

The Struggle over Technology in Education

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The Struggle over Technology in Education

Classroom technology has proliferated as diverse tools have been introduced. The University of Phoenix surveyed teachers in the United States and found that in 2017, “sixty-three percent of K-12 teachers use technology in the classroom daily” (Poll, 2017). For-profit educational technology developers sell stories of success to promote their products, while administrators in underfunded school districts struggle to keep their programs up to date. The use of computers in classrooms is also controversial.

To some, classroom technology can be a distraction from educational goals. For example, Sana (2012) found that “participants who multitasked on a laptop during a lecture scored lower on a test compared to those who did not multitask.” Perhaps because people tend to overestimate their skill at multitasking, “students are more commonly found engaged with their laptops or smartphones during class time.”

Others argue that new technology has improved learning efficiency. Sawyer (2017) showed that “integrating multimedia presentation of lesson material with active-learning techniques enhanced educational benefits” relative to spoken or written presentation alone.

These claims’ validity depends upon the goals of education groups with divergent interests and educational values, including software companies and educators. They compete to influence the policies governing classroom technology. This competition effects the policies and standards that are put in place in controlling classroom technology. And these groups highlight various goals of education while often blatantly ignoring others in order to further their agendas.

Review of Research

Researchers have found that too much technology use can be harmful to students. “Students who reported a high use of technology tended to score lower than their peers who reported low or no use of technology” (Bouygues, 2019). Carter (2016) allowed only a third of students in a United States Military Academy class to use laptops; students who used the laptops performed worse on final exams than others. However, Education Elements (2017) reported that their services helped “students achieved average growth of 130% in reading and 122%.”

A 2017 meta-analysis looked at hundreds of examples of experimental evidence relating to classroom technology and overall “found that simply providing students with access to technology yields largely mixed results” (Escueta, 2017). In this analysis, “computer-assisted learning and behavioral interventions emerge as two areas that show considerable promise.” For technology to be successful, it must be implemented in ways that have proved to be productive.

These studies are helpful for understanding the success of classroom technology, but do not give insight into decision making for implementing technology or specify guidelines for educational technology. Some organizations are trying to set standards for using technology in education. One such group is the International Society of Technology in Education (ISTE). ISTE claims it stands for “the power of technology to transform teaching and learning, accelerate innovation and solve tough problems in education” (ISTE 2019). In Sep. 2019, after 88 percent of North Carolina educators “agreed that the ISTE standards represent the digital skills students need for success today and in the future,” the North Carolina State Board of Education adopted ISTE’s standards. According to an ISTE press, the board did so to “address the personalized, digital age education that K-12 public school students need to be successful in college and careers, and as globally engaged, productive citizens.”

Software Companies and Efficiency

For-profit software companies sell instructional programs to schools by advertising their educational efficiency. Squirrel AI Learning (2019), which implements adaptive learning in machine learning technology, claims that its “platform provides students with a supervised adaptive learning experience that has been proven to improve both student efficacy and engagement.” Since it was founded in 2014, Squirrel has grown quickly. It has built an expansive network of classrooms, “opened over 1700 schools and has 3,000 teaching staff in more than 200 cities” in China. It claims that one of its products, an AI-simulated human teacher, provides thousands of students with “a personalized learning plan and one-on-one tutoring, with 5 to 10 times higher efficiency than traditional instructions.”

Another company based in California, Cognii (2019), claims that its tools “create a new type of educational experience that benefits all the stakeholders in the education ecosystem - students, teachers, administrators, parents, and governments.” Its products use machine learning to give students “one-to-one tutoring” and “coaching best suited to each student, based on highly accurate open-response assessment.” Unlike human instructors in a physical classroom artificially intelligent programs can serve a potentially unlimited number of students. With enough processing power, AI programs can answer any number of students’ questions at any time. This can significantly reduce the workload for human instructors by letting the virtual instructor answer simple repetitive questions and allocating more time for advanced questions. This can even result in a cost-saving benefit for institutions because fewer humans are needed to assist classes.

Georgia Tech demonstrated virtual teaching assistants in a class (Goel and Polepeddi, 2017). A knowledge-based AI known as Jill Watson (JW) was used “for supporting learning at scale by automatically answering a variety of routine, frequently asked questions, and automatically replying to student introductions.” Goel and Polepeddi found that JW increased student retention rate for Massively Open Online Courses (MOOCs). MOOCs typically have a retention rate of less than 50% (Yaun & Powell 2013). With JW, the “retention ratio in the online section has been 75-80%, only slightly lower than the 80-85% in the residential sections” (Goel and Polepeddi, 2017). Students in this advanced college course could more easily get responses from the virtual instructor than from a human instructor. The virtual instructor quickly responded to simple questions from students and deferred advanced questions to human instructors. Squirrel and Cognii advertise such efficiency in their products.

Instructors and Potential Harm

Instructors who question technology in the classroom claim that personal devices distract students and undermine important human interaction. Professor Trevon Logan of Ohio State University saw grades rise in his economics course after banning all electronics during class (McKenzie, 2018). Of Logan’s students, “about 25 percent mentioned the policy in their open-ended course evaluations” and endorsed it.

The American Federation of Teachers (AFT) questions the place of for-profit educational corporations in classrooms as threats to “the trusting relationship among students, teachers, and their support staff” (AFT, 2018). AFT maintains that only educational technology of proven value belongs in classrooms and that “even the most sophisticated artificial intelligence cannot replace the many important one-on-one relationships students need to advance in school and

life.” According to AFT, the human connection in education equips students with “life’s lessons that help students grow and succeed” (AFT, 2018).

Critics also contend that classroom technology often contributes little to student’s education. AdvancED Research found that in “more than half of classrooms direct observations show no evidence students are using technology to gather, evaluate, or use information for learning; two-thirds of classrooms show no evidence of students using technology to solve problems, conduct research, or to work collaboratively” (van Broekhuizen, 2016). The research was, based on an analysis of “three years of direct classroom observations in K-12 schools across 39 states and 11 countries.”

Some instructors believe that technology can give a false sense of what learning is. Virginia Union University Dean, Matthew Lynch, believes that “learning does not always have to have a “fun” portion attached. Sometimes it is just challenging, but the payoff is greater” (Lynch, 2016). He also contends that technology allows more students to cheat and has shifted the way students view teaching, saying that “most interesting caveat of modern-day cheating in U.S. classrooms is that students often do not think that what they are doing is wrong.” Among United Kingdom Universities there was a “42% rise in cheating cases involving technology over...four years – from 148 in 2012 to 210 in 2016” (Marsh, 2017).

Administration Desires Despite Costs

Grade school administrators wish to stay relevant with rapidly evolving technology. Schools with the funds to incorporate technology into the curriculum do so because of the benefits promised by software companies. The implementation of classroom technology does not come without cost and research. The United States spent 1.87 billion dollars on education technology

in 2014 alone (CB Insights, 2015). More recently in 2018, “U.S. education technology companies raised \$1.45 billion” (Wan, 2019). On top of cost of buying the technology, investments need to be made to ensure faculty and students are effectively using it. Roselawn Condon Elementary School in Cincinnati Vice Principal Bonita Henderson stated that her school has “a full-time technology specialist who helps teachers and offers beginning computer classes for parents in the evening” and “also offer in-service training by companies from which [they] purchase software” (Education World, 2012).

While these purchases usually have good intentions, often software can go unused and hardware can become outdated. Glimpse K12 (2019) studied two billion dollars in purchases across 275 schools in the United States and “found on average that 67 percent of software licenses were going unused, though in some cases the number was as high as 90 percent.” This can be compared to wasted spending on “printed materials (28 percent).” This is the result of a lack of training for faculty and for buying more licenses for software than a curriculum needs.

Despite these costs, many school administrators see value in educational technology. Chris Kimball, a school superintendent in Washington, believes that “technology is a tremendous catalyst for teaching and learning. It can help accelerate, differentiate and automate. It connects students and faculty to resources unimaginable even a decade ago, and when used properly can catalyze thinking and expression for students that readies them for the future ahead of them” (Kimball qtd. in Krueger, 2009).

Low-Income Students and Technology Disparity

Students in Low-income areas are often left behind in introducing modern technology in the classroom. Some educational technology, such as instructional videos, require a high-speed

internet connection at home. This creates a divide between students that do and do not have access. According to a study by Pew Research, “17% of teens say they are often or sometimes unable to complete homework assignments because they do not have reliable access to a computer or internet connection” (Anderson, 2018). The reasons these students don’t have reliable internet access is because their families cannot afford it. “Four in 10 parents without a home computer (40%) or home Internet access (42%) say the main reason they do not have these items is because they are too expensive” (Rideout, 2016). In an effort to provide students with a modern technology-based education, low-income students fall behind because they can not do all the assignments assigned to them.

Schools in low-income areas also do not always have the funding provide the same level of education as other schools. According to Susan Patrick, president of the International Association for K-12 Online Learning, “some schools may have access to one-to-one pilots, and other schools have old infrastructure that is barely functional, so that kids don't have access to the computers” (Pandolfo, 2012). Furthermore, students are “not building their technology skills, they’re not able to access some of the courses and supplemental materials that would help them ramp up and be successful.”

A survey analysis of educators in Australian undergraduate institutions found that educators “at the undergraduate level commented that they expect their students to have acquired digital literacy skills through their secondary education” (Coldwell-Neilson, 2018). This is contrary to another finding in the same survey that “academics expectations are far higher than what they observe of students’ digital literacy capabilities and that digital literacy skills are not being adequately scaffolded and extended through the curriculum.” These expectations included skills like “understanding digital copyright” and being able to “manage their online identity.”

These increased expectations significantly disadvantage those that were not exposed to learning these skills during their secondary education.

Students and Independence

Most students in higher education believe that technology is beneficial to them. A McGraw Hill survey of over 3,300 students found that over 80% of students believe that technology has helped “improve their grades” and “improve their efficiency and effectiveness” (Reed, 2016). Students reported that “digital learning technology leads not only to better grades, but to improvements throughout students’ academic lives: 82 percent of students say digital learning technology allows them to spend more time studying through increased accessibility; 63 percent of students say it makes them feel better prepared for class.”

Technology gives students freedom and independence for how they learn. The same survey also reported that “most college students agree or strongly agree that digital learning technology should adapt to their unique way of learning (89 percent) and be individualized (80 percent).” Technology in classrooms enhances student independence to learn classroom material in a way that is most effective to them. One survey of over 4,000 middle school students found that “75 percent of students believe they learn well when working independently on a computer through guided digital learn” and “77 percent of students believe they learn well when working with a teacher” (New Classrooms, 2016). Including classroom technology may give students options in how they learn material, which may vary between subjects or even lessons.

Online education technology increases accessibility to people that would otherwise not be able to attend school. A study completed at the Georgia Institute of Technology found that “online education can provide mid-career training without forcing individuals to quit their jobs

or move to locations with appropriate educational institutions” (Goodman, 2017). People that do cannot physically attend a university due to restrictions such as family or work responsibilities can succeed through taking online classes. Digital technology can also open online learning to mass amounts of students in the extreme case of national emergencies. During the outbreak of COVID-19 in 2020, “At least 200 universities and colleges have canceled or postponed in-person classes” by midway through March (Coleman, 2020). Despite schools closing in-person classes, many students were able to successfully continue their classes online.

Schools and Cybersecurity

Increased technology in schools also creates new threats to security. Using technology like personal computers requires IT infrastructure and collecting student data. This source of information is vulnerable to attacks. “In 2017 and 2018, the education sector (K-12 and higher education) experienced 49 events exposing over 48 million records” (Spivak, 2019). Attacks like this have costed American tax-payers millions of dollars (Douglas, 2020). In 2019, “The largest attack cost a Texas district about \$2 million” (Schaffhauser, 2019).

According Malware Labs’s 2019 report, the education industry is the number one industry affected by Trojan malware and “education, which makes an appearance in nearly all of [their] threat categories, was hit hardest with adware in 2018” (Kujawa, 2019). This is because “Teachers, administrators, and support staff have access to highly-confidential student data that is housed online, and because they don’t know enough about cybersecurity, they can inadvertently allow for a breach” and “[students] are often not taught fundamental cybersecurity awareness at home” (Zamora, 2019).

Student privacy is also at risk when trusting schools with important information in order to use classroom technology because “schools are data-rich targets for cybercriminals, including the names, Social Security Numbers, and email addresses of students, their academic and health records, financial information, and more” (Zamora, 2019). “Student data showed up in more than 60 percent of the K-12 data breaches” and “that stolen data is showing up on dark web marketplaces, where it can be bought and exploited by identity thieves” (Schaffhauser, 2019). Attacked school systems can put students at risk of these potential dangers.

In order to protect students, schools must “ensure funding to support school districts in ongoing efforts to respond to cybersecurity threats and breaches, including technology, training, and updates to infrastructure” (Ng, 2020). These are additional costs to implementing technology on top of acquiring hardware and licenses for software.

Conclusion

The increase of classroom technology over the last couple decades has resulted in a paradigm shift of how teaching is viewed. Different groups with diverse agendas highlight various advantages while attempting to minimize the downsides of specific products to support their goals. This has come with many diverse viewpoints on what educational technology has to offer. Several benefits are often emphasized such as creating more efficient way for learning, giving students variety and independence, and increasing the number of students that have access to quality education. These developments are not without criticism. Critics argue that technology encourages poor behavior in learning, it creates a disparity for low-income families, it requires a lot of additional costs, and it can leave students vulnerable to privacy concerns. This tradeoff is

important to consider when assessing current classroom technology and evaluating new opportunities.

Ultimately, powerful technology supplements but cannot replace great teaching. To successfully implement educational technology requires lots of additional funding and training for faculty. When done incorrectly, technology can easily hinder learning and obscure educational goals. Technology has not progressed enough yet to effectively replace teachers in classrooms. Administrators should consider whether teaching efficiency is worth sacrificing the overall learning potential of their students. However, this is not to say that classroom technology should be abandoned entirely. When realized correctly, technology can greatly support a human teacher's learning objectives by helping reinforce concepts learned in class and giving students multiple different avenues to learn. All technologies should be studied in depth before being implemented into large communities and be constantly reevaluated for pros and cons. Teachers should be adequately trained to know the limitations and dangers of the technology being used. As time continues to progress, new technologies will constantly be developed and advertised to the educational market. These developments will further enhance potential benefits but also harms, and must be reviewed carefully to understand the consequences of these impacts.

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