



NMC/CoSN Horizon Report Preview

2017 K-12 Edition



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The NMC Horizon Report Preview series provides summaries of each of the upcoming edition's trends, challenges, and important developments in educational technology which were ranked most highly by each edition's expert panel.

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Long-Term Trends: Driving edtech adoption in K-12 education for five or more years

Advancing Cultures of Innovation

Schools have become regarded as a vehicle for driving innovation and entrepreneurship. The focus of this trend has shifted from understanding the value of fostering the exploration of new ideas to finding ways to replicate it across a span of diverse and unique learning institutions. Research has been conducted over the past year to better understand how schools can nurture the types of culture that promote experimentation. A significant element for progressing this movement is the call for K-12 education to alter its status quo to accept failure as an important part of the learning process. The act of integrating entrepreneurship into K-12 education further acknowledges that every big idea has to start somewhere, and students and educators can be equipped with the tools needed to spark real progress. In order to keep pace, schools must critically assess their curriculum and implement changes to their evaluation methods in order to remove barriers that limit the development of new ideas.

Deeper Learning Approaches

There is a growing emphasis in K-12 education on deeper learning approaches, defined by the William and Flora Hewlett Foundation as the mastery of content that engages students in critical thinking, problem-solving, collaboration, and self-directed learning. In order to remain motivated, students need to be able to grasp how new knowledge and skills will impact the world around them. Pedagogical approaches that shift the dynamic from passive to active learning allow students to develop ideas themselves from new information and take control of how they engage with a subject. These approaches include problem-based learning, project-based learning, challenge-based learning, and inquiry-based learning, which encourage creative problem-solving and actively implementing solutions. As the enabling role of technologies in learning crystalizes, educators are leveraging these tools to connect the curriculum with real-life applications.

Mid-Term Trends: Driving edtech adoption in K-12 education for the next three to five years

Growing Focus on Measuring Learning

This trend describes an interest in assessment and the wide variety of methods and tools that educators use to evaluate, measure, and document academic readiness, learning progress, skill acquisition, and other educational needs of students. As societal and economic factors redefine what skills are necessary in today's workforce, schools must rethink how to define, measure, and demonstrate subject mastery and soft skills such as creativity and collaboration. The proliferation of data mining software and developments in online education, mobile learning, and learning management systems are coalescing toward learning environments that leverage analytics and visualization software to portray learning data in a multidimensional and portable manner. In online and blended courses, data can reveal how student actions contribute to their progress and specific learning gains.

Redesigning Learning Spaces

As conventional teaching models evolve and emerging technologies gain a solid foothold in classrooms worldwide, formal learning environments require an upgrade to reflect the 21st century practices taking place in them. Education has traditionally relied on teacher-centric approaches where lectures were the main source for knowledge transference. Today, student-centric pedagogies are being embraced to better prepare learners for the future workforce, and new approaches to classroom design are supporting this shift. Additionally, innovative thinking in architecture and space planning is influencing the sustainable design and construction of new school infrastructures that have the potential to significantly impact classroom practices and student learning.

Short-Term Trends: Driving edtech adoption in K-12 education for the next one to two years

Coding as a Literacy

Coding refers to a set of rules that computers understand and can take the form of numerous languages, such as HTML, JavaScript, and PHP. Many educators perceive coding as a way to stimulate computational thinking: the skills required to learn coding combine deep computer science knowledge with creativity and problem-solving. Code.org recently projected that by 2020 there will be 1.4 million computing jobs but only 400,000 computer science students to fill them. To better prepare learners from a young age, an increasing number of school leaders and technologists are making the case for embedding coding into K-12 curricula. Schools worldwide are developing coding programs in which students collaboratively design websites, develop educational games and apps, and design solutions to challenges by modeling and prototyping new products. Additionally, the advent of user-friendly tools including Raspberry Pi, Scratch, and LegoNXT is making it easier than ever for students to begin learning to code.

Rise of STEAM Learning

In recent years, there has been a growing emphasis on developing stronger science, technology, engineering, and mathematics (STEM) curriculum and programs, as these disciplines are widely viewed as the means to boost innovation and bolster national economies. As a response to the focus on STEM learning at institutions, some education leaders believe there is the need for a more balanced curriculum that integrates disciplines such as the arts, design, and humanities into the sciences. This notion has fostered the STEAM learning movement, in which the A stands for “art+.” The company STEAM Education expands this definition to a fundamental philosophy that all disciplines can and should relate to each other to provide students with the big picture of how a wide variety of knowledge and skill sets tie into each other in the real world. In other words, technology use does not exclusively relate to advancing science and engineering; STEAM education is about engaging students in a multi and interdisciplinary learning context that values the humanities and artistic activities, while breaking down barriers that have traditionally existed between different classes and subjects.

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

Authentic Learning Opportunities

Authentic learning experiences, those that bring students in touch with real-world problems and work situations, are still not pervasive in schools. The term authentic learning is seen as an umbrella for several important pedagogical strategies that have great potential to immerse learners in environments where they can gain lifelong learning skills; these approaches include vocational training, apprenticeships, and certain scientific inquiries. Advocates of authentic learning underscore the importance of metacognitive reflection and self-awareness as cornerstones. An increasing number of schools have begun bridging the gap between academic knowledge and concrete applications by establishing relationships with the broader community; through active partnerships with local organizations, learners can experience the future that awaits them outside of school.

Improving Digital Literacy

The productive and innovative use of technology encompasses 21st century practices that are vital for success in the workplace and beyond. Digital literacy transcends gaining isolated technological skills to generating a deeper understanding of the digital environment, enabling intuitive adaptation to new contexts and co-creation of content with others. Schools are charged with developing students' digital citizenship, ensuring mastery of responsible and appropriate technology use, including online communication etiquette and digital rights and responsibilities in blended and online learning settings and beyond. This category of competence is affecting curriculum design, professional development, and student-facing services and resources. Due to the multitude of elements comprising digital literacy, school leaders are challenged to obtain institution-wide buy-in and to support all stakeholders in developing these competencies. Frameworks are helping schools assess current staff capabilities, identify growth areas, and develop strategies to implement digital literacy practices.

Difficult Challenges: Those we understand but for which solutions are elusive

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. In the technology-enabled classroom, teachers' primary responsibilities are shifting from providing expert-level knowledge to constructing learning environments that help students gain 21st century skills including creative inquiry and digital literacy. Educators are now acting as guides and mentors, modeling responsible global citizenship and motivating students to adopt lifelong learning habits by providing opportunities for students to direct their own learning trajectories. These evolving expectations are changing the ways teachers engage in their own continuing professional development, much of which involves social media, collaboration with other educators both inside and outside their schools, and online tools and resources. Pre-service teacher training programs are also challenged to equip educators with digital competencies amid other professional requirements to ensure classroom readiness.

Teaching Complex Thinking

It is essential for learners both to understand the networked world in which they are growing up and also — through complex thinking — to learn how to use abstraction and decomposition when tackling complex tasks and to deploy heuristic reasoning to complex problems. 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. While some aspects of this topic could be framed as similar to or overlapping “design thinking,” for the purposes of this report the two are considered as distinct concepts. The term “complex thinking” refers to the ability to understand complexity, a skill that is needed to comprehend how systems work in order to solve problems, and can be used interchangeably with “computational thinking.” Teaching coding is increasingly being viewed as a way to instill this kind of thinking in students as it combines deep computer science knowledge with creativity and problem-solving.

Wicked Challenges: Those that are complex to even define, much less address

The Achievement Gap

The achievement gap refers to an observed disparity in academic performance between student groups, especially as defined by socioeconomic status, race, ethnicity, or gender. Environmental factors such as peer pressure, student tracking, negative stereotyping, and test bias are exacerbating this challenge. Schools use various success standards to define learning expectations, including grades, standardized test scores, and completion rates, leading to comparison of student performance at the individual and group level. Adaptive and personalized learning technologies are beginning to play a more integral role in identifying lower performing students and student populations, helping educators and leaders understand contributing factors, and enabling and scaling targeted intervention methods and engagement strategies that help close the gap. Global concerted action will be necessary, however, to address ongoing obstacles to education for children in countries experiencing civil unrest, as well as cultural barriers depriving females' access to school.

Sustaining Innovation through Leadership Changes

Sustainability for long-term success is a vital consideration when developing a new program, especially as external factors such as funding and leadership are prone to change. However, the process for preparing for the unknown is not always well-defined, nor is it currently the norm in schools. Planning for and implementing innovative approaches to improve student success in schools requires dedication from leadership, faculty, and staff. Unfortunately, leadership vacancies or transitions can result in project delays or hinder the development and growth of programs to effectively meet student needs. Turnover in key district or school positions can also render promising initiatives without a driver, especially if a clear innovation strategy is not implemented to propel sustainable change and other participants do not feel a sense of ownership over the program. Districts and schools must identify successful strategies for making continued progress on promising innovations in the face of transitioning governance.

Time-to-Adoption Horizon: One Year or Less

Makerspaces

The turn of the 21st century has signaled a shift in what types of skillsets have real, applicable value in a rapidly advancing world. 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 students carry out their ideas. The driving force behind makerspaces is rooted in the maker movement, a following comprised of artists, tech enthusiasts, engineers, builders, tinkerers, and anyone else with a passion for making things. Makerspaces are intended to appeal to students of all ages, and are founded on openness to experiment, iterate, and create. 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 students. Proponents of makerspaces for education highlight the benefit of engaging learners in creative, higher-order problem-solving through hands-on design, construction, and iteration.

Robotics

Robotics refers to the design and application of robots, which are automated machines that accomplish a range of tasks. The first robots were integrated into factory assembly lines in order to streamline and increase the productivity of manufacturing, most notably for cars. Today, the integration of robots into mining, the military, and transportation has improved operations for industries by taking over tasks that are unsafe or tedious for humans. It is expected that the global robot population will double to four million by 2020, a shift that is expected to shape business models and economies all over the world. There is a substantial debate on how workers will continue to be affected by the global economy's growing dependence on robots, especially now that robots are more autonomous, safer, and cheaper than ever. Robotics programs are focusing on outreach efforts that promote robotics and programming as multi-disciplinary STEM learning that can make students better problem solvers for the 21st century. It is also clear that some students with spectrum disorders are more comfortable working with robots to develop better social, verbal, and non-verbal skills.

Time-to-Adoption Horizon: Two to Three Years

Analytics Technologies

Today, almost any interaction made over the internet or through the consumption of goods and services is being tracked, stored, and used in targeted ways. This has led to the notion of big data -- massive amounts of data that reflect the behavior and actions of various populations. Data scientists and data collection platforms are now able to computationally organize petabytes and exabytes of data so that it is easy to analyze and identify patterns that may have otherwise gone undetected. With the complexity surrounding such large, diverse sets of data, displaying the information is crucial to its success. Information visualization uses infographics, the graphical representation of technical data designed to be quickly and easily understood. In education, data mining is already underway to target at-risk students, personalize learning, and create flexible pathways to success. As schools become more adept at working with and interpreting big data, they can make more informed decisions that reflect real learner needs. However, at the same time there is a need for better tools and to explore the potential of collecting and analyzing data more deeply. Understanding how to use new data tools and enabling analytic skills, including data literacy, computational thinking, and coding are essential for both faculty and students to advance the understanding and use of big data.

Virtual Reality

Virtual reality (VR) refers to computer-generated environments that simulate the physical presence of people and/or objects and realistic sensory experiences. At a basic level, this technology takes the form of 3D images that users interact with and manipulate via mouse and keyboard. Contemporary applications allow users to more authentically “feel” the objects in these displays through gesture-based and haptic devices, which provide tactile information through force feedback. While VR has compelling implications for learning, to date, it has been most prominently used for military training. Thanks to advents in graphics hardware, CAD software, and 3D displays, VR is becoming more mainstream, especially in video games. Today, head-mounted displays make game environments and actions more lifelike. As both games and natural user interfaces are finding applications in classrooms, VR can make learning simulations more authentic.

Time-to-Adoption Horizon: Four to Five Years

Artificial Intelligence

In the field of artificial intelligence (AI), computer science is being leveraged to create intelligent machines that more closely resemble humans in their functions. The knowledge engineering that allows computers to simulate human perception, learning, and decision-making is based on access to categories, properties, and relationships between various information sets. Neural networks, a significant area of AI research, is currently proving to be valuable for more natural user interfaces through voice recognition and natural language processing, allowing humans to interact with machines similarly to how they interact with each other. By design, neural networks model the biological function of animal brains to interpret and react to specific inputs such as words and tone of voice. As the underlying technologies continue to develop, AI has the potential to enhance online learning, adaptive learning software, and simulations in ways that more intuitively respond to and engage with students.

Internet of Things

The Internet of Things (IoT) consists of objects endowed with computing power through processors or imbedded sensors that are capable of transmitting information across networks. These connections allow remote management, status monitoring, tracking, and alerts. Municipal governments and schools are applying the capabilities of IoT, leveraging data to streamline processes and promote sustainability. Connected devices are generating data on student learning and activity, informing the direction of content delivery and school planning. As more smart devices arrive on school grounds, schools are examining implications for privacy and security. The IoT has potential to help schools cut costs, more efficiently use student data, and provide students with tools to create novel solutions to real-world problems.