Technology Trends for 2015 and Beyond

A look at how today's technology trends inform our vision of the future.

By JR Renna

Taking a trip in the Wayback Machine to see some early 20th-century predictions of how technology would improve learning 100 years in the future (or as we like to call it, the present) provides some eerie, if not entertaining, results.

In 1910, the French artist Villemard imagined a future where books would drop into the hopper of a crank-operated machine that would grind them up and pump the information through wires into special thinking caps that students would wear. You may recognize that vision today, as students listening to podcasts and audiobooks through the earbuds attached to their smartphones or tablets.

In 1954, psychologist B. F. Skinner proposed the idea of teaching machines, wherein students would each have a typewriter-like device that would guide them through a learning program and provide instant feedback as they solved math or word problems. (There's a great video of this at http://youtu.be/jTH3ob1IRFo.) Today, we refer to those things as one-to-one initiatives and learning management systems.

When we look at today's technology trends, how do they inform our forecasts of what learning will look like in the future?

It's about the Data

The phrase "data-driven decision making" has become embedded in the workplace lexicon. Why? Because technology is quite good at collecting and connecting data for us, putting highly informed decisions at our

fingertips. Funding formulas and budgets, teacher evaluations, and student performance profiles are all built on connected systems and information databases.

How the data are collected. The current trend is about more than data storage and data use—it's about how data are collected. Most of us carry a smartphone loaded with sensors and apps that collect data about our location, health, interests, behaviors, and more. The rationale behind that increased focus on data collection is that the data can benefit our lives by providing metrics and motivation for improvement. For example, health and physical education teachers could use an app that charts heart rate, distance, pace, and calories to teach students about achieving the optimal heart rate during exercise. That trend of self-knowledge through numbers is known as the quantified self. (Learn more at www.quantifiedself.com.)

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Lending support to this trend are myriad Internet-connected, sensor-laden personal accessories (such as watches, shirts, shoes, and pillows) and other devices (smart thermostats, smart appliances, and vehicles). This network of physical objects embedded with sensors that connect to a network of users is called the Internet of Things.

One particularly interesting example from the world of education is school busses and building doors that check students in and out through radio-frequency ID badges, helping us account for students' whereabouts and even sending notifications to parents. Within a few years, calculating microlocation—like GPS for inside buildings—will be common in public places, including schools.

According to ABI Research, almost 40 billion active wireless connected devices will exist in 2020 (www.abiresearch.com/press/the-internet-of-things-will-drive-wireless-connect).

How the data are stitched together. If there's one term that's abused more than data-driven decision making, it's "the cloud." The nickname is unfortunate, because it not only conjures images of gloomy weather, it also creates a fog of confusion for those trying to figure out what it means.

In simple terms, the cloud refers to services or applications that are delivered over the Internet. The cloud connects and applies the data we collect, making access and collaboration available from anywhere at any time from any device. If the application runs in your school's data closet, it's in a private cloud. But because of economies of scale, more schools are hosting applications in the public cloud (in someone else's data closet) with companies like Google or Amazon. Google Apps for Education is an example of a cloud service.

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The shift to the cloud—combined with users' expectation that they will be able to connect all of their devices to the Internet—puts the spotlight on your school's Internet connection. The State Educational Technology Directors Association advises that schools have connections rated for 100 megabits per second for every 1,000 users this school year (www.setda.org/priorities/equity-of-access/the-broadband-imperative/). For the 2017–18 school year, that recommended number goes to 1,000 megabits: a tenfold increase.

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What we do with the data. Here comes the fun part: the implications for teaching and learning. By allowing students and teachers to use personal Internet-connected devices in the classroom, we can capitalize on data to provide more authentic learning experiences.

Skinner's learning machine is possibly the first conception of using technology to allow students to work at their own pace, receiving individualized reinforcement when needed. That vision can be a reality today, although most schools are far from fully realizing it. Obstacles to implementation include policy, curriculum, professional development, investment in the platforms and infrastructure that make such learning possible, and of course funding and equity issues.

Setting those challenges aside, I'd like to talk about Netflix for a moment. Hang with me. As most of you know, Netflix is a service that streams movies and TV shows. On the basis of what you watch, how you rate it, and what it knows about the qualities and popularity of its videos, it builds a personalized profile of you, which it then uses to recommend what it thinks you should watch next. The more data Netflix has collected over the years, the better its recommendations have become. The company has even leveraged that knowledge to produce original content that the data indicate will be well-received by subscribers.

Now, apply that same model to a database of educational content, including on-demand viewing of recorded lessons, games, activities, and assessments. The system can recommend which topics students should review next according to their activity. What that adds to the learning equation is students' ability to binge-watch differentiated content that is both engaging and aligned to curricular standards. Remedial materials can be recommended as necessary. What it subtracts is the frustration of having to work at the same pace as the rest of the class.

Rather than dispensing knowledge, educators become facilitators, guiding students through their learning. By having real-time access to student performance data, teachers can easily identify the students who might need interventions. It also allows teachers to evaluate their own lessons.

On a district level, data would provide insights into the popularity and efficacy of the curriculum and could be used to identify precursors of failure and dropouts—in essence, an early-warning system.

When students are able to access rich content outside the school day from their always-connected personal devices, they have many more opportunities to learn. When teachers no longer have to use class time to teach content, they can spend more time doing hands-on activities and building students' collaboration and creative skills.

Concerns about Devices and Data

I would be remiss if I didn't address concerns about and objections to this model of technology-enhanced learning. Privacy advocates, including President Obama, want clear rules so student data are stored securely and not used for marketing purposes. Districts should participate in the conversation about data privacy with national groups like the Department of Education's Privacy Technical Assistance Center.

There is a spirited debate about how early to give children access to tablets or smartphones, and about restrictions of their use. In fact, Steve Jobs was a low-tech parent. (A great read on the topic can be found at http://nyti.ms/1lUC52Y.)

Of course, there are concerns about equity. Not every family can afford to buy devices for their children or to subscribe to Internet access. Not all districts have broadband available. Google has gone to great lengths to level the playing field by making its cloud productivity suite, Google Apps, fully available and free to all schools. It has established a platform of specialized laptops called Chromebooks at a very affordable price. Google is even working on flying giant balloons that would provide affordable broadband to remote locations through its Project Loon.

The Future Vision

Sometimes, life imitates art. Some of the greatest real-life technological marvels have sprung from the scripts of science fiction. Consider the 2013 Spike Jones movie *Her*, in which, in the not so distant future, the main character falls in love with Samantha, the personal assistant on his smartphone. Although I'll leave a discussion of the complications of a relationship with a computer program for another article, I think the film offers insight into a couple of noteworthy predictions.

Talking to Siri, the iPhone's personal assistant, is often useful, but not yet a replacement for real human conversation. Natural language interaction—combined with computer learning and increased bandwidth and processing power—shows the potential for digital assistants to be more than just gimmicks or utilities. I believe they will eventually be able to serve as teachers. I don't see them replacing teachers, but they can certainly be available in times and places that are not practical for their human counterparts.

Whether it's walking down the hallway or sitting at the dinner table, chances are you know someone who just isn't present in the moment because his or her eyes are glued to a smartphone. That is a side effect of how we interact with the device today: with our eyes and our fingers. The world painted in *Her* is largely devoid of that side effect because the interaction is through speech. As natural language interfaces with our devices and becomes more nuanced and reliable, our interactions with technology will become much less distracting and more seamless. That congruence sits nicely with the aim of successful technology integration. Instead of saying, "Let's stop what we're doing and use computers instead," we should engage with the content and use technology as a means, not as an end.

Then again, those predictions might end up sounding just as goofy as feeding books into the hopper of a crank-operated machine.

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