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Integrating Online Learning and Technology in Education

This report offers an overview of current research on the integration of technology in education. While the use of technology in education continues to rise, scholars have come across a variety of obstacles including lack of teacher technology training, inequitable access to the internet, and overall social acceptance of technology.[1] Yet there are also unique opportunities for growth as technology allows greater student accessibility and autonomy.

The application of technology in learning occurs in three forms: hybrid, distance, and traditional classroom learning. This report discusses the efficacy of each avenue in detail based on studies conducted by education scholars. Each structure of learning offers unique pros and cons. Thus, a multitude of systems and programs may be necessary to ensure that technology is efficiently and effectively integrated into Vermont classrooms.[2]

Impediments to the Adoption of Technology in Education

Research indicates technologies such as virtual instruction and intelligent tutoring systems (ITS) offer distinct benefits for teaching and learning.[3] However, the challenges associated with implementation are significant. Successful integration of appropriate technologies in an education system requires more than providing internet connections and computers in classrooms.[4] Endeavors to positively impact educational outcomes with tech rarely succeed without a concerted, collaborative effort joined by educational planners, district supervisors, school-level administrators, and classroom teachers to fully understand and address the broad range of factors involved.[5]

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[1] G. Bull et al., "Preliminary Recommendations Regarding Preparation of Teachers and School Leaders to Use Learning Technologies," *Contemporary Issues in Technology & Teacher Education* 17, no. 1 (2017), accessed May 1, 2019, https://eric.ed.gov/?id=EJ1132387.

[2] U.S. Department of Education, Office of Educational Technology, "Reimagining the Role of Technology in Education: 2017 National Education Technology Plan Update" (Washington, D.C.: U.S. Department of Education, January 2017), accessed April 25, 2019, https://tech.ed.gov/netp/.

[3] Wenting Ma et al., "Intelligent tutoring systems and learning outcomes: A meta-analysis," *Journal of Educational Psychology* 106, no. 4 (2014): 901–18, accessed May 1, 2019, https://doi.org/10.1037/a0037123.

[4] Peggy A. Ertmer, "Teacher Pedagogical Beliefs: The Final Frontier in Our Quest for Technology Integration?," *Educational Technology Research and Development* 53, no. 4 (2005): 25–39, accessed May 1, 2019, https://www.jstor.org/stable/30221207.

[5] Ludwig Van Broekhuizen, "The Paradox of Classroom Technology: Despite Proliferation and Access, Students Not Using Technology for Learning" (Alpharetta, GA: AdvancED, 2016), accessed April 21, 2019, http://www.advanc-ed.org/sites/default/files/AdvancED_eleot_Classroom_Tech_Report.pdf.

Technology Integration Planning

Schools may procure advanced equipment to deploy new e-learning strategies for teaching and learning, but a lack of adequate planning has prevented the majority from achieving technological integration.[6] Where well-equipped classrooms exist, students' active use of technology for learning remains conspicuously low.[7] Research suggests a broad range of factors at play, including:

- the general lack of support and training teachers receive with developing blended lesson plans;
- administrators' resistance to fully embracing technology for fear of its effect on school culture; and,
- policies concerned with exacerbating inequalities among students of differing socio- economic backgrounds.

These factors indicate a systemic issue of underdeveloped and underutilized technology policies.[8] Technology integration planning reduces the potential for gaps between tech trends and the use of tech in schools by providing a blueprint for what schools hopes to achieve.[9] A technology policy plan should outline actions that reflect a local school community's expectations and goals concerning the integration of information and communication technology (ICT).[10] Ultimately, a shared commitment by managers, teachers and parents to a school-wide vision is necessary for success.[11]

Beyond vision building, the development of an e-learning program oriented to students' needs requires attention toward elements such as: professional development supports for educators; reconfiguration of learning spaces; and new measures for evaluating learning outcomes.[12] In addition, the steady pace of technological advance warrants administrative flexibility. Planners should conduct periodic reassessments of policies with a willingness to make adjustments.[13] However, as new technologies enable new educational experiences, schools must work to keep the learning environment aligned with their pedagogical objectives.[14]

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[6] Cher Ping Lim et al., "Bridging the Gap: Technology Trends and Use of Technology in Schools," *Journal of Educational Technology & Society* 16, no. 2 (2013): 59–68, accessed May 1, 2019, https://eric.ed.gov/?id=EJ1016573.

[7] Ludwig Van Broekhuizen, "The Paradox of Classroom Technology."

[8] Cher Ping Lim et al., "Bridging the Gap."

[9] Cher Ping Lim et al., "Bridging the Gap."

[10] R. Vanderlinde, J. Van Braak, and J. Tondeur, "Using an Online Tool to Support School-Based ICT Policy Planning in Primary Education: School-Based ICT Policy Planning," *Journal of Computer Assisted Learning* 26, no. 5 (October 2010): 434–47, accessed May 1, 2019, https://doi.org/10.1111/j.1365-2729.2010.00358.x.

[11] Yasemin Gülbahar, "Technology Planning: A Roadmap to Successful Technology Integration in Schools," *Computers & Education* 49, no. 4 (December 1, 2007): 943–56, accessed May 1, 2019, https://doi.org/10.1016/j.compedu.2005.12.002.

[12] Helena Rodrigues et al., "Tracking E-Learning through Published Papers: A Systematic Review," *Computers & Education* 136 (July 1, 2019): 87–98, accessed May 1, 2019, https://doi.org/10.1016/j.compedu.2019.03.007.

[13] Barry J. Fishman and BaoHui Zhang, "Planning for Technology: The Link between Intentions and Use," *Educational Technology* 43, no. 4 (2003): 14–18, accessed May 1, 2019, https://www.jstor.org/stable/44428843.

[14] Helena Rodrigues et al., "Tracking E-Learning through Published Papers."

Even after conducting a robust planning process, the introduction of advanced technological tools in classrooms can fail to produce positive outcomes if implemented poorly.[15] The process of e-learning adoption requires significant investments in dedicated IT staffing and human resources training.[16] Leaders will also need to identify solutions to the challenge of extending connectivity to the homes of all students so that access to the types of learning made possible in schools is not limited to the premises.[17]

Funding for Equitable Access to Reliable Internet

Another barrier to technology integration in schools is the disproportionate access to electronic devices and reliable internet. This socioeconomic disparity is often referred to as the "digital divide," in which unavailability of internet and unaffordability of tech devices limits who has access to online education.[18] There are some existing systems intended to close the divide. For example, E-Rate, a program funded by the Universal Service Fund, "provides discounts for telecommunications, Internet access and internal connections to eligible schools and libraries."[19] Yet, the process of applying for and receiving the grant is not straightforward and although the program prioritizes the highest poverty applicants, those that would be eligible may not have the knowledge and skills necessary to apply.[20]

Benefits and Challenges of Applying Technology in the Classroom

For students with learning disabilities, integrating technology in the classroom has benefits and obstacles. Technology allows more student accessibility and autonomy. Yet, successful integration into the classroom requires that students learn how to navigate the internet proficiently and avoid distractions.

Student Accessibility

For teachers whose students have learning disabilities frequent assessment is required to ensure that they are meeting their benchmarks.[21] Digital tools, such as the online assessment application Socrative, give teachers real-time feedback allowing them to design their lesson plans in accordance with students' needs while also recognizing students' growth.[22] Online assessment tools also reduce the time that teachers normally spend grading, therefore providing more time for valuable tasks such as lesson

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[15] Donatella Persico, Stefania Manca, and Francesca Pozzi, "Adapting the Technology Acceptance Model to Evaluate the Innovative Potential of E-Learning Systems," *Computers in Human Behavior* 30 (January 1, 2014): 614–22, accessed May 1, 2019, https://doi.org/10.1016/j.chb.2013.07.045.

[16] Samantha Adams Becker et al., "Horizon Report 2018 Higher Education Edition" (Louisville, CO: EDUCAUSE, 2018), accessed May 1, 2019, https://www.learntechlib.org/p/184633/.

[17] Samantha Adams Becker et al., "Horizon Report 2018 Higher Education Edition."

[18] Susan Thomas, "Future Ready Learning: Reimagining the Role of Technology in Education. 2016 National Education Technology Plan," (Office of Educational Technology, US Department of Education, January 2016), accessed April 25, 2019, http://eric.ed.gov/?id=ED571884.

[19] Federal Communications Commission, "E-Rate: Universal Service Program for Schools and Libraries" (FCC, February 9, 2018), accessed May 5, 2019, https://www.fcc.gov/sites/default/files/e-rate_universal_service_program_for_schools_and_libraries.pdf.

[20] Federal Communications Committee, "E-rate."

[21] Ciampa, "Building Bridges between Technology and Content Literacy," 103.

[22] Katia Ciampa, "Building Bridges Between Technology and Content Literacy in Special Education," *Literacy Research and Instruction* 56, no. 2 (April 3, 2017): 85–113, accessed May 5, 2019, https://doi.org/10.1080/19388071.2017.1280863.

planning.[23] Integrating technology "[appears] to increase their students' productivity and outputs by accelerating their students' rate of learning."[24] This is because for students with learning disabilities, assistive technology tools such as word prediction and speech-to-text help them overcome the physical barrier of writing by hand. In addition, sharing their projects with peers or online, motivates students to take pride in their work and in turn, produce higher quality assignments.[25]

Student Autonomy

Another beneficial aspect of online learning is the ability for student autonomy and interest-based learning. With technology, teachers can cater to unique learning styles and interests, motivating students to learn by allowing them to pursue areas of study they find especially interesting. For example, using "multiple means of expression" (various types of media to display information) boosted students' performance, overall achievement, and willingness to engage.[26] Further, by using technology, students can access content at home, allowing for continued learning outside the classroom.

There are obstacles to applying e-learning tools in the classroom. Students, particularly those with learning disabilities, often lack the analytical skills necessary to effectively conduct online research.[27] Given that students with learning disabilities can become overwhelmed when performing complex tasks, some classrooms use chunking, a tool that, "minimizes the number of new technical skills introduced, so that the focus remains on learning the content of the lesson and not on learning the tool."[28] In addition, it is often challenging for students to find information on the internet as sources often exceed their reading ability.[29] Thus, for students who struggle to read, online reading can be overwhelming. Finally, one universal concern about technology in the classroom is the heightened access students have to distracting content. Steps can be taken to address distraction, including limiting or blocking websites, using software that monitors student's online activity, and even configuring the classroom so that the students' screens are visible to the teachers.[30]

Types of Online Learning

Online learning encompasses a wide range of educational activities and resources presented to students via the internet.[31] An online curriculum can be administered in three distinct ways: through entirely online distance learning, integration into a traditional classroom setting, or through a blended model. Online distance learning refers to a method of teaching done either entirely or almost entirely via the internet.[32] Under this model, in-person interaction between students and instructors may be very limited or even non-existent. Instead learning is largely self-directed, as students complete assigned

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[23] Ciampa, "Building Bridges between Technology and Content Literacy," 103.

[24] Ciampa, "Building Bridges between Technology and Content Literacy," 99.

[25] Ciampa, "Building Bridges between Technology and Content Literacy," 101.

[26] Ciampa, "Building Bridges between Technology and Content Literacy," 100.

[27] Ciampa, "Building Bridges between Technology and Content Literacy," 97.

[28] Ciampa, "Building Bridges between Technology and Content Literacy," 103.

[29] Ciampa, "Building Bridges between Technology and Content Literacy," 97.

[30] Nicole Mace, "8 Strategies for Using Technology in the 21st Century Classroom" (Concordia University-Portland, August 7, 2018), accessed May 5, 2019, https://education.cu-portland.edu/blog/classroom-resources/using-classroom-technology/.

[31] Digital Learning Collaborative, "Snapshot 2019: A Review of K–12 Online, Blended, and Digital Learning" (Evergreen Education Group, April 2019), accessed May 5, 2019, https://www.digitallearningcollab.com/snapshot.

[32] Digital Learning Collaborative, "Snapshot 2019."

lesson plans with the assistance of online instructional tools or remote contact with an educator.[33] Online learning does not, however, necessarily have to be done from a distance.

Educational technology can also be integrated into traditional classroom settings. In this method, technology is used to assist and supplement instruction from an actual teacher, and students still attend a physical school during weekdays.[34]

In between distance learning and integration into a traditional setting are blended models of online learning. Blended learning "describes any combination of online learning and site-based, face-to-face education."[35] This definition includes schools in which curriculum is delivered through a mixture of distance learning and either traditional in class time or in person tutoring time. Each of these definitions is relatively broad and leaves significant room for variance. Within blended learning courses alone, there is a range, on average, of 30-79 percent of content being delivered via an online medium.[36]

Efficacy of Online Learning Models

Many scholars study the efficacy of online and blended learning models in comparison to traditional forms of classroom instruction.[37] On average, fully online distance education produces learning outcomes that do not differ substantially from traditional classroom instruction.[38] Still, there is wide variability between studies, as some favor distance learning and some favor classroom instruction. Blended learning has recently been thought of as the "best of both worlds," combining the efficacy of online and classroom learning.[39] Research has supported this notion, demonstrating blended learning models to be, on average, slightly more effective than traditional learning.[40] However, Means et al. caution against construing these results as evidence that online learning is superior as a medium: "Rather, it is the combination of elements in the treatment conditions, especially the inclusion of different kinds of learning activities, that has proved effective across studies."[41] Any conclusion drawn from research on online learning outcomes must, therefore, recognize the wide variety of factors that determine results, as well as the ever changing technological base for online education.

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[33] Digital Learning Collaborative, "Snapshot 2019."
[34] Digital Learning Collaborative, "Snapshot 2019."
[35] Digital Learning Collaborative, "Snapshot 2019."
[36] Maria Joseph Israel, "Effectiveness of Integrating MOOCs in Traditional Classrooms for Undergraduate Students," *The International Review of Research in Open and Distributed Learning* 16, no. 5 (September 29, 2015), accessed May 5, 2019, https://doi.org/10.19173/irrodl.v16i5.2222.
[37] Peter Serdyukov, "Innovation in Education: What Works, What Doesn't, and What to Do about It?" *Journal of Research in Innovative Teaching & Learning* 10, no. 1 (April 3, 2017): 4–33, accessed May 3, 2019, https://doi.org/10.1108/JRIT-10-2016-0007.
[38] Bernard et al., "A meta-analysis of blended learning and technology use in higher education: from the general to the applied", *Computer Higher Education,* (2014), 88, accessed May 1, 2019, https://link.springer.com/content/pdf/10.1007%2Fs12528-013-9077-3.pdf.
[39] Bernard et al., "A meta-analysis of blended learning and technology use in higher education."
[40] Barbara Means et al., "The Effectiveness of Online and Blended Learning: A Meta-Analysis of the Empirical Literature," *Teachers College Record* 115, no. 3 (2013), accessed May 5, 2019, https://www.sri.com/sites/default/files/publications/effectiveness_of_online_and_blended_learning.pdf.
[41] Means et al., "The Effectiveness of Online and Blended Learning".

Physical Space of Schools

Another shift that has been prominent among newly developing models of education involves the physical space of the classroom. Educational scholars note the importance of academic architecture, emphasizing how learning is influenced by the space in which it occurs.[42] In this context, changes have been employed to improve the efficiency of classrooms beyond simply addressing capacity and acoustics. Most of this research into classroom design has occurred at the college undergraduate level, notably with North Carolina State's 'Student-Centered Active Learning Environment for Undergraduate Programs' (SCALE-UP) project.[43] The classrooms designed in this project facilitate group work by large numbers of students (100 or more), and include laptops, 7-foot diameter round tables, projection screens at opposite ends of the room, and large whiteboards.[44] The round tables are key in reducing the inadvertent discrimination of an instructor's attention experienced by students in back rows of classrooms. Nationwide, 250 colleges and universities have adopted SCALE-UP classrooms for instruction in a variety of subjects.[45]

Like learning spaces, the structure of actual schools themselves have changed greatly with the advent of technological integration. Oasis High School in Aptos, California, for example, is a blended learning institution with a physical structure that does not resemble traditional schools. Students on Oasis' campus work as much or as little as they choose, completing the rest of their coursework online.[46] The campus itself constitutes five open office rooms, including a small kitchen and meeting space. Students schedule meetings with tutors or work independently in central workspaces. In schools such as Oasis, the structure of the campus reflects its purpose. Learning is largely self-directed, and workspaces exist as a means by which to facilitate interaction with a tutor.[47]

Conclusion

The prevalence of online learning has increased greatly over the last 20 years. However, when integrating technology in classrooms, administrators must weigh its benefits and costs. Technology allows for greater accessibility for students with learning disabilities. It also gives students greater autonomy over their education and, for some, more motivation to engage. Yet there are also barriers to implementation such as funding, inequitable access to information and communication technologies, and the complexity of technology integration planning.

There are three main models for implementation; hybrid, distance, and incorporation into traditional classroom learning. Due to the variability of implementation styles within online and blended learning models, the efficacy each process differs widely. On average, online models are roughly equal to the outcomes of traditional classroom instruction, however, blended learning models tend to produce higher learning outcomes. The model of education is not the only factor that impacts the quality of education. The physical space in which learning occurs has a vital role in how students learn. Newly

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[42] Elisa L. Park and Bo Keum Choi, "Transformation of classroom spaces: traditional versus active learning classroom in colleges," *Higher Education* 68, no. 5 (November 1, 2014): 749–71, accessed May 5, 2019, https://doi.org/10.1007/s10734-014-9742-0.

[43] Elisa L. Park and Bo Keum Choi, "Transformation of classroom spaces."

[44] Elisa L. Park and Bo Keum Choi, "Transformation of classroom spaces."

[45] Elisa L. Park and Bo Keum Choi, "Transformation of classroom spaces."

[46] Digital Learning Collaborative, "Snapshot 2019."

[47] Digital Learning Collaborative, "Snapshot 2019."

designed classrooms and schools have attempted to account for technological development encouraging group work in common spaces and self-directed learning.

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