HOW TECHNOLOGY IS CHANGING EDUCATION

When a Stanford University professor offered a free online course in artificial intelligence in 2011, he had no idea that the experiment would attract 160,000 students from 190 countries and generate a wave of publicity.

That's one of many examples of how technology is reshaping education around the world. From the rapid proliferation of massive open online courses, or MOOCs, to the widespread use of mobile devices that support a variety of "blended learning" models (part online, part bricks-and-mortar based), technology is creating new challenges and many new opportunities for educational institutions of all types, from early education to universities.

" . As educators begin to rethink the learning experience, we believe it will be important to also reshape educational spaces to support this evolution," says Andrew Kim, a Steelcase WorkSpace Futures researcher and a member of the Steelcase Education Solutions team that has been investigating the spatial implications of learning and technology. So far, the study has involved observing and interviewing students and teachers at 20 schools.

Among the fastest-growing and irreversible trends at all levels of education: increasing use of laptops, tablets and other mobile devices. Many primary schools now provide every student with a laptop or tablet. At colleges and universities, many undergrads now own tablets as well as laptops. Always interested in the advantages of portability, a growing number are also now asking for content delivered to their smart phones.

As recently as a few years ago, mobile devices were used almost exclusively as only a souped-up substitute for conventional tools like handouts, transparencies for overhead projectors, books, paper and pens. Today, however, these technologies are beginning to transform how instruction and learning actually take place.
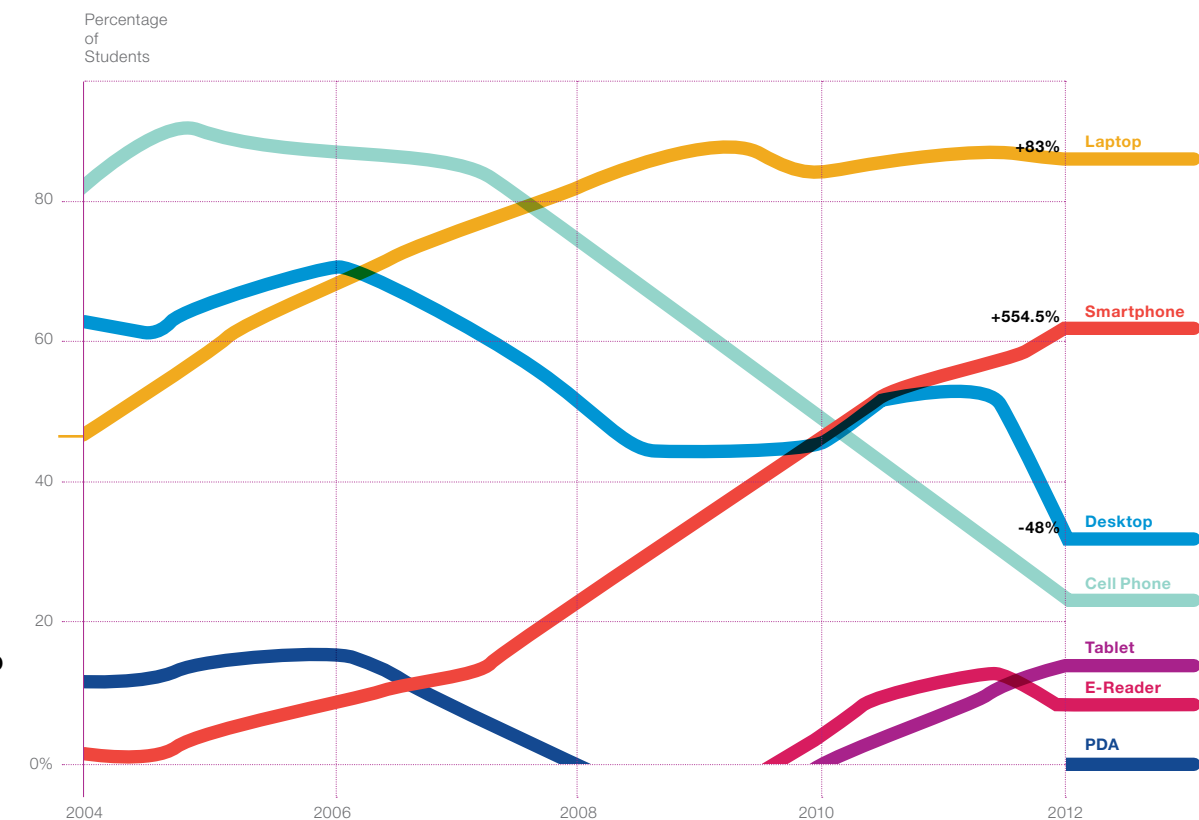
Teachers are using technology to replace old models of standardized, rote learning and creating more personalized, self-directed experiences for their students. There's more multi-device synchronization with software that supports multiuser collaboration and more support for virtual conversations, both within and beyond a classroom. And more students and teachers are creating their own digital content, including animations and videos.

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**Andrew Kim,
Steelcase WorkSpace Futures**

Percentage
of
Students

**Longitudinal Trends
in Undergraduate
Technology Ownership
2004 - 2012**

Source:
Educause Center for Applied Research

+83% Laptop

+554.5% Smartphone

-48% Desktop

Cell Phone

Tablet

E-Reader

PDA

80

60

40

20

0%

2004   2006   2008   2010   2012

Much of the information that only teachers possessed in the past is now available to students online, challenging the old model of teachers presenting content and students absorbing it. As a result, educators are now leveraging technology to create a different role for themselves in their classrooms. Instead of using class time to spoon-feed information, technology is helping them use their time with students to advance problem-solving, communication and collaboration—exactly the type of higher-order skills that leading education specialists say should be the goals of education for today's world.

"More and more, classrooms are becoming places where knowledge is created versus consumed by students," says Kim. "As students start to have more control over what they use to help them learn, you need to have spaces that support more creative or generative activities. This means more mobility inside and outside of classrooms, as well as new kinds

of learning spaces that support varying individual activities and rates of learning. Providing a palette of place, posture and presence—i.e., virtual as well as face-to-face interactions—is as important in educational spaces as it is in workplaces, for many of the same reasons. In fact, schools are beginning to leapfrog corporations in the use of mobile devices and many are facing the related challenges head on."

As the tsunami of technology trends washes over education, some things have managed to stay the same. For example, students and teachers haven't abandoned analog materials—and aren't expected to anytime soon. They continue to use whiteboards, paper and notebooks to capture and visualize thought processes, and will continue to need spaces designed to support the parallel use of analog and digital tools.

BLENDING WORLDS

Within all levels of education, learning is now occurring both remotely and onsite through blended learning programs that combine online and face-to-face interaction. Just one of many examples is the flipped classroom model in which students access content online outside the classroom as their homework and then apply this new knowledge in the classroom by engaging in active learning practices, such as discussion or group work.

Blended learning can cut costs, which makes it popular in today's challenging economy. There are also early signals from several studies that suggest giving students more control over how they access information can be more effective than all face-to-face or all virtual learning.

"What's interesting is that as learning is becoming more virtual, the virtual activities are actually becoming more physical. You might say the virtual and the physical are meeting in the middle," says Kim. "In many instances, you have different subjects happening all in one room, and multiple teachers acting as tutors and motivators to give directed support. It's shoulder-to-shoulder, even closer than face-to-face."

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Technology inclusion in lesson delivery
is becoming the norm

160k

students enrolled in a massively
open online course (MOOC)
offered by Stanford in 2011.
Source: Inside Higher Ed, 2012

20k

education and learning appli-
cations have been built for the
iPad and 1.5 million iPads are
currently in use in educational
institutions and schools.

79%

secondary school teachers in
France believe that in the
past two years they have been
using more technology in
the classroom than ever before.

65%

of students in the U.S. have
taken online classes.

Because blended learning changes the role of the educator to become more of a facilitator and coach, there's a growing use of para-educators who work alongside teachers to manage online learning and help with classroom activities. There are also spatial implications. Classrooms designed for a teacher at the front of the room may now need to concurrently support self-directed work at computers as well as collaborative projects. In the United States, for example, even some kindergarten classes now have a separate zone for individual online work within the classroom. Other schools are dramatically reducing the amount of space allotted for classrooms, instead creating large open areas for self-directed learning.

Colleges and universities, while embracing various forms of online learning, are also looking for ways to build student-teacher engagement and monitor performance. With MOOCs, in particular, approaches are still experimental. Despite online discussion forums, many students still seek face time with their professors and each other. The MOOC platforms are meeting this need by making it easier for students to meet through online social networking portals, grouped by geographical proximity.

Teachers have always been very aware that schools engender social learning as well as cognitive learning, and so the search for adding physicality to cyber schooling continues. For example, one MOOC professor announces "office hours" at a coffee shop in his destination city whenever he travels for students who want to meet in person. Some community colleges are now creating blended courses using MOOC content, with the MOOC providing the online experience and the community college picking up the offline experience of professors interacting in person with students.

Even as learning becomes more virtual, the importance of teachers and bricks-and-mortar places are expected to remain valuable components in the educational equation, says Kim. "As we continue our research, it's clear that the best places for education will bring people, technology and space together in innovative ways. If you think of classrooms as places where knowledge gets created instead of consumed, they have similarities to innovation studios where flexibility is built in and it's easy to switch between individual work and collaboration. More than ever, we're seeing the need for classrooms to become highly flexible spaces that support the new behaviors of learning that are the direct result of new technologies."

As rapid development occurs in previously underdeveloped nations and new technologies impact the way that knowledge is transferred and embodied, education is becoming even more valuable and valued throughout the world, and the quest continues to refine both its processes and the places where it occurs. ○