1 New Models of Education

In a 1915 book titled *Schools of Tomorrow,* the educator John Dewey complained that the conventional public school "is arranged to make things easy for the teacher who wishes quick and tangible results."[1] Rather than fostering personal growth, he argued, "the ordinary school impresse[s] the little one into a narrow area, into a melancholy silence, into a forced attitude of mind and body."[2]

In criticizing the academies of his day, Dewey made the case that education needed to adopt new instructional approaches based on future societal needs. He argued that twentieth-century schools should reorganize their curricula, emphasize freedom and individuality, and respond to changing employment requirements. In one of his most widely quoted commentaries, Dewey warned that "if we teach today's students as we taught yesterday's, we rob them of tomorrow."[3]

Writing nearly a century ago, Dewey could not have envisioned the current world of the Internet, electronic resources, digital textbooks, interactive games, social media, and robotics. Yet his basic message remains highly relevant today. If schools do not reinvent themselves to engage students and train them for needed areas, it will be difficult to compete in the global economy.

Imagine an educational system in which pupils master vital skills and critical thinking in a collaborative manner, social media and digital libraries connect learners to a wide range of informational resources, student and teacher assessment is embedded in the curriculum, and

parents and policymakers have comparative data on school performance. Teachers take on the role of coaches, students learn at their own pace through real-life projects, software programs track student progress, and schools are judged by the outcomes they produce.[4] Rather than being limited to six hours a day for half the year, this kind of education moves toward 24/7 engagement and full-time learning.[5]

Pilot projects from across the country and around the globe are experimenting with different organizations and delivery systems, thereby transforming the manner in which formal education takes place. In this book, I examine new models of instruction made possible by digital technologies. In particular, I look at personalized learning, blogs and wikis, mobile technology, video games, augmented reality, and real-time assessment in K–12 and higher education. Emerging approaches to education make it possible to envision a system where the barriers between high school and college are broken down and students can take courses that fit their needs and interests.

My goal is to identify leading innovations in education and find what works and what does not in order to draw lessons about long-term effectiveness. Digital technology enables fundamental shifts in instructional methods, content, and assessment. However, technology by itself will not remake education. Meaningful change will require alterations in technology, organizational structure, instructional approach, and educational assessment.[6] If we combine innovations in technology, organization, operations, and culture, we can overcome current barriers, produce better results, and reimagine the way schools function.

Disrupting Education

The revolution in information and communications technology has transformed numerous industries over the past few decades. Virtual devices such as automated teller machines, grocery scanners, and airport check-in kiosks have reduced costs, facilitated shifts in organizational models, and enabled the delivery of innovative services and products. Industries from food, banking, and airlines to manufacturing and entertainment have embraced digital technologies and deployed them to automate routine tasks, flatten organizations, and dramatically improve efficiency and effectiveness.

Many of these improvements were made possible by the invention of the transistor in the 1950s. The transistor created unimaginable economies of scale for mechanical devices and paved the way for microchips and computerized systems. As noted by Harvard Business School professor Clayton Christensen, most earlier machines and transmitters were based on vacuum tubes.[7] Large mechanisms transmitted electrical signals and powered small devices such as radios and televisions.

However, transistors changed the entire industry. By making possible small and inexpensive electrical transmission mechanisms, silicon-based semiconductors revolutionized manufacturing and ushered in integrated circuitry. Powerful appliances and machines were developed in miniaturized form that reduced financial costs while increasing the power and sophistication of processing devices. Electronics went from large and bulky devices to pocket-sized transistor radios, and computers shrank from room-sized machines to desktop computers, laptops, tablets, and handheld devices.[8]

In industries that are lightly regulated by the government and subject to market feedback, it is possible for pathbreaking inventions such as transistors or hydraulic systems to transform key sectors. Discoveries typically start at the low-cost end of the industry; as specific benefits are demonstrated, they migrate up the value chain and produce transformation in a short period of time. Seeing the virtues of new creations, business leaders alter their business operations to bring low-cost products into the marketplace.

But when the field is highly regulated and there are weak market mechanisms to guide innovation, industry disruption is more challenging. Powerful business and labor interests can use government bodies to delay change and create barriers to experimentation and adoption. The weakness of market signals to parents, producers, and policymakers makes it difficult to assess costs and benefits and leads to misperceptions of risks as well as virtues.

In this situation, people hang on to old ways of doing things because the benefits of inventions are not clearly apparent. Rather than embracing transformation and using technology to further innovation, organized interests fight change and argue that the old system is superior to newly emerging ones. That type of status quo orientation slows change and raises the political and economic costs of innovation.

This dynamic is the central problem limiting changes in education today. The field is regulated and lacks market mechanisms such as consumer information, price points, transparency, and clear assessment mechanisms. Defenders of the status quo fight change, and the lack of commonly accepted metrics makes it difficult to judge the effectiveness of proposed reforms. Uncertainty over costs and benefits limits the potential for meaningful change in public schools. Joanne Weiss, the U.S. Department of Education's chief of staff, notes that "the biggest challenge for us is that education has been a place that is wildly resistant to innovation. . . . It was designed very much to resist the status quo so that crazy fads wouldn't use kids as guinea pigs. And the problem with that is now when we desperately are in need of innovation, we have built a system that is really, really good at repelling it."[9]

Some areas such as K–12 charter schools are more open to experimentation. They perceive students as customers, adopt new learning models, allow greater flexibility in student and teacher roles, and are less regulated by the government. These qualities enable them to see what works and where they need to make adjustments so as to maximize the positive impact on students. Over 5,000 charter schools have been established in the United States, 180 of which are cyberschools featuring virtual learning environments.[10]

Some colleges and universities also value new approaches to instruction. They are self-governed through independent boards, and they face a competitive marketplace in recruiting faculty and students. Market pressures force them to respond to student needs and open them to new pedagogic approaches and delivery systems. Innovations in one institution diffuse to others as their utility becomes apparent.[11]

But this is not the case for all education institutions.[12] In public K–12 schools, there is resistance to change that various interests see as threatening. Jay Greene, an education researcher, argues that "the biggest obstacle [to change] is the teachers union and their political allies. They would be hurt by expanded choice and competition because it would put pressure on them to improve quality and it would shrink resources available to them for their own benefit."[13]

In their book *Liberating Learning,* Terry Moe and John Chubb describe unions' opposition to the introduction of technology. Labor

leaders worry that this type of innovation will undermine learning and endanger the traditional role of the instructor in the classroom.[14] Through campaign contributions and influence over legislatures in some states, the authors claim, unions have blocked policy changes that would facilitate the adoption of education innovations.

However, others dispute that interpretation and argue that the problems are more systemic and include factors such as poverty and inequitable access to educational resources. Randi Weingarten, the president of the American Federation of Teachers, says, "States with the most densely unionized teachers—Massachusetts, New York, Maryland—do the best. And the countries with the most densely unionized populations—Finland and Japan—they do the best. . . . There are problems we have to solve, one of which is poverty. We have to compete with poverty, that's what public education is."[15]

Barriers to Reform

In a sense, all these criticisms are right. There are many barriers that constrain change in basic learning models and organizational design. According to Paul Peterson, education institutions retain an old-fashioned instructional structure, organizational approach, and daily schedule based either on an agrarian or industrial society, not a postindustrial one.[16] Similar to an agricultural order, the school day takes place between 8:30 a.m. and 3 p.m. from fall to spring, with time off during the summer. Class sessions are demarcated by bells, as in industrial factories. Educators do not tailor teaching to the differential learning approaches of individual students or take advantage of digital systems for accessing or transmitting knowledge.

This is problematic, according to Cathy Davidson, because digital technology is transforming the way we think, work, and learn. She suggests that "65 percent of today's grade-school kids may end up doing work that hasn't been invented yet."[17] "While we've all acknowledged the great changes of the digital age," she says, "most of us still toil in schools and workplaces designed for the last century."[18] This orientation makes it difficult to change structures and implement different ways of organizing and operating education institutions.

Table 1-1. *Teacher Use of Technology to Facilitate Student Learning, 2008 and 2010*

Percent

Use	*2008*	*2010*
Homework and practice	36	58
Create graphic organizers	33	51
Conduct investigations	20	47
Create physical models	33	41
Create cues or questions	30	40
Provide feedback	38	38
Note taking and information synthesis	27	37
Set student objectives	33	34
Facilitate group collaborations	22	32
Track effort to achievement	12	16

Source: Project Tomorrow, "The New 3 E's of Education," May 2011 (www.tomorrow.org/speakup/pdfs/SU10_3EofEducation_Educators.pdf), p. 5.

Constrained by current structures, education institutions find it hard to change. Innovation diffuses slowly and unevenly across the fragmented universe of public elementary and secondary schools, private schools, and colleges and universities. It takes a lot to move decentralized bureaucracies with entrenched business and labor interests. New practices take hold when the complex interplay of teachers, administrators, school boards, vendors, parents, and community organizations come together. Progress tends to be slow and episodic.

A Project Tomorrow survey of 35,525 teachers of K–12 students finds that few schools are making extensive use of available classroom technology. As table 1-1 shows, the most frequent use of technology in 2010 was for homework and practice (58 percent), followed by creating graphic organizers (51 percent), conducting investigations (47 percent), creating physical models (41 percent), and creating cues or questions (40 percent). Only 16 percent of teachers deployed technology to track the effort students make for achievement.[19] Still, on almost every measure, teacher use of technology increased over 2008.

Similar obstacles exist at the level of higher education. A survey of students found wide variation in the use of computer technology in arts and science courses.[20] As shown in table 1-2, more than three-quarters of students used the Internet in their classes in 2007. But for most other

Table 1-2. ***Student Use of Various Technologies in Arts and Sciences Classes, 2003 and 2007***

Percent

	2003		*2007*	
Use	*Sciences*	*Arts*	*Sciences*	*Arts*
Internet	56	58	77	77
Out-of-class computers	61	63	76	78
Conferencing and websites	50	52	75	71
E-mail	47	41	63	66
Word processors	50	63	54	78
Interactive software	42	15	40	21
Presentation software	26	22	26	35
Spreadsheets	28	16	25	22
In-class computers	19	16	20	23

Source: Rana Tamim and others, "A Multi-Year Investigation of the Relationship between Pedagogy, Computer Use, and Course Effectiveness in Postsecondary Education," *Journal of Computing in Higher Education* 23, no. 1 (2011): 1–14.

purposes, use of other electronic resources was below that level. For example, only 40 percent of science students and 21 percent of arts students made use of interactive software, and only 20 percent of science students and 23 percent of arts students used computers in class. Student use of technology increased between 2003 and 2007.

In general, many young people find school today boring, which makes it difficult to engage them effectively. Outside of school, students are online regularly through the Internet and digital news sources, and they interact frequently with friends and acquaintances through text messages and social media. But in many education institutions, students are required to turn off electronic devices and read paper-based materials by themselves with little interaction with others. This contrast between dynamic digital interaction in their out-of-school hours and static, out-of-date textbooks during the school day frustrates young people and makes it difficult to hold their attention.

The slow adoption of technology by American schools illustrates the need for change. It is vital to prepare students for twenty-first-century jobs. Education has long been the engine of economic and social development. Outmoded instructional techniques and pedagogic approaches stymie intellectual growth and fail to engage students and teach them

the skills needed for a post-industrial economy. The jobs of tomorrow require skills of collaboration and adaptation that are missing from current education models.

Cultural barriers also pose problems to technology innovation.[21] Schools that innovate often have leaders dedicated to change and instilling a culture of achievement throughout the organization. This means creating a can-do spirit, building coalitions that work for change, and finding resources to support key innovations. Schools that do not make these efforts are unable to exercise leadership, identify the tangible and intangible benefits of education reform, build coalitions of parents, teachers, and outside groups, and implement the shifts in culture, operations, and organizations that are required.

Finally, in an era of massive government deficits, financial barriers limit change. Technology is expensive and in many cases requires upfront investment.[22] It is not a simple matter to find resources to support teaching innovation. Although such investments often pay off in the long run, the short-term costs are considerable, and difficulty finding that money typically slows the rate of social innovation.

These barriers are unfortunate because digital technologies have the potential to transform education operations, overcome geographic disparities, improve access, personalize learning, and make information sources available in digital form. Technology can deepen education by altering the way students master core content, teachers operate their classrooms, and parents and policymakers evaluate education.

It is for those reasons that former Florida governor Jeb Bush believes the top priority in education reform is "applying digital learning as a transformative tool to disrupt the public education system, to make it more child-centered, more customized, more robust, more diverse, and more exciting."[23] Unless education becomes more collaborative and output driven, Bush argues, it will be hard to get the results that students, parents, and teachers want.[24]

New Skills for the Twenty-First Century

It is clear that new skills and approaches are needed if students are to compete effectively in the changing international economy. Jobs are changing, and most sectors are becoming globalized. Students are

competing not just with fellow citizens but with job seekers from around the world. New specialties are required that cross disciplines and areas of knowledge and are global in scope.

The Harvard economists Claudia Goldin and Lawrence Katz have described the "co-evolution" of educational attainment, technology, and wages. They argue that America was prosperous in the twentieth century because of human capital investments and the mass education of young people. Systematic training reduced inequality and boosted income for the masses. However, over the past thirty years, an "educational slow-down" has unfolded, and the undermining of mass education has increased inequality and weakened long-term prosperity.[25]

To improve this situation, schools must use technology not just to deliver the existing education paradigm but also to deploy alternative approaches to instruction. Schooling needs to become more student centered, interest based, results oriented, and personalized through digital technology. Teachers must take on broader roles as coaches and mentors, and assessment should be more nuanced than annual standardized tests allow.

Henry Jenkins and his colleagues, of the Massachusetts Institute of Technology, argue that students require new learning skills in the twenty-first century. They include

—play: "the capacity to experiment with one's surroundings as a form of problem-solving"

—performance: "the ability to adopt alternative identities for the purpose of improvisation and discovery"

—simulation: "the ability to interpret and construct dynamic models of real-world processes"

—appropriation: "the ability to meaningfully sample and remix media content"

—multitasking: "the ability to scan one's environment and shift focus as needed to salient details"

—distributed cognition: "the ability to interact meaningfully with tools that expand mental capacities"

—collective intelligence: "the ability to pool knowledge and compare notes with others toward a common goal"

—judgment: "the ability to evaluate the reliability and credibility of different information sources"

—transmedia navigation: "the ability to follow the flow of stories and information across multiple modalities"

—networking: "the ability to search for, synthesize, and disseminate information"

—negotiation: "the ability to travel across diverse communities, discerning and respecting multiple perspectives, and grasping and following alternative norms."[26]

These skills are vital for an Internet era, but they are not often emphasized in contemporary schools. For a "participatory culture," Jenkins says, students need "skills valued in the modern workplace, and a more empowered conception of citizenship."[27] The digital era requires alternative conceptions of literacy beyond those that are dominant in a print-based world. Mastery of collaboration, critical reasoning, and analysis is vital for future employment and citizen participation in democratic political systems. We need new forms of education that shift from a twentieth-century assembly-line approach to twenty-first-century models based on collaboration, interactivity, and critical analysis.

Howard Rheingold, of Stanford University, argues that students today need lessons in what he calls "crap detection 101." "You can't outsource your critical faculties," he points out. "Students have to investigate [information] themselves. There is no authority left anymore. But the ability to critically assess information is an uncertain literacy when you ask whether . . . a sufficient number of people will have the ability to do it."[28]

Citing Ernest Hemingway's famous 1954 line that "every man should have a built-in automatic crap detector operating inside him," Rheingold says that skepticism and the ability to evaluate information sources represent valuable skills in the digital era.[29] Unlike peer-reviewed books and journal articles, which are edited and fact-checked before publication, electronic resources come from a variety of credibility levels, and students need to be able to identify "misinfo, disinfo, spam, scams, urban legends, and hoaxes."[30]

That view is echoed by Alan November, a senior partner and founder of November Learning, a nonprofit education organization: "We need web literacy for educators to understand the ecology of information. Kids are taught syntax and grammar in order to better understand writ-

ten resources. But they do not learn the syntax and grammar of the web so they don't know how the Internet works."[31]

Others point to the importance of human creativity in education. Mitchell Resnick, the director of the innovative Lifelong Kindergarten research group at the MIT Media Lab, argues that "'digital fluency' should mean designing, creating, and remixing, not just browsing, chatting, and interacting."[32] To teach programming skills, he and his colleagues created Scratch, a website where children can use software to create their own interactive projects. More than 1,500 video games, simulations, animations, and interactive projects get uploaded each day; most of the programmers are eight to sixteen years old. Experts praise this site as the "YouTube of interactive media."[33]

Education technologies give students access to instructional material and skill mastery tailored to their interests and the Common Core Standards recently adopted by most states across the country. But this does not mean that the role of teachers is no longer vital. Indeed, under new models of education, teachers remain central to the instructional enterprise; they just have a different role orientation. The model of teacher as lecturer is replaced with the model of teacher as coach and mentor. Even as students take greater responsibility for their own education, they need to be coached and mentored so that they move in the right direction. They have to be taught how to evaluate online resources and where to find reliable information. They also need to be instructed about what is important for their future and the best ways to take advantage of digital information. In a world of personalized learning, teachers are crucial "trust filters" through which students acquire information.

The economist Eric Hanushek has analyzed the economic value of higher teacher quality and the role that technology can play in evaluating teachers. Looking at the impact on future student earnings, he finds that "a teacher one standard deviation above the mean effectiveness annually generates marginal gains of over $400,000 in present value of student future earnings with a class size of 20."[34] Raj Chetty, John Friedman, and Jonah Rockoff find income gains of $250,000 in replacing a low-performing teacher with one even of average ability.[35] Using technology to evaluate teachers and remove poor ones has substantial ramifications for student achievement.

Noteworthy innovations are taking place in contemporary schools, and much can be learned from them. There are instructive experiments arising in K–12 as well as higher education in terms of distance learning, shared collaboration, e-learning and e-tutoring, and game-based instruction. By analyzing what works, and which organizational and policy barriers constrain innovation, policymakers can determine the best ways to proceed with education reform.

The Open Learning Initiative

The Open Learning Initiative is a successful example of open-source content for distance education. Developed at Carnegie Mellon University in 2002, the initiative features web-based courses using open-source educational resources available to a consortium of colleges. Subjects offered include statistics, French, economics, biology, physics, and visual communications design, among other topics.

Students can take courses for free from instructors at Carnegie Mellon and around the world. They can use Open Learning Initiative web resources to supplement their own materials. Each course is developed by a team and reflects ongoing data analysis regarding what works and how students and faculty respond. A salon-style social network allows users to pose questions, compare notes, and learn from one another.

Research on the Open Learning Initiative statistics course has found positive impacts on student learning. Integrating web-based materials into traditional classes speeds up concept mastery. One analysis comparing traditional, stand-alone courses with those conducted exclusively on the web found no significant differences in student achievement. However, in a hybrid model integrating traditional and web content, "students learned a full semester's worth of material in half as much time and performed as well [as] or better than students learning from traditional instruction over a full semester."[36]

This is one of the key characteristics of technology change. Hybrid models sometimes outperform either the old or new approach to operations. It takes a while for service deliverers to feel comfortable with new products or delivery systems, so hybrid approaches dominate until the virtues of the new perspective become so apparent that few can deny it.[37]

In the case of statistics instruction, professors feel that the web-based course adds to student learning through several different means. There are many opportunities for students to apply statistical analysis. For example, as they learn major concepts, students encounter "comprehension-check" questions, real-life applications, short-answer questions, experimental applications, and questions concerning the areas to which the knowledge is most relevant. The web course also provides "immediate and targeted feedback" tailored to each student. If a student is demonstrating difficulty with a particular problem, hints pop up on the screen designed to lead the student to the correct answer. Visual animations reinforce lessons presented in the text.

These results suggest the virtues of a combination of web and human instruction in learning statistics. That perspective helps students master material and make the greatest progress in the shortest period of time. Interactive features add value as well. Pop-up hints, real-time feedback, and animation engage young people used to interacting with commercial and entertainment sites. Real-time feedback helps students know what they are learning, how well they are doing, and where they need to focus more attention.

The Shared Learning Collaborative

Gene Wilhoit, the executive director of the Common Core State Standards Initiative, notes that "one of the early concerns [about standards reform] that was raised [by teachers] is what kind of support are you going to give us as we try to implement."[38] Instructors felt that to make progress on the standards, they needed online curricular material, evaluation, and collaboration tools. Out of those conversations came the idea of a "resources clearinghouse." And from that idea arose the Shared Learning Collaborative.

The Shared Learning Collaborative is a new learning network designed to personalize learning, provide teachers with online lesson plans and instructional tools, track student achievement, and provide dashboard metrics for individual students. Funded by the Bill and Melinda Gates Foundation and the Carnegie Corporation, it offers a digital infrastructure for teachers, students, parents, administrators, and policymakers.[39]

According to Common Core State Standards, students are expected to demonstrate mastery in a variety of areas. The Shared Learning Collaborative offers content and pedagogic tools to teachers so they can help students meet these standards. Using an open-source network, the collaborative provides a visual mapping of content standards and tools to track individual learners as they navigate across those maps.

Initially, the core standards initiative is focusing on nine states (New York, Illinois, Massachusetts, North Carolina, Colorado, Delaware, Kentucky, Georgia, and Louisiana). Districts in those areas are piloting the instruction and determining what works and does not. Users employ social networking to learn from one another's experiences and share ideas. Over the course of the next decade, the goal of the Shared Learning Collaborative is to extend the network to other states across the country.

Teachers in participating school districts have access to an "apps store" that accesses lesson plans, learning modules, instructional materials, and student-tracking tools. Particular applications are peer reviewed by education experts and crowd sourced through teacher ratings. By embedding assessment vehicles throughout the learning process, teachers get detailed and regular updates on student mastery and where they need additional instruction.

ePals and In2Books

Collaboration is a virtue in the online world. Technology enables students to collaborate with one another and work with a range of interactive, instructional resources. This can include teachers, parents, peer tutors, volunteers, and other interested individuals. Turning education into a social event with regular feedback and challenging assignments helps spur student achievement.

One organization undertaking innovative work in this area is the company ePals and its affiliate, In2Books. The former focuses on collaborative and self-directed education, and the latter is an e-mentoring program emphasizing reading, writing, and critical skill development in grades three to five. ePals matches students with adult pen pals who read books in five different genres (fiction, biography, folktales, social studies, and science) and exchange letters about those volumes. The

correspondence covers not just what students comprehend from the book but also how students write up their impressions and analysis.

Research undertaken on the use of In2Books shows improvements in reading comprehension. For example, William Teale and Linda Gambrell have analyzed Washington, D.C., student reading achievement during the school year.[40] Washington is a particularly compelling case because of high poverty within the district and a sometimes challenging home and education environment. The authors compare Stanford Achievement Test results across several categories of students: classrooms where teachers had used the reading program for two or more years, those in the first year of implementation, and those that did not use the program. In each of the three grade levels studied (two, three, and four), students participating in the program scored significantly higher than those not in the program.

In reviewing reasons for this positive impact, researchers note that four factors are important: reading "high-quality, age-appropriate, appealing books"; repeated reading and discussion of the book; following a writing process that emphasizes drafting, revising, and editing the book reviews; and regular professional development for teachers.[41] Having challenging, authentic, and persistent work appears to make the greatest difference for students. The use of a learning community based on collaboration correlates highly with success.[42]

Another study focused on teacher attitudes. Using interviews with 137 of the 161 Washington, D.C., instructors participating in the In2Books program, Elizabeth Goldfeder, Weiping Wang, and Steven Ross found that 91 percent of the teachers felt that the pen-pal activity on book reading was valuable to students. Eighty-eight percent felt that In2Books was an effective program.[43] Positive teacher assessments and the impact on student achievement suggest the value of this approach to education collaboration.

Still another assessment project, based on a survey of 219 elementary students who participated in the study, looks at the organization's pen-pal program for reading, writing, and discussion. Students read books, discussed the material with an adult pen pal, and participated in small group discussions about the material. A comparison of performance before and after completion of the program reveals that the pen-pal activity improved student motivation, group interactions, and

discussion participation. Study members report improvements in their motivation for reading, the quality of their interactions with other students, and engagement with class discussions.[44]

Quest to Learn and the Institute of Play

For a generation accustomed to video games for entertainment purposes, the opportunity to learn substantive topics through augmented reality—simulations that enhance real-life situations with computer graphics—is a major advantage.[45] A Pew Internet and American Life national survey of school children aged twelve to seventeen finds that 97 percent of the children play video games. Sixty-five percent play while other people are in the room, indicating a possible social dimension to the activity. However, there is a gender dimension to game playing: 65 percent of those who say they play every day are male, and 35 percent are female.[46]

With the widespread use of games, it is little surprise that educators have developed tools based on video games. Quest to Learn is a New York City– and Chicago-based public school that employs digital media and video games for educational purposes. It has developed a curriculum using games and augmented reality that immerse students in game-based and academically challenging learning environments.

In its Smallab, operated by the Institute of Play, Quest to Learn puts students in a physical space with video cameras and top-down digital projection. Students interact with digital images that are chosen by their teachers and projected on the floor. One module projects a scene from ancient Mesopotamia and asks students to identify pottery, tablets, and papyruses that were distinctive to that particular culture.[47] This helps students master concepts through what Quest calls "embodied learning."[48]

Creators of the sixth-grade curriculum focused on design, innovation, and knowledge integration. During that year, "students will be learning about geography as a system of elements that affect how things grow and survive; learning to see whole number operations as elements of mathematical systems, or that the rules of language (grammar and syntax) order elements in ways that allow us to communicate and express ideas."[49]

The school uses "missions," which it defines as "challenge-based units with a bit of narrative flair," to organize learning into concrete quests. "Each quest poses a problem students have to learn to solve, either by gathering relevant resources, doing mathematical calculations, reading and analyzing texts, designing tools, repairing broken systems, creating models, doing scientific experiments, building games, or a host of other activities," according to instructional manuals.[50]

Quest to Learn's executive director, Katie Salen, argues that "membership in a community of game producers means sharing thoughts and experiences with fellow players. This ability to gain fluency in specialist language and to translate thinking and talking about games into making and critiquing them (and vice versa) suggests that games not only teach literacy skills but support their ongoing use."[51]

Scholars who write about educational games say that game-based pedagogic techniques have a "tremendous educative power."[52] There is debate about whether video games isolate individuals or involve them in social networks and the differential social impact. But with the development of Internet-based gaming platforms involving large numbers of people and classrooms, where students interact and learn material through social games, this may become less a concern over time.[53] As has been demonstrated in various schools and military training programs, games represent a valuable way to convey important skills and concepts to young people.

Outline of the Book

Throughout this volume, I examine new approaches to education that incorporate digital technologies and organizational innovation. I compile evidence on opportunities for and barriers to successful experimentation. Using interviews, case studies, and empirical evidence, I seek to determine the most effective ways to move forward with education.

Chapter 2 focuses on personalized learning and ways education can be tailored to the needs of individual students. Wired classrooms and instructional sets provide pupils with individualized instruction and allow them to learn at their own pace. This makes education more adaptive and timely from the student standpoint and increases the odds of

pupil engagement and mastery of important concepts. It also frees teachers from routine tasks and gives them more time to serve as coaches for students. I focus particularly on new innovations and ways to scale up pilot projects.

Chapter 3 focuses on blogs, wikis, and social media. There has been a dramatic expansion in collaboration technologies that help students learn from one another as well as from teachers, coaches, parents, and mentors. Using blogs, wikis, and social media, these new approaches break down walls within schools and between schools and the overall community. I explore examples of social collaboration and how it aids in the education of young people.

Chapter 4 looks at video games and augmented reality. As seen in the entertainment sphere, video games offer ways to engage young people and get them to learn educational material. By placing skills and concepts in the context of games and augmented reality, new technologies help students role-play and engage in various types of simulated situations. I explore the potential and impact of these approaches and how they change education.

Chapter 5 examines real-time student assessment. Since the enactment of the No Child Left Behind legislation in 2001, assessment has focused on annual student test scores. Digital technology, on the other hand, enables real-time assessment throughout the instruction process. It is possible to monitor how long students devote to readings and videos, where they get electronic resources, and how quickly they master key concepts. I analyze these new assessment approaches to see how useful they are and what kinds of feedback they provide.

Chapter 6 focuses on ways to evaluate teachers. How can we assess teacher performance in a digital era and use these assessments to inform analysis of school operations? Technology makes it possible to evaluate teacher impact in real time and in far more nuanced ways than were previously available. I explore alternative ways to track performance and make recommendations on best practices in teacher assessment.

Chapter 7 explores distance learning. As technology improves, it offers a host of possibilities for connecting far-flung students with the classroom and other learning opportunities. What characteristics of models create positive outcomes for students? How can we replicate those initiatives? What sources of funding are there for these programs?

I examine the role, use, and impact of distance learning and online education, focusing on examples of effective implementation and dissemination of educational materials.

Chapter 8 looks at special education and nontraditional students. Considering substantial increases in the numbers of children identified with learning disabilities, I examine ways technology can help with special needs students. Technology offers the potential to assist these students through programs that allow them to progress at their own pace. Rather than promoting students on the basis of time spent in a chair, new ventures focus on skill mastery and promotion when children demonstrate knowledge of key concepts. This creates new opportunities to rethink special education and language instruction for non-English speakers.

Chapter 9 concludes the book and makes recommendations for moving forward. I review advances in education technologies and how they improve the prospects for learning and achievement. There remain important barriers to adoption, but school officials have the opportunity to make progress in a variety of areas. With key policy changes, it is possible to meet Dewey's challenge and educate students for the needs of tomorrow.