

The next-generation digital learning environment and a framework for change

for education institutions

Framework and roadmap to digitally transform learning environments for greater student success and campus services cost-effectiveness

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“To realize success, educational organizations must address how they teach and what they teach to better engage students, create a great learning experience, and drive innovation for the future.”

Santos and Patton

Evolution of digital learning environments

Education institutions, like all service organizations in the digital information era, must seek every means to enhance quality of service delivery and drive efficiency and cost-savings. In other words, the journey for the digital transformation in education should lead to a broader vision that enables constant innovation and enhancement of teaching and learning; it must also improve the operational efficiencies of administrative and management services for students, educators, and the community.

Our observations of forward-thinking education institutions show that the right integration of pedagogy and technology with the strategic vision of the school or university is essential for the return on investment and continued success of digital initiatives. This type of approach can help the institution ensure all digital learning environments—both physical and virtual—can meet the changing needs of education, the labor market, and citizenship in the 21st century.

Historically, education institutions adopted digital technology to realize improvements in the efficiency of school administrative processes such as scheduling classes, managing budgets, tracking students, reducing operational costs of energy in buildings, enhancing safety and security, and providing information tools for staff, academics, students and researchers.

Forward-thinking educational institutions are now seeing the power of technology to transform the learning environment, merging the physical with the virtual, and realizing better student outcomes. These institutions understand the current change dynamics and are moving rapidly to innovate and transform their business models, acknowledging the evolving role of faculty, understanding the requirements of the students of the future, and examining their educational delivery methodologies.

Those leaders who are still of the mind that only modest incremental shifts are necessary could miss the next generation of teaching and learning.

To better understand the process of evolution and the adoption of digital technologies for pedagogical purposes, we can look back in time and point out important technology milestones that have transformed learning environments, and see how this evolution has positively influenced student success:

The latest shift in the adoption of digital technologies for pedagogical purposes has enabled next-generation learning environments—both physical and virtual—with better connections, easier communication paths, and more robust collaboration capabilities.

- In the 1980s, digital technologies were primarily used to support access to remote databases and computer programs. These technologies helped learners achieve specific learning goals, but were limited to only a few students, faculty members, and researchers.
- In the 1990s and early 2000s with the rapid growth of the Internet, the potential for collaborative learning networks grew exponentially, generating new ways to access to information, academic digital resource sharing, web-based discussion, idea sharing, and collaboration. However, all this potential innovation was limited to course web pages with hyperlinked resources.
- Relevant changes to teaching and learning began after the second decade of the new millennium. This was thanks to the growing availability of broadband infrastructure and the massive adoption of mobile devices like smartphones connected to the Internet. What some call the “consumerization of technology” triggered the ubiquity of personal computing for every learner and teacher.

Very simply put, this latest shift has enabled next-generation learning environments—both physical and virtual—with better connections, easier communication paths, and more robust collaboration capabilities.

The adoption of these new capabilities, and their subsequent integration into pedagogical projects, has generated benefits such as:

- Ubiquitous connectivity and collaboration among students and teachers enables people to share ideas, discuss the latest developments in their areas of study, and develop increasingly connected communities of practice.
- Faculty and mentors in a specific field can teach classes—from anywhere in the world—and share information anytime, anywhere, and on any device.

Education as an industry is poised for a monumental shift that will leave some wondering what happened to the traditional school and college campus. The potential for disruption in this community is high as new technologies, as well as a new generation of students, come onto the scene.

- Teachers can now be more innovative, accelerating the implementation of modern learning methods such as the flipped classroom, project-based learning (PBL), and personalized learning.
- For governments, borderless access to information ensures that people have more learning opportunities that meet their needs. They can also deliver education more efficiently with resources for digital curriculum and information databases, digital libraries, academic software, gaming, and a variety of knowledge sources.

While these resources can transform teaching and learning, they represent only a modest return on investment due to the very slow and gradual adoption of technology to change teaching methodologies. As a result, we still see that most school, college, and university classes are taught largely the way they were before the computer age.

The potential impacts of the digital disruption wave in education

It should now be clear that education as an industry is poised to go through a monumental shift that will leave some wondering what happened to the traditional school and college campus. The potential for disruption in this community is high as new technologies, as well as a new generation of students, come onto the scene.

Some of the impacts of digital disruption in education are seen through student demand for changes in traditional processes of teaching and learning, such as:

- Do students really need to attend lectures in person?
- Should mobile devices really be banned in class?
- Why aren't video-recorded lectures and other course materials readily available to help students learn more effectively and reach those who may not be able to attend class?

It is not a secret that our young learners, the millennial generation, are constantly connected—except when in class. For this generation, class time might be the only time in their day when they completely “disconnect.” This reality is critically important when considering the mismatch between potential employer expectations and the ways schools, colleges, and universities are preparing students for the future workforce, a disconnect that has been well documented in the press and in academic studies.

Other questions show the level of vulnerability that the education industry faces with the digital disruption wave, such as:

- How can traditional modes of classroom instruction engage and inspire students when life outside the classroom has changed so dramatically?
- What happens when students stop coming to class?
- What does it mean when students are not receiving an education that prepares them effectively for a job market that is changing so rapidly?

The risk and potential deleterious effects of disruption should be clear. Most schools, colleges, and universities have still not completed a transformation of their physical learning environments. Classrooms, libraries, study spaces, auditoriums, cafeterias, and campuses overall are still largely based on dated, traditional models. Not only are virtual teaching and learning nonexistent, but also many schools and campuses are far from conceptualizing and merging the physical with the virtual.

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Business leaders complain that schools, colleges, and universities are not producing adequately prepared job applicants; studies show a delta between the capabilities recent graduates believe they bring to the workforce and the capabilities employers find in their applicants.

As with other segments of the economy, education industry disruption is driven by a convergence of forces: the availability of digital technologies, the capabilities of these technologies, the changing demands of customers—in this case, students—and the rapidly evolving practices of competitors. In education, these competitors might be emerging online learning providers or colleges and universities expanding their reach and footprint outside of their home countries, e.g., U.S. schools offering degrees to students in Latin America or China.

The digital transformation of learning environments should be viewed as one component of the institution's larger strategy and vision. Importantly, technology must be used to transform instructional pedagogy and transcend traditional learning environments.

Digital disruption in the industry will force schools, colleges, and universities to transform their learning environments, both physical and virtual, as part of the way courses and classes are taught. This change is required to meet the expectations and needs of the student, citizen, and employer of this millennium.

To survive and realize success in the future, forward-thinking schools, colleges, and universities need to find new and innovative ways to attract and retain students and faculty, differentiate themselves from their peers, and effectively demonstrate the value of a degree from their institution, while simultaneously evolving the institution's business model.

Key challenges observed in most traditional learning environments

Educators and administrators share a common crisis in the delivery of learning. They suffer many of the same challenges, such as:

- Access to quality educational experiences
- The need to evolve outdated teaching methodologies
- The imperative to prepare students to become part of the workforce of the future
- Skyrocketing operational costs
- The need to keep tuition rates down
- A generation of students who are increasingly tuning-out and turning-off from the traditional approach of age-old instructional methods

The digital transformation of learning environments should not be seen only as adding new technologies, or as allocating resources in the maintenance of the traditional learning environment. The digital transformation of learning environments should be viewed as one component of the institution's larger strategy and vision. Importantly, technology must be used to transform instructional pedagogy and transcend traditional learning environments.

Higher education CIOs and leaders now have “dual responsibilities of keeping the lights on, as well as innovating for a new world. The CIO has to relentlessly identify and pursue the efficiencies and advantages that new technology offers to the existing business model... however, at the same time, the CIO needs to think what nobody yet has thought about that which everybody sees” in order to stay competitive.

The role of technology in the digital transformation of education

Technology plays a key role not only in enabling new ways of teaching and learning, but also in new business models required to drive the very transformation that educational institutions are trying to effect.

Technology can support new learning approaches that engage learners, driving new revenue streams, decreasing operational costs, and preserving and expanding highly valued school and university brands.

Today, CIOs, IT professionals, and the technology they support and deliver can no longer be left alone in a silo. They are literally the lifeblood of a successful university or school. According to industry analysts, higher education CIOs and leaders now have “dual responsibilities of keeping the lights on, as well as innovating for a new world. The CIO has to relentlessly identify and pursue the efficiencies and advantages that new technology offers to the existing business model...however, at the same time, the CIO needs to think what nobody yet has thought about that which everybody sees” in order to stay competitive.

Expected benefits from a digitally transformed learning environment

The positive impact of digitally transformed learning environments will not come by simply arranging and presenting content in virtualized or even in more personalized ways. Rather, it will come through the synergistic combination of benefits for different stakeholders: leadership, teachers, staff, and necessarily, students and the community.

Digitally transformed learning environments—properly designed and implemented according to strong pedagogical practices—can indeed function as a set of tools and processes that augment human learning and intellectual capability.

For students:

Students will benefit from the “on-line component” of collaborative and socially networked learning, and they will be able to choose and build an approach based on how they best learn, through a smart curriculum path that is more relevant to their personal context and areas of interest. Students will be more actively engaged, have a better learning experience, be better prepared for the careers of the future, and find new, innovative ways to solve problems.

From helping to define a vision, identifying gaps to providing a unifying technology architectural design—and a comprehensive set of solutions that address these gaps—the framework for digital transformation in education will help education institutions transform four major dimensions: teaching and learning, administration and management, safety and security, and research and knowledge.

For teachers:

Teachers will be able to innovate their teaching methods—and make their classes more interesting, engaging, and effective. Whether working with a single student or large numbers of students face-to-face or on-line, they will be able to make timely, targeted interventions and provide personalized feedback to individuals along the way.

For the curriculum:

The curriculum will be more interesting and relevant. New advances in technology make it possible to use digitally based personalized learning programs that are aligned with articulated goals and competencies required to meet the needs of students with different learning styles, regionally based requirements, and socio-economic realities.

Learner progress toward these goals will be dynamically supported through learning analytics, individual progress reports, rich interaction, and personalized learning paths.

For the institution:

The adoption of new learning technology will enable innovative solutions that promise to improve learning processes while enhancing the cost effectiveness of campus services.

Integrated information systems based on a connected and secure environment will help leaders identify and manage key “impact areas” that they would like to prioritize for focus and investment, and to determine the type of experience they would like to deliver across all constituents: faculty, administrative leaders, students, and staff.

Proposed framework for digital transformation in education

While there are many paths education institutions can take to transform, there are some key design principles that are critical for all leaders to consider as they look to build a more effective plan and ensure successful implementation through the major market transitions they are experiencing.

From helping to define a vision, identifying gaps to providing a unifying technology architectural design—and a comprehensive set of solutions that address these gaps—this framework will help education institutions transform four major dimensions: teaching and learning, administration and management, safety and security, and research and knowledge.

A strong vision will help all stakeholders align around a key theme, in this case, the transformation of traditional and physical learning to robust, engaging, virtual learning environments, where the physical and virtual converge for maximum benefit of students, faculty, staff, and the community.



We have found, in fact, that this framework increases the likelihood of success for major change initiatives, as it consolidates most of the best practices of forward-thinking education institutions from around the world.

Vision and leadership

The starting point is the digital vision building process, to establish a strategy for the future of the institution and a clear understanding of the direction to take, in terms of digital initiatives.

The digital vision should articulate the institution's future state: What are the most important and relevant areas of focus? What type of experience would you like to deliver for students, faculty, and staff, both on and off campus?

A strong vision will help all stakeholders align around a key theme, in this case, the transformation of traditional and physical learning to robust, engaging, virtual learning environments, where the physical and virtual converge for maximum benefit of students, faculty, staff, and the community.

Secondly, leadership, financial engineering and accountability are essential components of digital transformation success.

After the vision is set, the work to deliver on the vision begins, and the tracking of results and returns on investment starts.

The assigned leader or champion will work to firmly establish the vision created by the broader team and set it into motion. He or she will help to propagate understanding of the need to change across multiple departments,

A champion works to establish the vision created by the broader team and sets it into motion, instilling an understanding of the need to change across multiple departments, breaking down silos, and identifying other like-minded team members. A champion drives the initiative until it is complete.

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Finally, involving the right people in the visioning process is highly important; many of these individuals will naturally become standing members of task forces that implement the strategy and plan. A collaborative effort among senior management, educators, and IT experts is essential to build an adequate plan and begin implementation.

We recommend these stakeholders are involved in the vision-building process:

Decision and Opinion Makers:

- The school leader, university president, and provost who normally have a clear vision of the future (although this vision may not include a fully technology-enabled environment)
- CIO and IT personnel who can provide insights into what is possible and provide information on the state of the current technical environment
- CFOs and chief business officers who will help identify the resources for the change and assist with business case development
- Department chairs, vice-provosts, and chancellors of academic and student services

Influencers:

- Educators who are using technology today and educators who would like to use technology but have not made the jump
- Facilities managers and safety and security officers who can help identify opportunities for technologies

It is important to note the critical nature of teaching the teachers; the development of front-line capabilities must be pervasive, extending far beyond a single ICT training course. Many teachers are intimidated by new approaches and may be unconvinced of their value, but the frequent use of technology tends to help them overcome these hurdles and become passionate advocates.

- Key technology partners who can share future trends, current technologies, and ways to leverage technology investments across the operation
- Current students who are living in the existing environment
- Alums who have an interest in helping their school or university survive and thrive into the future

Culture

To ensure the successful implementation of digital transformation initiatives and the adoption of next-generation learning environments by educators, staff, and students, a deep and informed approach to digital culture must be at the heart of the institution.

The starting point should be the creation and development of a culture where educators, faculty, and staff use technology tools on a day-to-day basis to gain the real benefits of collaboration-enabled processes and to role model the use of these technologies for their peers.

Regular and persistent use of technology by educators and staff is the best way to create and propagate a digital culture, and thus, to create a new digital learning environment.

Changing culture is not easy. It requires that senior leaders and managers be linked to programs for digital skills development and significant cultural and process change.

The adoption of a digital culture by educators and institutional administrators will eventually encourage all stakeholders to work in teams to solve problems, deepen their understanding of various concepts, and increase their knowledge. This experience, once integrated into pedagogical practices, will generate the skills employers seek in new graduates, such as subject-area expertise, creativity, strong communication abilities, interdisciplinary thinking, and team-based problem solving.

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New social collaboration spaces make it easier for educators and students to connect before, during, and after traditional or virtual classes. These spaces create persistent learning environments, with ongoing interaction that helps the educator serve as coach and mentor to students, and that enables students to help one another.

Process and methodology

The process of transforming learning environments should focus on creating the right capabilities for educators to adopt effective teaching methodologies and innovation that put the learner at the heart of learning process—whether engagement is face-to-face, at a distance, or through blended learning modes. These include collaborative knowledge and learning methodologies that foster innovative approaches to empower learners to develop key competences and succeed in the 21st century: flipped learning, adaptive learning, project-based learning, and personalized learning, just to mention a few. New technology makes it possible to create environments where students get what they need, when they need it.

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This is why the process of defining how transformed learning spaces will look must consider the teaching methods that will provide the types of experiences we want to deliver to educators, staff, and students:

- For students to take classes anywhere, anytime, on any device
- To deliver a range of learning models, including online, hybrid, and flipped learning
- To connect with outside experts and bring them into courses as lecturers or guest educators
- To work with other schools and universities in the area, state, or nation to share courses, content, and educators, thus increasing the number of courses offered and the number of students served
- For faculty, staff, and students to connect seamlessly to the network
- To ensure a safe, secure, and reliable network
- To help ensure student safety across the campus

Technology plays a key role not only in enabling new ways of learning, but also in establishing new business models required to drive the very transformation that education institutions are trying to effect.

- To easily obtain cost-effective storage, compute, and processing resources for researchers
- For educators, staff, and students to connect and collaborate, regardless of location

Technology

Technology plays a key role not only in enabling new ways of learning but also in establishing new business models required to drive the very transformation that education institutions are trying to effect.

Today's students demand always-on access to the network, resources, and information needed to realize success.

- They expect speed in their wireless access and a simple and seamless online interface to their courses, academic and administrative information, and student services.
- They want access to information when they need it and where they can most easily find it.
- They want to attend classes anytime, anywhere. They don't necessarily want to physically attend every class.
- They want a persistent social environment that is easy to find and that creates a continual learning environment, before, during, and after class.

Some of the key success factors of a digital education platform rely on the core network infrastructure: wired and wireless connectivity and the underlying cybersecurity solutions that enable what is essentially the heartbeat of an institution.

Everything that follows is dependent on a strong, reliable core network that ensures:

A digital education platform is dependent on four key elements: ubiquitous campus connectivity through the network, comprehensive cybersecurity, virtualization of the digital campus, and collaboration and personalization for distance and blended learning.

- **The network: ubiquitous campus connectivity**
- **Cybersecurity**
- **Virtualization of the digital campus**
- **Collaboration and personalization for distance and blended learning**

Each of these layers of technology delivers specific roles and benefits to ensure the success of a digital transformation roadmap implementation.

The network: ubiquitous campus connectivity

The infrastructure must be stable, scalable, reliable, and capable of handling an increased rate of traffic from the explosion of mobile devices, the use of video, and the implementation of new applications for communications and collaboration.

The network represents the confluence of multiple technology trends:

- Mobility (ubiquitous, high-speed mobile networks, smart devices, and apps)
- Cloud computing, social networks, instant collaboration with anyone, anywhere
- Data analytics
- An explosion in connected “things,” including mobile devices, sensors, and cameras

Additionally, the network must be safe, secure, wired, and wireless, easy to manage and administer, and designed to meet future growth requirements for the connection of people, processes, data, and things.

Cybersecurity

Cybersecurity has become an enormous issue across all markets—but particularly in education. The education sector is among the top three most vulnerable targets for cyberattacks.

Schools, colleges, and universities are among the top three most vulnerable targets for cyberattacks. The expected academic culture of open access to knowledge and information for better research innovation and learning has created a unique and growing challenge, not only for IT but also for senior management who are both charged with protecting confidential and sensitive information against threats and attacks over the Internet.

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Best practices from education institutions highly recommend a strategic and holistic cybersecurity plan that combines a robust technology architecture, people awareness and training, and security policies and data management processes.

An effective cybersecurity architecture should make information available—yet segmented and secure—with the owner of the information deciding which people, groups, or organizations should have access to it based on user profiles.

Virtualization of the digital campus

An intelligent digital campus allows for the connection of people, data, and things. It incorporates a wide range of applications operating over the platform to support the business of the school, college, or university; enables “outdoor” teaching and learning activities; and delivers a good student experience, such as:

- Student services
- Campus Wi-Fi
- Smart buildings
- Smart parking
- Smart lighting
- Smart transportation
- Admissions and recruiting
- Campus security systems

Collaboration is already the tool of today's learners and employers, and should logically become the tool of today's teachers, schools, and the education systems as a whole.

Within the campus, enabling location-independent work is a top priority in creating a next-generation learning environment. Having a virtualized IT infrastructure can accelerate productivity of expensive and often scarce IT resources; generating benefits such as:

- Better financial efficiency and business agility for dynamic allocation of ICT resources.
- Maximize return on assets and investments in IT resources (e.g., HPC, storage, applications, etc.)
- Reduce under-utilization of expensive IT resources among different faculty and research departments
- Reduce total cost of ownership (TCO) of maintaining data center (DC) infrastructure (e.g., energy, IT management, etc.)

Virtualizing IT infrastructure with such capabilities increases business agility and financial efficiencies of on-line administrative services to educators, staff, students, and the community.

Collaboration and personalization

Collaboration is already the tool of today's learners and employers, and should logically become the tool of today's teachers, schools, and the education systems as a whole.

Educators and students can adopt connected and collaborative technologies to support online and blended learning. For example, connecting peers and bringing experts, who are physically distant from the students, virtually into the classroom will provide students with a unique, value-added learning experience. Connected and collaborative environments (physical and virtual) allow students, educators, and staff to use video and virtual interactive spaces for cost-effective on-line distance and blended learning.

Technology can help to break down the walls that have traditionally existed in education to make collaboration easier and more ubiquitous. The ability to hold online meetings, deliver collaborative workspaces, and utilize video across the campus helps people to connect and enables more frequent sharing of best practices, course design approaches, and access to outside expertise. Not having to travel across campus makes it easier for leaders

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These new collaboration technologies make it easier for students to engage on their own terms, and receive the personalized attention they need to be more successful in school or university. In support of that, new data analytics programs make it possible for educators to have a better understanding of where students are in the learning process, and then provide customized assistance for the student. This should also help institutions develop both online and campus-based programs to provide a more individualized approach to teaching, and feedback on instruction, methodology, the process of delivering courses, and best practices for incorporating technology into learning.

To make a real difference, technology must be deployed thoughtfully by IT leaders who understand the pedagogical goals of their faculty members, cooperating with and receiving professional guidance from education experts who can help them apply new technologies to learning.

Conclusions

The journey toward the digital transformation in education is dependent on a broader vision and a structured framework for implementation of selected priorities to enhance the quality and innovation in teaching, learning, and research while improving operational efficiency of administration and management.

The effective adoption of new digital technologies and approaches will make education more relevant, engaging and motivating for learners, enabling faster time to mastery.

However, educators must implement these new technologies in a way that transforms learning environments, creating more virtual opportunities for students, and merging the physical with the virtual.

We believe that technology can make a real difference, but it must be deployed thoughtfully by IT leaders who understand the pedagogical goals of their faculty members, cooperating with and receiving professional guidance from education experts who can help them apply new technologies to learning.

To realize the full benefits of digital technologies for education, a secure and reliable connected network and failsafe collaboration tools must be guaranteed.

Digital transformation is not a matter of technology only: it must be supported by a combination of vision and leadership, culture, and process and methodology, in addition to the technology itself.

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