Educational Technology in K-12 Classrooms: Who Decides?

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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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In 2020, the Institute of Education Sciences reported that 45 percent of schools in the United States have a computer for every student (Gray & Lewis, 2021). Today, educators can assign digital homework, stream virtual lectures, entertain students with online review games, and choose from a host of tools that digitize and organize the classroom. Rising prevalence of educational technology in kindergarten through grade 12 (K-12) classrooms has raised questions regarding how, where, and why these technologies should be used. Educators scramble to find the best combination of educational technologies, whether to prepare their students for careers, to improve their learning, to promote their personal growth, to foster civic responsibility, or to inculcate a capacity for responsible autonomy. Parents disagree about educational technology because they disagree about the good that education ultimately serves. Vendors' material interests make them consistent proponents of educational technology, though instead of citing their interests in such promotion, they invoke broadly held educational ideas and values. Students also respond to the technology in their schools. To promote the educational technology policies they favor, educators, parents, technology companies, and students strive to legitimize the educational philosophies that comport with their policy positions. Conversely, they characterize the technology policies that they oppose as threats to a sound education.

Review of Research

The use of educational technologies has been studied extensively. In 2018, researchers reviewed the concept of gamified online learning and suggested a related conceptual learning model (Ohn et al., 2019). During the COVID-19 pandemic, researchers evaluated teaching strategies employing educational technology in emergency remote learning (Crompton et al.,

2021). Nold and Williams (2004) compiled ways laptop computers are used by high school students. This research helps corroborate the experiences and observations of participants in the use of educational technology.

Researchers have also investigated various groups' perception of educational technology. Simsek (2005) compiled opinions of educational technologists to provide an outline for future research conducted on educational technology. In a 2021 survey, researchers found that most parents support technology use in classrooms (Maxwell, Kamp & Cullen, 2021). Tahir and Arif (2016) analyzed parents' attitude toward mobile technology in children's education, seeking to provide guidance for addressing concerns of parents. Maden (2012) identified characteristics among teachers that affected their disposition toward educational technologies. This research provides insight into the overarching goals of groups sharing their views on educational technology.

Educational Technology and People – Who says what?

What are teachers saying to each other about educational technology?

Educators coordinate with one another to identify valuable educational technologies. Educators have found success with software tools that gamify learning and can be found sharing their experience with peers. In a review of the interactive assessment tool Quizizz, one teacher said: "Quizizz is a great teaching tool. It creates a quiz environment that is light and fun with the game like atmosphere and memes for students after each question. The quizzes can be taken asynchronously which allows students to work at their own pace, on their own time" (Mikaela Y., 2021). In another review, elementary school teacher Michelle L. commented: "Easy to grade! It was very useful for the mandatory vocabulary tests. It graded them for you and allowed you to

print each student's individual quiz as needed" (Michelle L., 2020). Kahoot!, a review game where students compete against one another in real time, found similar success among teachers. Bailey W. (2022), a teacher from Maryland, wrote: "Overall, I think Kahoot! works really well in the classroom and engages students in a way that perhaps a normal quiz or review task would not. With a competitive nature, this allows students to practice the material all while participating in a game with their peers. Seeing students getting excited about the material and getting questions right is one of my favorite things." Janet L. (2022), a middle school teacher, added that: "I think it is a great teaching tool because it is a fun and engaging way to get your students to review concepts. I like that there's a huge bank of Kahoots already created." In a forum post discussing classroom games, a teacher wrote: "I've used Kahoot! and Quizizz for reviews, as well as Boss Battles in Classcraft. The new one that they LOVE (sixth grade) is Blooket... When they are having fun reviewing, they get super-loud. For more extended problem-solving and critical thinking, I use Breakout EDU" (Singvogel, 2021). Educators value one another's opinions and are quick to promote educational technologies that work.

Educators sometimes clash with vendors of educational technology because of monetization strategies. In a review of Quizlet, a digital review tool, one teacher commented: "Quizlet used to be a great platform for studying and learning in a fun way. It was especially a lifeline for my low-income students. Now almost every feature has been locked behind a paywall, making it useless for anything except digital flashcards. I have stopped using the website and am currently searching for alternatives" (Sophia G., 2023). Subscription based services in particular incite this sentiment. In a post about Kahoot!, one educator wrote: "I used Kahoot a couple of times, it used to be so much fun. Now it is paid, and boy are you being milked. A thousand different subscriptions, and all of them super expensive. Dont let the price

fool you tho - even a fat yearly (!) subscription will only get you extremely limited access" (Fokkens, 2022). Cost can cause problems even when educators believe a technology is worthwhile. In an article about Lexia, a popular literacy product, school administrator Christopher Dawson wrote: "Lexia is expensive. As in I could put together a few really nice computer labs for what I'd be spending on Lexia. Of course, these labs aren't of much use without software and Lexia does a great job both of remediating and allowing students to work ahead." Through these reviews and complaints, educators attempt to influence existing educational technologies – if enough educators become dissatisfied with a product, the material interests of the vendor are at risk.

What technology belongs in K-12 classrooms? A divisive question.

Some parents object to new classroom technologies. Alexander Hume, a parent with children in elementary school, fears that "we are creating addictions, distractions, dependencies, and they [the students] are missing out on a sensory learning experience" (Hume, 2018). Concerned parents organize to influence school technology policies, as those who established Parents Defending Education did. Groups like Parents Defending Education direct these parents to further their own agendas. Parents Defending Education opposes the inclusion of sexual orientation, gender, and race in school curriculum. Recently, the group has started to speak out against classroom use of TikTok and similar apps (PDE, 2023). On a Parents Defending Education post asking members whether they would allow the use of TikTok for assignments, Dianna McMillan commented: "No I would not, what does a social app have to do with teaching kids? [thinking emoji] just teach the normal way, white board, chalk board, PAPER pencil ……wth is wrong with schools?" (McMillan, 2022). If this PDE parent is expressing an aversion to all digital technology in classrooms, her position is not representative of parents of K-12

students in general; in a 2021 survey, researchers found that most parents support technology use in classrooms (Maxwell, Kamp & Cullen, 2021). Parents appeal to the judgement of educators and other parents to influence which educational technologies are added to the classroom.

Educators believe that forcing technology into classrooms is disruptive. The COVID-19 pandemic caused many schools to adopt remote learning; meeting services like Zoom and digital assignments became essential. The transition was often hard. One teacher worried for students learning English in a forum post: “the whole point is to be exposed to as much English speakers as possible, in addition to that one hour of ELD class. Sitting at home with their Spanish only speaking family and being online for a few hours a day wouldn't work” (Linguist92021, 2020). The remote learning shift harmed teachers as well. An anonymous educator wrote: “I work until midnight each night trying to lock and load all my links, lessons, etc. I never get ahead” (Anonymous, 2020). During the pandemic, changes in technology requirements outpaced the classroom’s adaptability. Yet this disruption had some benefits. Maurice Telesford, a high school science teacher, said: “I don't think there were really many teachers who weren't using technology in the classroom before the pandemic anyway. But anybody who was is now up to a baseline level of proficiency. We're at a new level, a new platform now” (Telesford, 2021). Educators make observations and express concerns regarding dramatic changes to the implementation of educational technology. They hope this feedback will influence the long-term plan for educational technology in a positive direction.

Vendors of educational software advocate the inclusion of their products in the classroom. Duolingo (n.d.), an online language learning tool, claims: “Learning with Duolingo is fun, and research shows that it works! With quick, bite-sized lessons, you’ll earn points and unlock new levels while gaining real-world communication skills.” Duolingo also provides

Duolingo for Schools (n.d.), a service that allows educators to group student accounts into a virtual classroom, assign lessons, and track progress. Duolingo advertises: “Duolingo for Schools applies both ACTFL [American Council on the Teaching of Foreign Languages] and CEFR [Common European Framework of Reference for Languages] learning standards to Duolingo’s extensive curriculum, allowing you to find content that meets your teaching needs.” Testimonials from teachers also appear on the software’s webpage. Pamela Parks (n.d.), a high school language teacher, is quoted saying: “Learning happens best when the application feels like a game. Duolingo is just plain fun, and we are able to leverage this in the classroom.” Classroom use of Duolingo increases traffic to advertisements on Duolingo’s webpage and exposes more users to Duolingo’s premium subscription service. Outschool, a platform for full length online classes on a variety of topics, appeals directly to parents. Outschool (2023) claims that their service will: “Let kids’ curiosity run wild with classes and groups on any topic you can imagine.” A large section of Outschool’s webpage is dedicated to creating homeschool curriculum. The ready-made and self-contained courses may appeal to parents homeschooling their children – Outschool (2023a) asserts: “You don't have to homeschool alone. Supplement your family's homeschooling with affordable courses, one-on-one tutoring, and social clubs.” Similar to Duolingo, Outschool’s webpage features testimonials from users. Krystal B. (n.d.), a parent using Outschool, reports: “I now feel empowered when it comes to her education. With Outschool, you have the power to choose. I have been able to watch her grow over the past several months.” Outschool charges by class taken; their material interests depend directly on increasing the service’s usage. Vendors target their online efforts toward educators and parents, promising results and using testimonials to gain trust.

Vendors of hardware educational technology also promote the use of their products in classrooms. In many cases, these products are the secondary focus of larger companies. LEGO, a toy company that primarily makes plastic building blocks, markets a product to educators that combines their plastic building blocks with simplified robotics concepts. They advertise: "LEGO® Education SPIKE™ Essential combines standards-aligned curriculum units, colorful LEGO® elements, a simple coding progression, and intelligent hardware" (LEGO Education, 2023). LEGO also includes a testimonial for the product on its store webpage. A third-grade teacher who used the product is quoted saying: "The lesson was really cool and interactive. My students got to problem-solve, build and use their hands - the kids who can't read were fine, too - and it incorporates technology, which is very motivating" (Anonymous, n.d.). The Education SPIKE Essential is a component of the suite of resources named the LEGO Learning System. LEGO's brand name is prominent on these products. Microsoft, a tech company, also promotes the use of their educational hardware in the classroom. As of 2019, more than 30 million Chromebooks are used in classrooms around the world (Vamvakitis, 2019). The Google for Education (n.d.) sales page touts Chromebooks as: "Simple yet powerful devices with built-in accessibility and security features to deepen classroom connections and keep user information safe." Classroom usage of Chromebooks results in increased prevalence of related Microsoft products like Google Classroom that are pre-loaded onto the machines. In addition to promising results to educators seeking educational hardware, these companies use their brand names to build credibility.

Educational nonprofits use their online presence to promote technologies they believe align with their missions. Code.org (2023), an education innovation nonprofit, describes their vision that "every student in every school has the opportunity to learn computer science as part

of their core K-12 education." Code.org focuses on increasing participation by young women and students from underrepresented groups in computer science. Online resources such as code tutorials, coding projects and games, and Hour of Code introductions to computer science support this goal. Students are enticed to: "Use code to choreograph a dance to today's top hits, add moody visuals to a poem, or even clean up the ocean!" (Code.org, 2023a). Code.org (2023b) provides workshops for teachers, encouraging educators: "Sign-up for our inspiring, high quality CS Fundamentals professional development workshops with experienced facilitators." Promotion of these workshops includes a testimonial from a teacher who attended one of their workshops, saying: "It was great to put myself in situations that my students might face. Talking with others about our lessons was super helpful because we could bounce ideas off of one another." (Wright, 2023). Maker Ed (2022) is another educational nonprofit that works to provide "training, support, and resources to individuals, institutions and communities who are integrating maker education into their learning environments." Maker Ed (2022a) describes maker education as the type of learning that "can happen with cardboard and duct tape; with a loom and wool; with your uncle's old car; with robots and LEDs." In pursuit of this ideal, Maker Ed works with educators to introduce materials and equipment allowing students to tinker, hack, and design. With their online presence, nonprofits prominently feature their mission, hoping to rally like-minded parents and educators to supporting their educational technology.

The smallest voices – What do the students think of the new tech?

While underrepresented in other forms of media, student opinions are common in the online forums that discuss educational technology. K-12 students are divided in their opinions on which technologies belong in the classroom. I-Ready, an online assessment tool intended to help teach math and reading in grades K-8, has met resistance from students. A petition on

Change.org to remove I-Ready from schools currently has over 38 thousand signatures (Tamayo, 2019). One student wrote in their reason for signing: “I'm in eighth grade and I know the horrible pain of I-Ready, and I don't want any of the younger students to go through the same things I have suffered” (Feldman, 2019). On the same petition, another student wrote: “I'm in 6th grade and had to go through I-ready I say we ban it cuz its useless it doesnt teach us anything and puts stress on us” (Izzard, 2021). DreamBox, a mathematics education software that gamifies learning for grades K-8, has received similar complaints from students. In a review of DreamBox, one student wrote: “So at my school we do DreamBox and I mean there are just so many things i hate about it. One, when ever I’m close to finishing a lesson it just adds more problems for me to do and it’s just really annoying. Two, the lessons don’t even really make me learn anything because when ever I get something wrong and it says “oops” it doesn’t give you the reason why you got it wrong. Three, when I get the answer wrong and it says “oops” it kinda makes me feel bad” (She, 2019). The student continues on to outline several more grievances, complaining about the pacing and boring nature of the lessons. Another student expressed strong feelings about the software, saying: “I HATE NIGHTMAREBOX! one, the lessons are mind numbing and fun eliminating. two, it gives you worlds dumbest lessons like "allie the alligator" which is just plain annoying. we are assigned 30 minutes of dream box a week and i can barely even do 1 minute!!!” (Nnnster, 2018). Often, these reviews appeal to the agendas of groups with more influence over educational technology, such as parents or teachers. Students claim that they are unhappy or not learning effectively, topics likely to get the attention of adults.

Some students promote the technologies they enjoy. In a review of Prodigy Math, a math learning game, one user wrote: “It so fun! I used to hate the thought of math, so I failed. Then when our teacher introduced us to this I started to like math. This makes learning math fun. All

the items you can earn, and the pets/companions you can earn. I especially love that your companions can evolve" (s.0rry, 2020). SMART Boards, interactive white board devices capable of projecting computer screens, also found support among students. In the comment section of a SMART Board showcase video, one viewer wrote: "I want my school to have these boards, I would definitely pay more attention in class. xD but our school has the promethean board, we moved to a new school so we don't know if we'll get the promethean boards or the new one. I hope they give us smartboards. :D" (JBDreamers, 2011).

Conclusion

The implementation of educational technology in K-12 classrooms is strongly influenced by discussions between participant groups. Often, this discussion appeals to educators; the other groups perceive educators as having the most initiative to introduce technology into the classroom. Educators caution against or recommend technologies to one another, increasing the visibility of useful technologies. Vendors or organizations looking to promote educational technology often include testimonials from teachers, seeking to tap into the trust between members of that group. Students and Parents comment on the educational technology's efficacy, appealing to both educators and to vendors working to maintain a profitable product. Importantly, the strategies are effective independent of whether the group supports or disapproves of a given educational technology. This can be generalized to reflect interactions between groups with different beliefs but similar goals. Groups with less influence highlight the elements of their agenda that align with the desires of other groups, while more influential groups organize internally to achieve their goal. Although these strategies have been observed in discourse on educational technology, the potency of the strategies was not investigated. Future

research could identify the direct influence of specific strategies on the classroom prevalence of a given technology.

References

Anonymous Teacher. (2020). In: Singer, N. (2020, Nov. 30). Teaching in the Pandemic: 'This Is Not Sustainable'. *New York Times.*

Anonymous Third Grade Teacher (n.d.) In: LEGO Education. (2023). LEGO® Education SPIKE™ Essential Set. education.lego.com/en-us/products/lego-education-spike-essential-set

Bailey W. (2022). Great Way to Keep Students Engaged and Participating! (online review). www.commonsense.org/education/reviews/kahoot/teacher-reviews/5106334

Code.org (2023). About Us. code.org/about

Code.org (2023a). Code with The Bad Guys. code.org/thebadguys

Code.org (2023b). Professional Development for Elementary Teachers. code.org/professional-development-workshops

Crompton, H.; Burke, D.; Jordan, K.; and Wilson, S. (2021, July). Learning with Technology During Emergencies: A Systematic Review of K-12 Education. *British Journal of Educational Technology 52*, 1554-1575.

Dawson, C. (2008, Sep. 8). To Lexia or not to Lexia. *Zdnet.* www.zdnet.com/article/to-lexia-or-not-to-lexia

Duolingo (n.d.). The free, fun, and effective way to learn a language! www.duolingo.com

Duolingo for Schools (n.d.). Free for your Classroom! schools.duolingo.com

Feldman, S. (2019). In: Tamayo, S. (2019). Ban I-Ready From Schools (change.org petition). www.change.org/p/ban-i-ready-from-schools

Fokkens, P. (2022, Dec.). I used Kahoot a couple of times… (public google review).

Google for Education (n.d.). Learn from Anywhere With Chromebooks. edu.google.com/intl/ALL_us/chromebooks/overview

Gray, L. and Lewis, L. (2021). Use of Educational Technology for Instruction in Public Schools: 2019–20 (NCES 2021- 017). U.S. Department of Education. https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2021017.

Hume, A (2018). In: Dodson, B. (2018, Sep. 23). Meet the parents who are resisting tech in schools. *Daily Herald.* https://www.heraldextra.com/news/2018/sep/23/meet-the-parents-who-are-resisting-tech-in-schools

Izzard, J. (2021). In: Feldman, S. (2019). In: Tamayo, S. (2019). Ban I-Ready From Schools (change.org petition). www.change.org/p/ban-i-ready-from-schools

Janet L. (2022). Fun way to engage students! (online review). www.commonsense.org/education/reviews/kahoot/teacher-reviews/5105502

JBDreamers (2011). I want my school… (youtube comment). In: Smart Technologies (2009, April 13). Smart Boards Why Are They So Easy To Use? (youtube video). https://www.youtube.com/watch?v=0U05WeXPGlk

Krystal B. (n.d.). In: Outschool. (2023) Set learning free. outschool.com

LEGO Education (2023). LEGO® Education SPIKE™ Essential Set. education.lego.com/en-us/products/lego-education-spike-essential-set

Linguist92021 (2020, Mar. 28). How Will Education Be Different After COVID?- Thoughts, opinions, etc. *A to Z Teacher Stuff.* https://forums.atozteacherstuff.com/index.php?threads/how-will-education-be-different-after-covid-thoughts-opinions-etc.206324

Maden, S. (2012, July). Teachers' Attitudes Towards Using Educational Technologies. *Energy Education Science and Technology Part B – Social and Educational Studies 4.* 2471-2478.

Maker Ed (2022). About Us. makered.org/about

Maker Ed (2022). What is Maker Education? makered.org/about/what-is-maker-education

Maxwell, J.; Kamp, J.; Cullen, T. (2021). Parent Perceptions of Technology Use in K-12 Classrooms. *Srate Journal* Spring 2021 30(1).

McMillan, D. (2022, Dec.) No I would not… (facebook post).

Michelle L. (2020). Easy to grade! (online review). www.commonsense.org/education/reviews/quizizz/teacher-reviews/5033812

Mikaela Y. (2021). Quizizz is a Great Quiz Based Application (online review). www.commonsense.org/education/reviews/quizizz/teacher-reviews/5069572

Nnnster (2018, March 26). How Do We Even Learn?! (apple app store review).

Nold, B. and Williams, S. (2004, May). Using Mobile Laptop Computers in K-12 Classrooms. *Media & Methods 40*, 32-32.

Ohn, MH.; Yusof, S.; Lansing, MG.; Ravindran, B.; Nisar, K.; Mchucha, I.; Iswandono, Z.; Luen, NP.; and Ohn, KM. (2019, June). Gamified Online Active Learning Theory (conference paper). Institute of Electrical and Electronics Engineers.

Outschool (2023) Set learning free. outschool.com

Outschool (2023a) Homeschool with Outschool. outschool.com/online-classes/homeschool

Parks, P. (n.d.) In: Duolingo for Schools (n.d.). Free for your Classroom! schools.duolingo.com

PDE (2023, Feb. 7) Parents Defending Education. TikTok in K-12. defendinged.org/investigations/tiktok-in-k-12

s.0rry (2020, June 3). It so fun! I used to… (google play store review).

She, J. (2019, Aug. 25). Meh (apple app store review).

Simsek, N. (2005, Jan.) Perceptions and Opinions of Educational Technologists Related to Educational Technology. *Educational Technology & Society 8.* 178-190.

Singvogel (2021, Dec. 27) Online Games for the Classroom. *A to Z Teacher Stuff.* forums.atozteacherstuff.com/index.php?threads/online-games-for-the-classroom.207273

Sophia G. (2023). Fallen From Grace (online review). www.commonsense.org/education/reviews/quizlet/teacher-reviews/5111615

Steckler, T. (2021) In: Klein, A. (2021, Apr. 20) 'A Year of Tremendous Growth.' How the Pandemic Forced Teachers to Master Technology. *Education Week.* www.edweek.org/technology/a-year-of-tremendous-growth-how-the-pandemic-forced-teachers-to-master-technology/2021/04

Tahir, R. and Arif, F. (2016, Sep.). Mobile Technology in Children Education: Analyzing Parents' Attitude Towards Mobile Technology for Children (conference paper). Institute of Electrical and Electronics Engineers.

Tamayo, S. (2019). Ban I-Ready From Schools (change.org petition). www.change.org/p/ban-i-ready-from-schools

Telesford, M. (2021) In: Walker, T. (2021, Mar. 5) ‘Technology Isn’t the Hero, Educators Are’. National Education Association. www.nea.org/advocating-for-change/new-from-nea/technology-isnt-hero-educators-are

Vamvakitis, J. (2019, Jan. 22). Around the World and Back with Google for Education. *The Keyword*. www.blog.google/outreach-initiatives/education/around-the-world-and-back

Wright, D. (2023). In: Code.org (2023b). Professional Development for Elementary Teachers. code.org/professional-development-workshops