the delivery of rich core content to students in innovative ways that allow them to learn and then apply what they have learned. Project-based learning, problem-based learning, inquiry-based learning, challenge-based learning, and similar methods foster more active learning experiences, both inside and outside the classroom. As technologies such as tablets and smartphones are more readily accepted in schools, educators are leveraging these tools, which students already use, to connect the curriculum with real life applications. These active learning approaches are decidedly more student-centered, allowing learners to take control of how they engage with a subject and to brainstorm and implement solutions to pressing local and global problems. The hope is that if learners can connect the course material with their own lives and their surrounding communities, then they will become more excited to learn and immerse themselves in the subject matter.
Increasing Use of Collaborative Learning Approaches

Collaborative learning among both teachers and students is a growing priority for schools, especially around how it can stimulate educational technology uptake. According to a report published by the European Commission, “Survey of Schools: ICT in Education,” around 40% of grade 11 students already engage in collaborative work at least once a week. Research studies have revealed that teamwork exercises and cooperative learning environments bolster student engagement and performance. Approaches such as project- and challenge-based learning promote group work around solving a problem or achieving a collective goal. Similarly, an increasing number of teachers are participating in collaborative professional development opportunities that allow them to share best practices and learn from each other.

Redesigning Learning Spaces

Some thought leaders believe that new forms of teaching and learning require new spaces. More universities are helping to facilitate these emerging models of education, such as the flipped classroom, by rearranging learning environments to accommodate more active learning. Educational settings are increasingly designed to facilitate project-based interactions with attention to mobility, flexibility, and multiple device usage. Wireless bandwidth is being upgraded in institutions to create “smart rooms” that support web conferencing and other methods of remote, collaborative communication. Large displays and screens are being installed to enable collaboration on digital projects and informal presentations. As K-12 education continues to move away from traditional lecture-based classes and to more hands-on scenarios, classrooms will start to resemble real-world work and social environments that facilitate organic interactions and cross-disciplinary problem solving.

Shift from Students as Consumers to Students as Creators

A shift is taking place in the focus of pedagogical practice in schools all over the world as students across a wide variety of disciplines are learning by making and creating rather than from the simple consumption of content. Creativity, as illustrated by the growth of user-generated videos, maker communities, and crowdfunded projects in the past few years, is increasingly the means for active, hands-on learning.
Short-Term Trends: Driving K-12 Ed Tech adoption over the next one to two years

**Growing Focus on Measuring Learning**

There is an increasing interest in using new sources of data for personalizing the learning experience, for ongoing formative assessment of learning, and for performance measurement; this interest is spurring the development of a relatively new field — data-driven learning and assessment. A key element of this trend is learning analytics, the application of web analytics, a science used by businesses to analyze commercial activities that leverages big data to identify spending trends and predict consumer behavior. Education is embarking on a similar pursuit into data science with the aim of learner profiling, a process of gathering and analyzing large amounts of detail about individual student interactions in online learning activities. The goal is to build better pedagogies, empower students to take an active part in their learning, target at-risk student populations, and assess factors affecting completion and student success. For learners, educators, and researchers, learning analytics is already starting to provide crucial insights into student progress and interaction with online texts, courseware, and learning environments used to deliver instruction.

**Increasing Use of Hybrid/Blended Learning Designs**

Perceptions of online learning have been shifting in its favor as more learners and educators see it as a viable alternative to some forms of face-to-face learning. Drawing from best practices in online and face-to-face methods, blended learning is on the rise in schools. The affordances blended learning offers are now well understood, and its flexibility, ease of access, and the integration of sophisticated multimedia and technologies are high among the list of appeals. Recent developments of business models for schools are upping the ante of innovation in these digital environments, which are now widely considered to be ripe for new ideas, services, and products. While growing steadily, the recent focus in many education circles on the rapid rise and burnout of massive open online courses (MOOCs) has led to the view that these sorts of offerings may be fad-like. However, progress in learning analytics; adaptive learning; and a combination of cutting-edge asynchronous and synchronous tools will continue to advance the state of online learning and keep it compelling, though many of these methods are still the subjects of experiments and research by online learning providers and schools.

**Rise of STEAM Learning**

The importance of high-quality science, technology, engineering, and mathematics (STEM) learning experiences has been the subject of many discussions among thought leaders in the past few years — especially as it relates to improving local and national economies by stimulating greater innovation and a more competitive global marketplace. However, as a response to this focus, a growing number of voices have articulated the need to better integrate humanities and arts education into these STEM classes and programs, hence the movement of STEAM learning. This trend has especially gained traction as there is more multi- and cross-disciplinary learning taking place at schools, revealing how these seemingly disparate subjects are interconnected. Experiencing the full spectrum of STEAM education can help students generate more well-rounded skill sets and views of the world.
**Significant Challenges**

**Solvable Challenges: Those which we both understand and know how to solve**

### Creating Authentic Learning Opportunities

Authentic learning, especially that which brings real-life experiences into the classroom, is still all too uncommon in schools. Authentic learning is seen as an important pedagogical strategy, with great potential to increase the engagement of students who are seeking some connection between the world as they know it exists outside of school, and their experiences in school that are meant to prepare them for that world. Use of learning strategies that incorporate real-life experiences, technology, and tools that are already familiar to students, and interactions from community members are examples of approaches that can bring authentic learning into the classroom. Practices such as these may help retain students in school and prepare them for further education, careers, and citizenship in a way that traditional practices are too often failing to do.

### Integrating Technology in Teacher Education

Teacher 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 competence, training in the supporting skills and techniques is rare in teacher education and non-existent in the preparation of teachers. As teachers begin to realize that they are limiting their students by not helping them to develop and use digital competence 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.

### Student Internet and Data Safety

Safety of student Internet activity and data has long been a concern in education, which is evident through legislation that has been passed to safeguard students and their personal data, such as the federal Family Educational Rights and Privacy Act in the United States. As schools embrace ubiquitous technology, and more learning takes place online and in 1:1 settings, researchers see great potential to leverage these digital learning environments to mine data, which can be used to decipher trends in student behavior and create personalized software. Schools around the world are adopting cloud computing to support adaptive learning, promote cost-savings, and encourage collaboration, but sometimes the safety of student data is threatened when third-party vendors provide low-cost software as a service in return for access to student data that they then profit from.
Difficult Challenges: Those we understand but for which solutions are elusive

Developing Effective Digital Assessments

Digital assessments have the ability to provide students with immediate feedback on their learning progress. These tools generate real-time feedback on what children know, combined with an array of tailored instructional materials, resulting in more customized instruction from teachers and a more personalized learning experience for each student. The digital overhaul of assessments is just beginning, and skeptics worry that many of the new products being promoted by educational technology companies will serve primarily to enable more efficient use of poor formative-assessment techniques. However, assessment and feedback form a significant part of the teacher’s workload and, with increased enrollment numbers, reduced budgets, and higher learning expectations, these new e-assessments must be integrated with new matrices and designs.

Personalizing Learning

Personalized learning includes a wide variety of approaches to support self-directed and group-based learning that can be designed around each learner’s goals. Solving this challenge means incorporating into school activities concepts such as personalized learning environments and networks, adaptive learning tools, and more. Using a growing set of free and simple resources, such as a collection of apps on a tablet, it is already quite easy to support one’s ongoing social and professional learning and other activities with a collection of resources and tools that is always on hand. There are two paths of development for personalized learning: the first is organized by and for the learner, which includes apps, social media, and related software. School goals and interests are driving the other path, primarily in the form of adaptive learning. In this pathway, which envisions the development of tools and data streams that are still some time away from being seen in schools, adaptive learning is enabled by intervention-focused machine intelligence that interprets data about how a student is learning and responds by changing the learning environment based on their needs. While the concept of personalized learning is fairly fluid, it is becoming more clear that it is individualized by design, different from person to person, and built around a vision of life-long learning.

Rethinking the Roles of Teachers

Teachers are increasingly expected to be adept at a variety of technology-based and other approaches for content delivery, learner support, and assessment; to collaborate with other teachers both inside and outside their schools; to routinely use digital strategies in their work with students; to act as guides and mentors to promote student-centered learning; and to organize their own work and comply with administrative documentation and reporting requirements. Students, along with their families, add to these expectations through their own use of technology to socialize, organize, and informally learn on a daily basis. The integration of technology into everyday life is causing many education thought leaders to argue that schools should be providing ways for students to continue to engage in learning activities, formal and informal, beyond the traditional school day. As this trend gathers steam, many schools across the world are rethinking the primary responsibilities of teachers. Related to these evolving expectations are changes in the ways teachers engage in their own continuing professional development, much of which involves social media and online tools and resources. While fully online schools are still relatively rare, an increasing number of teachers are using more hybrid and experiential learning exercises, and experimenting with social media and other ways of building learning communities.
Wicked Challenges: Those that are complex to even define, much less address

Keeping Formal Education Relevant

As online learning and free educational content become more pervasive, stakeholders and administrators must seriously consider what schools can provide that cannot be replicated by other sources. It is no longer necessary for parents to send their children to a brick-and-mortar school for them to become knowledgeable and gain skills that will lead them to gainful employment. There are, however, valuable skills and attitudes that can only be acquired in school settings. Soft skills, such as face-to-face communication and collaboration, for instance, are essential practices for solving problems in a world that is increasingly interconnected. Similarly, work ethic and the ability to persevere through even the toughest challenges, both social and academic, are reinforced in formal education environments. The idea is to rethink the value of education as a means of reinforcing attitudes and skills learners will need to seek credible information, work effectively in teams, and persist in achieving their goals. A recent survey by the Workforce Solutions Group found that more than 60% of employers say applicants lack “communication and interpersonal skills.” On the same note, the National Association of Colleges and Employers surveyed more than 200 employers about their top ten priorities in new hires and found that hiring managers desire people who are team players, problem solvers and can plan, organize, and prioritize their work; technical skills fell lower on the list. Generally speaking, trends in hiring make it clear that soft skills such as communication and work ethic are differentiating outstanding applicants from the norm.

Scaling Teaching Innovations

Our organizations are not adept at moving teaching innovations into mainstream practice. Innovation springs from the freedom to connect ideas in new ways. Our education institutions generally allow us to connect ideas only in prescribed ways — sometimes these lead to new insights, but more likely they lead to rote learning. Current organizational promotion structures rarely reward innovation and improvements in teaching and learning. A pervasive aversion to change limits the diffusion of new ideas, and too often discourages experimentation.

Teaching Complex Thinking

It is essential for young people both to understand the networked world in which they are growing up and also — through computational thinking — to understand the difference between human and artificial intelligence, learn how to use abstraction and decomposition when tackling complex tasks, and deploy heuristic reasoning to complex problems. The semantic web, big data, modeling technologies, and other innovations make new approaches to training learners in complex and systems thinking possible. Yet, mastering modes of complex thinking does not make an impact in isolation; communication skills must also be mastered for complex thinking to be applied meaningfully. Indeed, the most effective leaders are outstanding communicators with a high level of social intelligence; their capacity to connect people with other people, using technologies to collaborate and leveraging data to support their ideas, requires an ability to understand the bigger picture and to make appeals that are based on logic, data, and instinct.
Bring Your Own Device (BYOD)

BYOD refers to the practice of people bringing their own laptops, tablets, smartphones, or other mobile devices with them to the learning or work environment. 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 implementing BYOD policies, the company has reported up to 5 million hours of annual productivity gains, a statistic that is compelling many other companies to consider BYOD. In schools, the BYOD movement addresses the same reality; many students are entering the classroom with their own devices, which they use to connect to the school’s network. While BYOD policies have been shown to reduce technology spending, they are gaining traction more so because they reflect the contemporary lifestyle and way of working and learning.

Cloud Computing

Cloud computing refers to expandable, on-demand services and tools that are served to the user via the Internet from specialized data centers and consume almost no local processing or storage resources. Cloud computing resources support collaboration, file storage, virtualization, and access to computing cycles, and the number of available applications that rely on cloud technologies has grown to the point that few education institutions do not make some use of the cloud, whether as a matter of policy or not. Over the past few years, cloud computing has been firmly established as an efficient way for businesses to protect data and deliver software and online platforms. Schools are deploying similar strategies to boost collaboration, productivity, and mobility in teaching and learning.

Makerspaces

The driving force behind Makerspaces is rooted in the Maker movement, a following comprised of artists, tech enthusiasts, engineers, builders, tinkerers, and anyone else who has a passion for making things. The turn of the 21st century has signaled a shift in what types of skillsets have real, applicable value in a rapidly advancing world. In this landscape, creativity, design, and engineering are making their way to the forefront of educational considerations as tools such as 3D printers, robotics, and 3D modeling web-based applications become accessible to more people. The question of how to renovate or repurpose classrooms to address the needs of the future is being answered through the concept of Makerspaces, or workshops that offer tools and the learning experiences needed to help people carry out their ideas. Makerspaces are intended to appeal to people of all ages, and are founded on an openness to experiment, iterate, and create.

Mobile Learning

As smartphones and tablets become more capable and user interfaces more natural, old methods of computing seem place-bound and much less intuitive. People increasingly expect to be connected to the Internet wherever they go, and the majority of them use a mobile device to do so. The unprecedented evolution of these devices and the apps that run on them has opened the door to myriad uses for education. Schools all over the world are adopting apps into their curricula and modifying websites and educational materials so they are optimized for these devices. The significance for teaching and learning is that they have the potential to facilitate almost any educational experience, allowing learners to organize virtual video meetings with peers all over the world, use specialized software and tools, and collaborate on shared documents or projects.
Time-to-Adoption Horizon: Two to Three Years

3D Printing/Rapid Prototyping

Known in industrial circles as rapid prototyping, 3D printing refers to technologies that construct physical objects from three-dimensional digital content such as 3D modeling software, computer-aided design (CAD) tools, computer-aided tomography (CAT), and X-ray crystallography. A 3D printer builds a tangible model or prototype from the electronic file, one layer at a time, through an extrusion-like process using plastics and other flexible materials, or an inkjet-like process to spray a bonding agent onto a very thin layer of fixable powder. The deposits created by the machine can be applied accurately to build an object from the bottom up, layer by layer, with resolutions that, even in the least expensive machines, are more than sufficient to express a large amount of detail.

Adaptive Learning Technologies

Adaptive learning technologies refer to software and online platforms that adjust to individual students’ needs as they learn. According to a paper commissioned by the Bill and Melinda Gates Foundation, adaptive learning is a “sophisticated, data-driven, and in some cases, nonlinear approach to instruction and remediation, adjusting to a learner's interactions and demonstrated performance level, and subsequently anticipating what types of content and resources learners need at a specific point in time to make progress." In this sense, contemporary educational tools are now capable of learning the way people learn; enabled by machine learning technologies, they can adapt to each student’s progress and adjust content in real-time or provide customized exercises when they need it. In schools, many teachers envision these adaptive platforms as new, patient tutors that can provide personalized instruction on a large scale.

Information Visualization

Information visualization is the graphical representation of technical, often complex data that is designed to be understood quickly and easily by the layperson. Popularly called “infographics,” this type of media is highly valuable in the age of ubiquitous knowledge, and the people who create it are equally desired by organizations seeking to share messages that make an impact. A well-designed infographic can illuminate facts buried in the pages of a dense report or text, or explicate a detailed concept, such as an underground transit system, with clarity and simplicity. The modern age is embracing the power of design to engage and inform audiences through infographics, and social media is the vehicle to take them viral, making information more relevant and accessible on a global level. For teaching and learning, the study of infographics covers a number of valuable skills relating to data analysis, design thinking, and contextual, inquiry-based research, not to mention the technical capacities required to carry out ideas using creative software.

Learning Analytics

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 assess whether programs designed to improve retention have been effective and should be sustained — outcomes for legislators and administrators that have profound impact. For educators and researchers, learning analytics has been crucial to gaining insights about student interaction with online texts and courseware.
**Time-to-Adoption Horizon: Four to Five Years**

### Badges/Microcredit

Badges are seen as a way to grant certification for informal learning in the form of microcredits. 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.

### Drones

Drones are unmanned aerial vehicles that are controlled autonomously by computers or pilots with remote controls. They were innovated in the early 1900s for military personnel training and typically leveraged in operations that are too dangerous or time-consuming for humans. Still most commonly used for military purposes, drones have been deployed for a wide range of tasks, such as policing and community surveillance and security, filmmaking, and the surveying of agriculture and crops. In the past century, drone technology has advanced users’ abilities to extensively view objects and landscapes below, as well as to detect changes in environmental conditions. Features including biological and chemical sensors, electromagnetic spectrum sensors, and infrared cameras make these detailed observations possible.

### Visual Data Analysis

Visual data analysis blends highly advanced computational methods with sophisticated graphics engines to tap the extraordinary ability of humans to see patterns and structure in even the most complex visual presentations. Currently applied to massive, heterogeneous, and dynamic datasets, such as those generated in studies of astrophysical, fluidic, biological, and other complex processes, the techniques have become sophisticated enough to allow the interactive manipulation of variables in real time. Ultra high-resolution displays allow teams of researchers to zoom into interesting aspects of the renderings, or to navigate along compelling visual pathways, following their intuitions and even hunches to see where they may lead. New research is now beginning to apply these sorts of tools to the social sciences as well, and the techniques offer considerable promise in helping us understand complex social processes including learning and the diffusion of knowledge.

### Wearable Technology

Wearable technology refers to devices that can be worn by users, taking the form of an accessory such as jewelry, sunglasses, a backpack, or even actual items of clothing such as shoes or a jacket. The benefit of wearable technology is that it can conveniently integrate tools that track sleep, movement, and location. There are even new classes of devices that are seamlessly integrated with a user’s everyday life and movements. Smart watches, for example, are becoming commonplace, allowing users to check emails and perform other productive tasks through a tiny interface. A rapidly growing category of wearable technology takes advantage of the burgeoning interest in the “quantified self.” The Jawbone UP and Fitbit bracelets are two examples that track how you eat, sleep, and move.