Moving Edtech Forward

Upstart school networks are betting on a breakthrough

BY MICHAEL B. HORN

Artist rendering of a flexible education environment for a future AltSchool

ARTIST RENDERING / COURTESY MICHAEL LOGUE, AIA, LOGUE STUDIO DESIGN

THE DIGITAL REVOLUTION occurring in schools has focused predominantly on online education in its various forms—including fully online courses, learning management systems, games, and mobile applications—to personalize learning and boost the performance of all students.

To optimize the learning experience for each student, new school models may benefit from leveraging other types of digital tools—from wearable devices that track student metrics to video cameras that capture and digitize key learning moments to screens that read the expressions on students' faces to help determine how emotionally engaged they are in their learning.

Research at North Carolina State University, for example, shows that software that tracks facial expressions "can accurately assess the emotions of students engaged in interactive online learning and predict the effectiveness of online tutoring sessions." Assessing engagement is important because research in neuroscience is finding that emotional responses play an important role in learning.

Another study, in the peer-reviewed journal *IEEE Transactions on Affective Computing,* found that software was able to make judgments about students' levels of engagement that were as reliable as those of human observers, and that these video-based engagement scores predicted post-test scores better than pre-test scores could.

These studies appeared in 2013 and 2014, respectively, and companies like Pearson have been experimenting with technologies like these for several years. Yet these technologies have had little impact in actual K–12 schools. Using all of them productively still seems far off in the future, as in combination they can create more work for teachers without providing what teachers and students actually need.

If these technologies are to enable K–12 schools to boost each student's learning, how might that unfold?

The theory of interdependence and modularity that Harvard Business School professor Clayton Christensen developed many years ago sheds some light.

In the early days of most new products and services, leading providers tend to offer products with proprietary, interdependent architectures. The reason? The technology is still immature, and the ways the parts within the new system interact are not yet well understood and are therefore unpredictably interdependent. The organization must therefore integrate to control every critical component of the system and develop them in concert to make any part of the system function at a high enough level to satisfy users. In other words, in order to do anything, the organization must do nearly everything.

Gustavus Franklin Swift's approach in the 19th century to butchering, marketing, and selling beef illustrates the point. At that time, because there was no technology for transporting meat long distances, the beef industry lacked significant economies of scale and beef was sold on an exclusively local basis. So Swift integrated. He centralized butchering in Kansas City, which meant he could process beef at a very low cost. Then Swift designed the world's first ice-cooled railcars. He even made ice

cabinets and sold them to retail shops throughout the Midwest and Northeast so that once the beef arrived, it would stay fresh. One key to Swift's ability to market beef in far-flung regions was the assurance he could give customers that the beef was still safe to consume after it had traveled from the stockyards of Chicago to the market. Because a clear understanding of refrigeration and meatpacking processes did not exist at the time, Swift had to control the entire process to ensure that the temperature and storage practices were consistent. In other words, to revolutionize the beef industry Swift had to expand beyond his so-called core competencies and introduce new, interdependent lines of business.

But as an industry matures and products and services improve, there is a shift. The unpredictable interdependencies within a service become better understood and predictable, and suppliers of less integrated, more modular products can become industry leaders. This shift happens as a service's raw performance becomes good enough to get the job done, so customers start to prioritize the flexibility that modularity offers over the increased performance that integration makes possible.

Because modular parts fit and work together in well-understood, crisply codified ways and can be developed in independent work groups or by different organizations working at arm's length, standards arise that dictate how different components must interact. For example, a light bulb and lamp have a modular interface. Engineers have lots of freedom to improve the design inside the light bulb as long as they build the stem so that it can fit the established socket specifications.

Importantly, pure interdependence and modularity are the two ends of a spectrum. Most architectures fall somewhere between. There isn't a "right" place to be. Instead, organizations are more likely to succeed when they match the type of architecture to their particular circumstances.

Although some of the tools have been around for several years, it's still relatively early in the pursuit of personalized learning, and the various technologies are still underperforming. As a result, pursuing an integrated and proprietary approach to developing the technologies and controlling how they interact with the school's teachers, physical architecture, and philosophy may be critical. In other words, we may need to see more schools take what Andreessen Horowitz, a leading venture-capital firm, calls the "full-stack start-up" approach—the idea that a start-up builds a "complete, end-to-end product or service," and controls even the nontechnology components of a solution if those will perform better when integrated with the technology.

Although most district schools aren't equipped to take this approach—and having them try wouldn't be advisable—there are schooling networks emerging to tackle this work.

AltSchool, a private micro-school network (see "The Rise of Micro-schools," *what next,* Summer 2015), has attracted significant media attention because of the whopping $130 million in capital it has raised. The network is using a significant portion of this money to hire engineers to develop a full set of digital tools, including an online learning platform that supports its personalized learning playlists for each student; video cameras placed in every classroom, which allow teachers to record, document, and learn what works in different moments; and software that supports the administration and operations for its network of schools. If any school network would seem to be well positioned for experimenting with wearables and facial recognition, it would be AltSchool.

Summit Public Schools, a charter management organization with schools in California and the state of Washington, is taking a similar approach. It has brought in engineers to create a personalized learning playlist platform for its students and teachers.

Both networks ultimately want other schools to use the technologies that they are developing so they can have a wider impact. But it is an open question whether technologies that have been developed for specific schooling models with distinct philosophies about learning can be modularized for use by a school that doesn't have a similar instructional model, philosophy, and internal capacity. AltSchool's student-to-teacher ratio ranges from 8- to 12-to-1, and its founder, Max Ventilla says it aims to be a "Montessori 2.0 school." Summit is using a complex competency-based model of blended learning that gives students significant ownership over their learning.

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We can predict that before the wider world of schooling can benefit from these technologies, the performance of AltSchool and Summit will have to become reliable, and the interactions between the technologies and the different aspects of the school must be well understood. AltSchool and Summit might then begin to unbundle their offerings and develop clear standards that detail how the component parts must interact with each other.

Technology developed for a school with, for example, a 12-to-1 student-to-teacher ratio still may not export easily to a more traditional public schooling context. That may not be the only market for the technology, however. AltSchool could fuel the growth of independent schools in rural areas where it doesn't plan to compete directly. Such schools might be better candidates for adopting AltSchool's offerings.

Whether the platforms being developed at AltSchool and Summit succeed or whether wearables, video cameras that read expressions, and the like have an impact on education remains to be seen. But with schools now designing and building technology, the odds are better that we'll see some technology breakthroughs that will help educators everywhere to rethink school.

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