Digital Learning: Responses to the Rise of Technology in Public Education

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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Technology can extend classrooms beyond the confines of school buildings, reduce costs, and personalize the learning experience for students to grasp complex or intimidating subjects. It can close the "educational outcome gap" between races that has historically generated less opportunities for disadvantaged groups in the workforce (Kim, 2018). However, technology can also introduce new barriers of cost or usability, serve primarily as an excuse to raise student-to-teacher ratios, or interfere with educationally valuable interpersonal relationships (Startz, 2019).

How have students and educational staff responded to the allocation and inequitable effects of educational technology in U.S. public education for the past 10 years? Educational technology (EdTech) is technology that supports teachers' and students' instructional and educational needs (Earle, 2002). Voices from educators, government officials from the Department of Education, and students' families reveal discrepancies in the application of classroom technology and distribution of technological resources between public school communities across the country.

Review of Research

The U.S. Department of Education's Office of Educational Technology (OET) funds EdTech for public education and regulates policies concerning digital education in the classroom (Steyer, 2014). To reduce access inequities in K-12, the OET promotes personalized learning and broadband network connectivity. The International Society of Technology in Education (ISTE) hosts conferences and sets EdTech standards (Tsybulsky, 2020).

Keengwe et al. (2012) observe that technology in the classroom can boost academic performance and connect students to a wider range of resources on the Internet. Selwyn (2016),

however, cautions that EdTech's application can widen the educational access gap associated with the digital divide. Rollins and Bailey (2014) assess the goals of "integrating technology and education" that have been "outlined by the school districts" and reaches out to the teaching staff about the policies' effectiveness. From a survey of 250 teaching staff, Rollins and Bailey (2014) concluded that technology budgets should be based upon the "technology needs of faculty and students," and that EdTech tools should serve school districts' "curriculum goals."

Public school teachers disagree about the proper place of technology in education and caution that access to web-based educational resources also opens doors to distracting or harmful content by extending already excessive screen-time (Arnold-Schwartz, 2019). Wexler (2019) opposes EdTech, contending that evidence of its value is "equivocal at best" and references the digital divide. Purcell et al. (2020), however, find that many teachers welcome EdTech for its capacity to support various learning styles and promote a "more engaged environment." Albert et al. (2014) propose that EdTech developers apply a "Community of Inquiry (CoI)" framework so that their products foster and integrate social, cognitive, and teaching presences.

Koebler (2011) encourages the use of students' phones in the classroom, stating that, with proper cell phone etiquette, these devices can be a cost-effective and feature-filled asset to the learning environment. Barnwell (2016) contemplates the balance of student's handheld devices between its productive applications in research and its distractive entertainment features in social media. Brown (2020) has a strict "No Cellphones" policy in his classroom because of their disruption to the flow of the class and their ability to distract other students around trying to focus on course content.

Early Adopters of EdTech

Educators that define themselves as early adopters of technology in the classroom boast higher engagement and efficiency using new EdTech instructional tools. Veletsianos and Moe (2017) assert that the rise of educational technologies is "symptomatic to the technocentric belief" of technology being the most effective solution in all fields. Through iterative piloting and rapid feedback, Ganimian and Vegas (2020) believe technology-based education can scale up standardized instruction and increase student engagement. Lynch (2017) praises EdTech's efficiency in enhancing collaboration between students in remote classrooms, reducing teacher workload in automated grading, and engaging students in more creative ways during lectures.

The push to personalize learning has led both teaching staff and students' families to promote EdTech in school districts. Personalized learning means having individual "learning plans" for each student instead of a "one size fits all" traditional approach, customizing education to the needs of each child (Morin, 2020). France (2018) uses technological models like Responsible Classroom's interactive modeling to encourage building routines and strengthening social and emotional competencies in their abilities. Torchia (2021) highlights the wealth of resources EdTech has to offer for special needs students during virtual learning. Personalized learning is just the beginning, Lynch (2020) believes, as data-driven solutions trend in the education industry. Adaptive learning, which uses computer algorithms to tailer custom learning plans to each learner, and augmented intelligence, which uses the help of artificial intelligence to enhance cognitive performance, are predicted to push past the boundaries of current personalized teaching strategies (Lynch, 2020).

The cost- and resource-saving measures of online educational tools have inspired faculty and staff to transition into EdTech. On average, $50,000 is allocated annually for paper and ink

costs for K-12 schools and, for every $1 spent on printing, an additional $9 is spent on the management and services for the equipment (Samson, 2018). Many school districts are moving toward a paperless environment, using online services like Blackboard and Moodle to store course content, assign homework, and host exams (Craven, 2017). Buck (2016) interviews digital learning specialist Kerry Gallagher who emphasizes the availability of classroom content and grades, the ease of organizing lecture material, and the time-saving benefits of auto-grading for public school teachers. Educators have also been able to reclaim space in their physical classroom without the need for hard copies and utilize the room for more collaborative activities for students (Breed, 2019).

Teachers speak of the necessity of technology-assisted learning during the COVID-19 pandemic, a time where virtual schooling may be the only option. Greene (2020) speaks to the recent necessity of EdTech for public schools during the pandemic that forced school districts into virtual learning. Online learning platforms have scaled up their servers and offered free services to school districts in response to the rapid transition to remote learning (Li & Lalani, 2020). A survey from the EdWeek Research Center shows 87 percent of teachers increasing their training to use EdTech during school building closures (Bushweller, 2020). Li and Lalani (2020) also predict that technologies supporting the current learning environment will cause the entire education system to shift to a new hybridized model after the pandemic.

The incentive of EdTech's scalable qualities is getting more teachers and parents on board with technology-enhanced learning. Investors once believed the educational industry to be a "get-rich-slow, incremental growth" market before the rise of the digital age (Segal, 2014). Studies conducted by Renub Research currently predict the value of the online education market to reach $350 billion by 2025, tripling its value of $107 Billion in 2015 (McCue, 2018). Segal

(2014) attributes the boom in the education market to big data and on-the-go learning. Gilchrist (2020) acknowledges the increasing online presence of education and supports the training necessary for more teachers to be better prepared for handling digital tools. Funding from government programs, such as the $4 billion Broadband Technology Opportunities Program (BTOP) grant, also provides technological support for communities that lack Internet infrastructure and broadband services (Lee, 2020). The investment of technology-enhanced education from governmental agencies and EdTech companies gives Anderson (2019) confidence in equipping teachers with the knowledge and skills to integrate technology powerfully in class.

Technological Distrust in the Classroom

Teachers against EdTech argue about the distracting presence that technology has on students. Oppenheimer (2004) warns about technology's damaging control in the education system and hindering of students' abilities to reason, listen, and empathize. A study conducted by Neiterman and Zaza (2019) found that 49 percent of 378 students surveyed believed "off-task", or non-instructional, technology usage posed a distraction in the classroom. Teachers surveyed in the study resorted to using one of three methods for dealing with classroom technological use: tolerating the distractive devices, minimizing its uses by explaining the detrimental effects, or incorporating them into classroom activities (Neiterman & Zaza, 2019). Hazelrigg (2019) supports these claims stating that it will continue to be an uphill battle for educators to compete with the social media networks designed to attract attention.

The controversy over the ability to multitask has steered teachers away from incorporating technology in the classroom. Glass and Kang (2018) reveal a connection between

cellphone and laptop use in class and poorer exam scores, concluding that dividing attention between technological devices and lectures might not reduce the "comprehension" of the lecture content but can reduce "long-term retention" of the material. Sana et al. (2013) claim that public displays of multitasking using technological devices not only impair the learning ability of the "multitaskers" but also of those around them. Stenger (2013) agrees by explaining that the declarative memory, the part of your brain that stores and recalls facts or concepts, is best strengthened when focusing directly on the task at hand.

The inequality of technological accession has grown concerns for families living in poorer neighborhoods. Because public schools are funded through local property taxes, inconsistencies emerge in the accession technological resources between school districts, resulting in educational impairment for students with lower socio-economic statuses (Finley, 2020). Kim (2019) brings focus to students from rural towns living "off the grid" lifestyles that lack the technological competencies to understand material on laptops and smartphones. Dixon (2020) discusses the "digital divide" between students that have access to personal computers, educational software, and high-speed internet and students that need to share one family computer with unreliable or limited network connectivity. Green (2000) finds race and ethnicity a major factor in this divide, stating that the gap of home ownership of computers between White and African-American students has increased in recent years. In 2017, a study revealed that of the 53 percent of K-12 public school students in minority groups, only 60 percent of these families have access to computers or broadband networks in their household (Perrin & Turner, 2020). Lieberman (2020) urges education groups to share resources to collectively improve technology accession for students in non-white, rural, and low-income homes.

Parents and educators fear that the technological surge in the education system is contributing to device addiction and mental health issues. Public schools like Crestview High School have begun banning student electronic devices throughout the school day in hopes to control the addictive content of social media (Kano, 2019). Studies have attributed excessive cellphone use to feelings of anxiety and depression in adolescents through negative online social environments (Shoukat, 2019). Michael Mercier, a researcher of screen addiction and President of the non-profit organization Screen Education, explains how the toxic digital presence can lead to declining mental and physical health, shortening attention spans, and decreasing productivity as interests are diverted toward the "online world" (Forstmann, 2018). The predatory social media content cause Glass and Kang (2018) to recommend alternatives to bringing cellphones and other non-educational technologies to school.

Internet safety and cyberbullying have been a major topic of conversation in school districts around the US. Cyberbullying, a type bullying in the form of social media and other online communication platforms, has become rampant as more K-12 students build their online presence (Hinduja & Patchin, 2019). Data from the 2011 Youth Risk Behavior Survey began asking questions about electronic bullying and suggest detrimental effects to emotional well-being and social standing of adolescents at a "vulnerable stage in their development" (American Academy of Pediatrics, 2013). With one in six high school students admitting to being cyberbullied in the survey, school districts are responding with strict policy guidelines that carry major punishments to those crimes (Edouard-Vincent, 2014).

Legislation, Regulations, and Allocation of Educational Technologies

Since the initial push for technological innovation in the classroom, regulations have been placed to ensure the proper use, allocation, and control of the tools. With the industry valued in the billions, the Department of Education's OET ensures proper use of technology in public school districts and provides funding for more essential educational technologies (Rice, 2020). With new EdTech tools tailored to personalize learning, states are introducing data privacy laws surrounding the collection, use, or disclosure of student information (Corcoran, 2015). Singer (2015) backs this claim by referencing Georgia's law which bars online services from sharing student academic information, Delaware's law which forbids virtual platforms from selling personal student website data, and other bills recently introduced to bolster protection for student information online. The National Institute of Standards and Technology (NIST) works to guide the EdTech industry in data security measures to prevent breaches (Johnson, 2016).

Funds and services allocated by organizations and governmental departments provide support for students. The U.S. Department of Education recently pushed to require open licenses for competitive grant programs with the goal of sharing quality resources created from educational grants to all students in need (South, 2017). Jim Fruchterman, CEO of Benetech and a fellow grantee, utilized grant funds to aid visually impaired students in accessing graphical content in educational books across the country (South, 2017). Additionally, Jenkins (2021) highlights a program called Standards First program created by the leading non-profit collaborative Instructional Management System (IMS) Global Learning Consortium that supports interoperability between EdTech suppliers and school districts. Abel (2021) supports this program referring to its benefits in integrating technology-based educational tools for teachers and improving availability of useful data across platforms. Furthermore, the ISTE has

focused on expanding technological training for teachers unfamiliar with virtual tools in response to the push for remote learning due to COVID-19 (Belastock, 2020).

Further assessment of school district needs may better analyze the scalable limitations of EdTech. Ganimian and Vegas (2020) seek to diagnose the specific needs to improve student learning, the current infrastructure's ability to adopt technology-enabled solutions, and the capacity to integrate technology in the instructional process. Vegas et al. (2019) contemplate the placement of technology in the classroom and bring focus to reinforcing traditional teaching practices using technology-based tools. Popular metrics like the Measures of Academic Progress (MAP) created by the Northwest Evaluation Association can be used to understand the influence of technology-based learning on student growth in math and reading (Wan, 2016). Rather than using technology for "intense drill and kill exercises", Vegas et al. (2019) believe EdTech should complement preexisting learning models by providing real-time feedback and creatively applying and evaluating what students have learned.

Looking Toward the Future of Education and EdTech

With technology-driven solutions trending in the education system, experts analyze current implementations to predict the possibilities of EdTech for future generations. Since the first wave of COVID-19 hitting the U.S. in March 2020, an estimated 1.4 billion students worldwide were forced to transition to an online learning environment (McCarthy, 2020). This spurred both the EdTech industry and public school districts to focus on where to scale and improve their resources. The latest trends from Forbes Business Insights show artificial intelligence and machine learning technology leading in the smart classroom research and development industry with the hopes of boosting creative learning opportunities and engaging

students further (Versace et al., 2021). Studies show EdTech usage in the classroom jump from 42 percent in 2016 to 65 percent in 2020, explaining the growth of online learning services like Zoom, Blackboard, Ellucian, and many other EdTech startups (Gossett, 2020).

Teachers are hopeful about the promise of improved educational software as the EdTech trend continues to flourish. In 2015, a Pearson Education Study of more than 2,000 students showed 78 percent of elementary school students used tablets for their schoolwork and nine out of 10 students believe these handheld digital devices will "change the way students will learn in the future" (Daccord & Reich, 2015). Lynch (2016) is optimistic about assistive technologies for the estimated 6.5 million students in the U.S. with disabilities, hoping that these students can enjoy a comparable educational experience as their peers. Hance (2018) expects the cost of augmented reality to decrease so that students can enjoy the immersive experience of interacting with visual learning environments for notoriously difficult subjects in the classroom.

Skeptics warn about potential downfalls of future educational technologies. The Every Student Succeeds Act, or ESSA, is a metric supported by President Barack Obama in 2015 that helps gauge the effectiveness of EdTech, among other tools, when applied to a real classroom environment (Loewus, 2017). Rice (2019) argues that only a handful of technology-based tools received high ratings using the ESSA metric and personalized learning does not imply using technology-based services. Escueta et al. (2017) warn about the lack of rigorous evidence of educational technology programs before being adopted by schools and suggest extensive studies for future software tools. Arnold-Schwartz (2019) urges the EdTech industry and its investors to stop thinking about education as a market and start thinking about students as the future generation of our society.

Conclusion

Technology has changed the education system far beyond traditional norms, resulting in controversial opinions between parents and teachers. The eclectic selection of educational technologies introduces new practices and resources such as personalized learning, online teaching environments, and instructional digital devices that can improve the educational experience for public school students across the country. Parents praise the technologically-enhanced resources for their children, especially with the hinderance of the recent COVID-19 pandemic, and teachers attribute EdTech to effective instructional strategies. However, disagreements arise in the application and allocation of EdTech as studies reveal inconsistencies of technological availability in historically disadvantaged neighborhoods, mental health and information retention issues from classroom devices, and predatorial behaviors from the technology and social media industry. Experts conduct surveys and implement analytical metrics to provide regulators information to control the placement of EdTech and offer support for educators and students to succeed in the digital education system.

As technology-enhanced solutions fueled by data-driven analyses take hold on industries worldwide, it is crucial to understand the capabilities and limitations of technology's influence, especially when involving the future generation of adults. Rather than focusing purely on the financial gains of online educational platforms and endless possibilities of technological progress, industry professionals should orient their priority to the needs of K-12 students and their potential for success in the working world. The goal of the education system should continue to revolve around the ability for adolescents to collaborate and excel in today's increasingly complex society.

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