

K-12 teachers' experiences and challenges with using technology for Emergency Remote Teaching during the Covid-19 pandemic

Le esperienze degli insegnanti di scuola primaria e secondaria e le sfide dell'uso della tecnologia nell'insegnamento da remoto durante la pandemia del Covid-19

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ABSTRACT During the COVID-19 pandemic, more teachers than ever before turned to technology to support continuity of learning for students at a distance. This study explores K-12 teachers' (N=334) experiences and challenges with using technology for emergency remote teaching. Ninety percent of the participants were located in the United States, with the remaining respondents located internationally. Findings indicate that while educators increased their use of digital tools, these technologies seemed to support traditional classroom communication, information delivery, and management practices. Participants identified several challenges, including accessing, evaluating, learning to use, designing instruction with, and supporting student and family use of technology. These concerns, combined with the rapid pace at which technology had to be employed at a time of great uncertainty, left educators feeling woefully ill-prepared for effective remote teaching. This paper considers why technology may not have lived up to its potential in a time of immense need.

KEYWORDS Teaching and Learning with Technology; Teacher Learning; Access; Technology Barriers; Emergency Remote Teaching (ERT).

SOMMARIO Durante la pandemia del COVID-19, gli insegnanti hanno dovuto utilizzare la tecnologia per permettere la continuità dell'apprendimento per gli studenti a distanza. Lo studio (N=334) esplora le esperienze degli insegnanti della scuola primaria e secondaria (negli Stati Uniti denominata "K-12") riguardo l'uso della tecnologia per supportare l'insegnamento da remoto d'emergenza. Il 90% dei partecipanti allo studio sono negli Stati Uniti, mentre il resto sono localizzati nel mondo. I risultati

indicano che con l'incremento dell'uso di strumenti digitali, queste tecnologie supportano gli insegnanti nella comunicazione tradizionale in classe, la consegna di informazioni, e le pratiche di gestione. I partecipanti hanno identificato diverse sfide, incluse la valutazione, la scelta, l'apprendimento, l'adattamento dell'insegnamento e il supporto agli studenti e alle loro famiglie nell'uso della tecnologia. Queste sfide, combinate alla grande velocità con la quale la tecnologia è stata impiegata in un periodo molto incerto, hanno dato la sensazione agli educatori di non essere preparati per un insegnamento remoto efficiente. Questo articolo considera perché la tecnologia potrebbe non aver espresso tutto il suo potenziale in un periodo di grande bisogno.

PAROLE CHIAVE Apprendimento e Insegnamento con la Tecnologia; Apprendimento degli Insegnanti; Accesso; Barriere Tecnologiche; Insegnamento da Remoto.

1. INTRODUCTION

The 2020 COVID-19 pandemic created widespread disruption to traditional teaching practices. To reduce the spread of the virus, many schools and universities closed for weeks or months, with more than three-quarters of students worldwide (1.37 billion) forced to stay home (UNESCO, 2020). Educators had to figure out how to shift their practice from in-person teaching to “*emergency remote teaching*” (Hodges, Moore, Lockee, Trust, & Bond, 2020, para. 5), which included “*creating content for online spaces, learning new delivery tools, understanding online pedagogy, engaging parents, addressing student mental health issues, and attempting various pedagogical strategies to address both synchronous and asynchronous teaching and learning*” (Hartshorne, Baumgartner, Kaplan-Rakowski, Mouza, & Ferdig, 2020, p. 138).

Traditionally, teachers can choose whether and how to use technology in school, however, the global pandemic required nearly all educators to use technology to reach and teach learners at a distance. Citing data from LearnPlatform’s *Edtech Top 40 Report*, Poth (2020) noted, “*When schools closed and all instruction shifted to remote, the average number of tools used each month rose from 952 to 1,327, which represents an 89% increase compared to that of the prior year*” (para. 7). Yet, at the same time, this push to use technology to alleviate the pandemic-induced educational problems created a “*Seller’s Market*” based on “*solutionism*” rather than supporting quality instruction (Teräs, M., Suoranta, Teräs, H., & Curcher, 2020). At a time when “*flexible digital education [was] deployed in haste, driven by an immediate need to adapt to rapid changes in delivery, namely as suddenly other than face-to-face, all amidst the threat and uncertainty of a widely circulating, poorly understood pathogen*” (Veletsianos & Houlden, 2020, p. 3), we sought to collect qualitative survey data from teachers in situ as they shifted to emergency remote teaching to highlight the experiences and challenges they faced when teaching with technology during the onset of the global pandemic.

2. LITERATURE REVIEW

When an emergency or crisis affects schooling, individuals often turn to technology to devise solutions for pressing problems, such as how to communicate with, and teach, learners at a distance (Hendrickson, Croymans, & Cronin, 2017; Ramadan, 2017; Rush, Partridge, & Wheeler, 2016). Technology has the potential to “*advance relationships between educators and students, reinvent our approaches to learning and collaboration, shrink long-standing equity and accessibility gaps, and adapt learning experiences to meet the needs of all learners*” (U.S. Department of Education Office of Educational Technology, 2017, p. 3). Current and emerging technologies, such as augmented reality, virtual reality, social media, open

access media production tools, and real-time collaboration platforms (e.g., Google Apps for Education) can support anytime, anywhere learning that is not limited by the spatial and temporal boundaries of the brick-and-mortar classroom (e.g., Greenhow & Chapman, 2020; Ibáñez & Delgado-Kloos, 2018; Ito et al., 2020; Kavanagh, Luxton-Reilly, Wuensche, & Plimmer, 2017). Additionally, there are a number of affordances of learning technologies, including interactivity, adaptivity, feedback, choice, nonlinear access, linked representations, open-ended learner input, and communication with other people (National Academy for the Sciences, Engineering, and Medicine, 2018).

However, the use of technology in education varies quite significantly. In the *Project Tomorrow Speak Up Research Initiative* survey (Evans, 2019), featuring data from 289,373 students and 26,122 teachers and librarians in the U.S., middle school students reported that the most commonly used technologies were: Google tools to complete schoolwork, online tests or assessments, skill developing software, online videos, online games, and online textbooks. These technologies typically serve as a substitute to traditional practices, such as completing a written test, submitting a worksheet, or watching a presentation. Additionally, “only one-fifth of classroom teachers (22%) say they are very comfortable using technology to facilitate student collaborations, integrating mobile devices within instruction or differentiating instruction using digital tools,” while “39% say they are not comfortable at all with those types of technology-enhanced instructional practices” (Evans, 2019, p. 10). The *Common Sense Census: Inside the 21st-Century Classroom* report (Vega & Robb, 2019), featuring data from more than 1,200 U.S. K-12 educators, reflected similar findings. Educators in the study saw the value in digital creation tools for developing students’ 21st century skills, including communication, collaboration, critical thinking, and creative thinking, yet these tools were used by only one-quarter of the participants. The most commonly used tools were video-streaming services (e.g., YouTube) and productivity and presentation tools (e.g., GSuite for Education, Microsoft Office). Similarly, data collected from hundreds of schools after the shift to emergency remote teaching indicated that the most popular educational tools used were productivity and presentation tools (GSuite for Education), video conferencing tools, information dissemination tools (Wikipedia, Khan Academy), and quiz tools (Quizlet and Kahoot!) (LearnPlatform, 2020). Ultimately, while teachers seem to be placing more value on technology as an instructional tool, their use of technology tends to be limited to teacher-centered presentation, dissemination, organization, and assessment of information.

The use of technology as an educational tool can be shaped by a number of factors. More than two decades ago, Ertmer (1999) identified first-order and second-order barriers to technology integration that still hold true today. First-order barriers refer to obstacles, limitations, or the absence of external resources, including support, equipment, training, and time. Second-order barriers are those internal to educators, such as their underlying beliefs about teaching and learning. According to Webb and Cox (2004) teachers’ “*thinking and beliefs about teaching and learning were linked to what they did in the classroom and choices they made in selecting how to integrate ICT into their teaching*” (p. 244). That is, when teachers have teacher-centered beliefs, they are more likely to select technologies that allow them to teach in that way (Cox & Prestridge, 2020; Greenhow & Chapman, 2020, Tondeur et al., 2017). Cox and Prestridge (2020) noted that there is a dynamic relationship among conceptions of teaching (i.e., beliefs), teaching context, and enacted practices that influence how instructors use technology in online settings. In their study, teaching context factors, including workload, class sizes, compliance with curriculum, student-teacher ratio, and discipline, played a role in motivating teacher-centered practices in online settings.

Teachers’ beliefs about their students can also shape how they use technology in their practice. Rafalow (2020) found that educators in three demographically distinct middle schools in the U.S. shared quite different conceptualizations of the role of technology in education. Teachers in the school with mostly wealthy, white students considered digital play and tinkering essential to learning, while teachers in the school with

a predominantly Asian American student population considered digital play as “*threatening rather than an opportunity for learning*” (para. 24). Educators in the mostly Latino, working class school felt that digital play was a waste of time for students who needed to learn skills for hands-on jobs.

The use of technology is never neutral - it is a socially constructed tool that is created or used by someone or some organization with their own values, aims, and objectives (Kimmons, 2020; Krutka et al., 2020; Selwyn, 2010; Teräs et al., 2020). In Rafalow’s (2020) study, the use of technology for learning shaped and was shaped by societal and cultural contexts and beliefs. Tawfik, Reeves, and Stich (2016) noted that “*despite the favorable impacts of some technologies on educational excellence, these advances have taken place within a broader social context—one that is significantly unequal*” (p. 598). Education technology (edtech) companies also play a role in designing technologies that amplify systemic biases and inequities (Krutka, Heath, & Mason, 2020; Watters, 2019). For instance, YouTube, Twitter, and other social media platforms have been called out for racist or extremist algorithms that influence what educators see and can do in those spaces (Hern, 2020; Ribeiro, Ottoni, West, Almeida, & Meira, 2020). Uncovering the values, aims, and objectives of edtech companies is essential to providing inclusive, accessible, and safe learning experiences for students, yet few educators have been trained in doing so. Ultimately, in times of considerable challenges, technology is not simply a “quick fix” that can solve educational problems (Morozov, 2013; Teräs et al., 2020; Veletsianos & Houlden, 2020).

The use of technology in education requires critical examination of the barriers, beliefs, external influencers, and contexts that shape teaching and learning. As Selwyn (2010) noted, “*greater attention now needs to be paid to how digital technologies are actually being used – for better and worse – in ‘real-world’ educational settings*” (p. 66). For this study, we sought to address this need by exploring educators’ uses of technology during the onset of the COVID-19 pandemic.

3. METHODS

In this exploratory qualitative research study, we analyzed preliminary survey data from K-12 educators who shifted from in-person to emergency remote teaching during the early days of the COVID-19 outbreak in the U.S. We adopted an interpretivist perspective to guide the data collection and analysis methods (Erickson, 1986). The following research questions guided our study:

- RQ1: What digital tools and apps did participants use during emergency remote teaching?
- RQ2: What challenges did educators face with technology during the shift to emergency remote teaching?

3.1. Data collection

We drafted a list of survey questions that would allow educators to share their experiences with technology during the shift to emergency remote teaching. The design of the survey was informed by the criteria for electronic survey design (Dillman, Smyth, & Christian, 2014). We shared the survey questions with several practicing K-12 educators for review and incorporated their feedback into the final survey protocol. After securing approval to conduct this study from our university’s Institutional Review Board (IRB), we created a digital version of the survey using the Qualtrics commercial survey platform. The survey was reviewed and pilot tested by a handful of practicing educators before final launch.

The survey consisted of 8 demographic questions, 4 multiple answer prompts, and 4 open-ended questions. This study focuses on the responses from one multiple answer prompt (“Which digital tools/apps did you start using (or used more) as a result of emergency remote teaching?”) and one open-ended question (“What were the 3 biggest challenges you faced once you started emergency remote teaching?”). The options for

the multiple answer prompt were identified by conducting an informal quantitative frequency analysis of social media posts by educators in the public Facebook group “Educator Temporary School Closure for Online Learning,” an international community of more than 100,000 educators created on February 27th, 2020. Member posts and comments were examined over a one-month period (March 2020) for mention of specific applications and tools (e.g., Google Apps, Zoom, Seesaw). Based on the review, 2,784 tool mentions were tabulated, with further analysis resulting in 15 tools, or tool themes (e.g., learning management systems, screen recording tools, Google suite), that were used as the multiple answer options. Participants could also add tools not included in the list in two “other” boxes on question prompt.

We posted the survey link on popular social media channels for educators, including Twitter (i.e., #remoteteaching, #pandemicteaching, #remoteteaching), Facebook (i.e., Educator Temporary School Closure for Online Learning group), Reddit (i.e., r/edtech subreddit), and Edmodo subject communities (i.e., Math, Science, Language Arts, and Social Studies). We also distributed the survey via local Massachusetts school district email listservs and the International Society for Technology in Education (ISTE) Commons discussion forums. Between April 3 and June 28, a total of 334 K-12 educators filled out the survey.

3.2. Participants

Most participants taught in public schools ($n=260$; 78%), with some teaching in independent/private schools ($n=53$; 16%) or charter schools ($n=19$; 6%). Their years of teaching experience ranged from 1-38, with an average of 16. Participants reported teaching in Pre-Kindergarten ($n=9$; 3%), elementary (kindergarten - 5th grade; $n=127$; 38%), middle (6th - 8th grade; $n=66$; 20%), or high school (9th - 12th grade; $n=96$; 29%), or some other combination of schools such as K-8 or 6-12 grades ($n=29$; 9%). More than half of the participants ($n=184$; 55%) reported teaching in suburban schools, while 99 (30%) taught in urban schools and 49 (15%) were in rural schools. Nearly one-third of the participants ($n=104$; 31%) reported working in lower poverty schools with less than 25% of students receiving free or reduced-cost lunches (a common indicator for poverty in United States schools), while 79 (24%) reported working in high poverty schools with more than 75% of students receiving free or reduced-cost lunches. The remaining participants indicated working in schools with between 25% and 75% of students receiving free or reduced-cost lunches. Most participants were located in the United States ($n=300$; 90%). The remaining participants were located around the world, including Egypt ($n=3$), Hong Kong ($n=3$), Canada ($n=2$), Italy ($n=2$), Spain ($n=2$) and one participant each from Albania, Brazil, China, Guatemala, Ireland, Jordan, Mexico, Philippines, Qatar, Romania, United Arab Emirates, and the United Kingdom.

3.3. Data analysis

To analyze the multiple answer prompt data, we generated descriptive statistics. For the open-ended question, we conducted a thematic analysis (Braun & Clarke, 2006) to identify common patterns and interesting themes within the participants’ responses. The lead author reviewed the data multiple times while engaging in open coding to identify commonly occurring and interesting responses related to technology use for emergency remote teaching. Then, the lead author synthesized the codes into broader themes. For instance, many educators reported challenges related to figuring out how to adapt their teaching practices to remote settings with technology, such as presenting information, testing student knowledge, and managing behavior. This indicated a common pattern of “teaching concerns,” which became one of the broader themes. The lead author and co-author then engaged in rounds of coding and discussing and resolving discrepancies among the themes before developing a final codebook (see Appendix Table A1 Codebook for common themes). The codebook was used as a guide to complete the final round of coding of the data for the open-ended prompt. To increase credibility and trustworthiness, we used investigator triangulation by having multiple researchers involved in all qualitative data analysis and we conducted member checking of

our interpretations of the data with four educators who were willing to review our findings (Nowell, Norris, White, & Moules, 2017; Twining, Heller, Nussbaum, & Tsai, 2017).

4. RESULTS

4.1. RQ1: What digital tools and apps did participants use during emergency remote teaching?

Participants reported using, on average, five different types of digital tools/apps for emergency remote teaching (see Table 1). More than half of the respondents indicated using Google Apps for Education ($n=209$; 63%) more often when schools closed. Video-based learning tools, such as Brainpop and YouTube ($n=151$; 45%), and learning management systems ($n=150$; 45%) were also employed more often during emergency remote teaching. The most common new tools that educators started using included video conferencing tools, such as Zoom and Google Meet, and screen recording tools. Participants also reported facilitating emergency remote teaching with a range of other digital tools and apps, such as the Microsoft Office Suite ($n=110$; 33%), quiz tools ($n=105$; 31%), and interactive video viewing tools (e.g., Ted-Ed, EdPuzzle) ($n=99$; 30%). Other popular education technology tools, such as Flipgrid, Class Dojo, Remind, Padlet, Nearpod, and Seesaw, were utilized by less than a quarter of participants.

Tool	Started Using	Used More Often	Total Users
Video conferencing tools (e.g., Zoom, Google Meet)	$n=198$; 59%	$n=86$; 26%	$n=284$; 85%
Google Apps for Education	$n=48$; 14%	$n=209$; 63%	$n=257$; 77%
Learning Management System	$n=69$; 21%	$n=150$; 45%	$n=219$; 66%
Video-based learning tools (e.g., Brainpop, Khan Academy, YouTube)	$n=42$; 13%	$n=151$; 45%	$n=193$; 58%
Screen recording tools	$n=114$; 34%	$n=57$; 17%	$n=171$; 51%
Microsoft Office Suite	$n=11$; 3%	$n=99$; 30%	$n=110$; 33%
Quiz tools (e.g., Quizlet, Kahoot, Gimkit, Quizziz)	$n=32$; 10%	$n=73$; 22%	$n=105$; 31%
Interactive video viewing tools (e.g., PlayPosit, Ted-Ed)	$n=57$; 17%	$n=42$; 13%	$n=99$; 30%
Flipgrid	$n=47$; 14%	$n=26$; 8%	$n=73$; 22%
Class Dojo	$n=23$; 7%	$n=49$; 15%	$n=72$; 22%
Microsoft Teams	$n=39$; 12%	$n=29$; 9%	$n=68$; 21%
Padlet	$n=30$; 9%	$n=21$; 6%	$n=51$; 15%
Remind	$n=18$; 5%	$n=31$; 9%	$n=49$; 15%
Nearpod	$n=23$; 7%	$n=20$; 6%	$n=43$; 13%
Seesaw	$n=21$; 6%	$n=22$; 7%	$n=43$; 13%

Table 1. Participants' reported use of digital tools/apps during emergency remote teaching (spring 2020).

Based on participants' responses, the most popular tools used during emergency remote teaching were for delivering content (e.g., videos and screen recordings), engaging in real-time communication (e.g., video conferencing platforms), organizing and disseminating information and activities (e.g., learning management systems), facilitating student work (e.g., Google Apps for Education and Microsoft Office Suite), and assessing student learning (e.g., quiz and interactive video viewing tools). Participants could also write in digital tools and apps not featured on the list of choices. The tools participants added similarly focused on delivering content (e.g., Explain Everything, Flocabulary), organizing and disseminating information (e.g., class websites), and assessing learning (e.g., Gimkit, Boom Cards, Pear Deck).

4.2. RQ2: What challenges did educators face with technology during the shift to emergency remote teaching?

A total of 277 participants identified challenges that influenced their transition to emergency remote teaching. Slightly more than half of these participants' responses ($n=159$; 57%) focused on technology. Technology-related challenges fell within the following themes: teacher learning, access, teaching concerns, technology concerns, student use of technology, and parent/guardian support of student technology use. In the following section, we will provide details about each of these themes.

4.2.1. Teacher learning

The most commonly cited challenge was learning how to find, evaluate, and use new digital tools and apps ($n=57$; 36%). Nineteen respondents (12%) specifically mentioned that they felt overwhelmed when trying to “sort” or “filter” through the many digital tools and resources available to find the right ones for their practice. One teacher shared that it was exhausting *“filtering through all of the digital resources being sent to me. There were so many websites offering free trials and digital learning options that I spent hours researching and exploring them before finding a few that would work for me and my class”*. Respondents also noted that it was challenging learning new technologies on their own and “on the fly”. For instance, one participant stated that it was difficult *“learning new tools and implementing tech tools without training and without the support of an onsite tech”*. Some individuals mentioned turning to YouTube, webinars, and online articles to figure out how to set up and use digital tools for remote teaching. The most commonly listed tools that participants mentioned learning about were for delivering content (e.g., video-making and screen recording tools) and organizing and disseminating information and activities (e.g., learning management systems).

4.2.2. Access

One-third of the participants ($n=53$) identified technology access as a significant challenge. Five educators stated that their own Internet was unreliable or limited, while 49 participants' responses focused on student access to technology, as exemplified in the following quotes:

- *“Most of the population [of students] that have free/reduced cost lunch do not have access to devices or the Internet. While the county has a plan for distributing devices, if you can't get access to the Internet, the device does you no good.”*
- *“Not all of our students had access to devices (computers and iPads) at home. Or they have to share with family members.”*
- *“Students don't have access to computers. I have students writing essays on their cell phones. My AP [Advanced Placement] Seminar students without computers are struggling to do their research”.*
- *“I live in a rural area where high-speed Internet access is both limited and expensive. We have only*

local companies that serve most of the area where my students live and they are not offering discounts. Out of 80 students, I have about 15 who are regularly able to complete online assignments”.

Access to technology posed a significant barrier to remote teaching. Several teachers struggled to figure out how to ensure continuity of learning for students at a distance when students’ access to technology varied depending on the device they had, if or when they could access the device (e.g., sharing it with family members), and a reliable Internet connection. One participant commented:

“I am having trouble assigning engaging work because I know many students can’t access it. If I set a time to video call with my classes, there is no guarantee students can join in. Many are sharing computers or tablets with siblings, possibly even parents who work from home. Most have phones, but sometimes no quiet or private space. I feel backed in a corner, assigning busy work”.

This quote illustrates how limited, unreliable, or infrequent access to quality Internet and technology created additional barriers to emergency remote teaching and learning.

4.2.3. Teaching concerns

Nearly one-third of the participants ($n=51$; 32%) reported difficulties with figuring out how to teach with technology. The most commonly cited challenges included communicating with students and their families at a distance ($n=40$; 25%) and engaging students in learning ($n=37$; 23%). Several educators indicated that they struggled to figure out how to disseminate information and interact with students and their families, especially when the family members’ native language was different from their own or when students/families would not respond to their messages. Educators also felt that it was difficult to engage students in remote learning. Some blamed the change in school/district requirements, as one teacher wrote: *“The move to pass/fail immediately undermined student motivation and accountability, both of which are challenges even in normal times”.* Other participants felt that lack of engagement was due to multiple factors, including lack of access to technology and wifi, lack of parent/family support, or a general lack of interest in learning that was present before the COVID-19 pandemic. Interestingly, none of the participants identified their teaching practices as a reason for lack of student engagement.

Participants listed several other teaching challenges, including determining how to teach with different tools, providing feedback to students digitally, handling behavior management online, and delivering instruction and assessing student learning at a distance. For instance, one educator wrote: *“first grade is so hands-on, so it has been hard to try to teach and reinforce content via a computer”*, while another shared that it was difficult *“trying to transition my classroom teaching lessons to online. Including, how to administer a test - which I am still not sure of how to do”*. Several educators’ struggles seemed to stem from trying to replicate their traditional in-person teaching strategies in a digital environment.

4.2.4. Technology concerns

Almost one-quarter of the participants ($n=33$; 21%) reported that general issues related to technology, such as troubleshooting problems and too much screen time, negatively impacted their ability to engage in emergency remote teaching with technology. Multiple educators wrote about screen time fatigue. For instance, one individual commented that *“staying focused while staring at a computer for long periods of time was exhausting”*, while another participant shared that *“increased screen time led to severe migraines”*. The issues related to screen time fatigue seemed to come from trying to replicate in-person teaching strategies (e.g., presenting and discussing via Zoom) or spending ample time using online resources to learn how to use or troubleshoot new technologies. A handful of educators also indicated that they were concerned about the accessibility, equity, and privacy of using various digital tools for remote learning.

4.2.5. Student use of technology

Sixteen percent of the participants ($n=25$) indicated that students' lack of technology competencies influenced their ability to teach remotely with digital tools. One educator wondered, "*How were my students going to access Google Classroom? Could they do it independently and are their parents (with limited technological and academic abilities) able to help?*" Participants identified several challenges related to student use of technology, including "*kids turning in assignments without attachments of work*", "*students not being able to open assignments*", "*getting all of my students to log on Canvas*", and "*students are not technologically literate and do things like share their Google docs assignments (which sends it to my email) instead of turning it in, making it harder to keep track of it all*". Some individuals noted that their lack of use of technology during in-person schooling meant that their students were not ready to use technology for learning at home. The shift to emergency remote teaching seemed to dispel the myth that students are digital natives who speak the "*digital language of computers, video games and the Internet*" (Prensky, 2001, p. 1).

4.2.6. Parental/guardian support of student technology use

Some respondents ($n=24$; 15%) mentioned that parents' and guardians' technology competencies played a role in shaping student use of technology. As one educator noted that it was difficult to teach when "*students or parents are not tech savvy and have trouble finding all the information needed*". Several educators mentioned having to spend substantial time responding to questions from parents/guardians regarding how to set up, troubleshoot, login to, and use the technologies assigned for schoolwork. Adapting practices based on parents' or guardians' concerns about technology also served as a challenge for teachers as well. For example, one individual wrote that "*parents refusing to allow their child to video record with Flip Grid and be part of Google Meet*" made it difficult to support that students' learning. The responses from educators seemed to indicate that parents and guardians of students could benefit from training and support for evaluating and supporting their child's use of technology for learning.

5. DISCUSSION AND IMPLICATIONS

In returning to Selywn's (2010) recommendation that we pay greater attention to how technology is actually being used in real world educational settings, this study shows that during the onset of the COVID-19 pandemic, educators increased their use of digital tools and apps to facilitate emergency remote teaching, however, they also faced several barriers that influenced how they taught with technology.

Participants identified multiple external first-order barriers (Ertmer, 1999) that negatively impacted their ability to teach remotely with technology, including lack of access to technology, lack of training and support for teaching and learning with technology, school and district-wide mandates (e.g., pass/fail grading), and lack of technology support from parents/guardians. These barriers stemmed from the social, cultural, economic, and political contexts that influenced schooling well before the COVID-19 pandemic. For instance, equitable access to high quality and reliable technology and the internet has been a long-standing issue shaping student success. Moore, Vitale, and Stawinoga (2018) noted that even though the digital divide has persisted for more than a decade, underserved students still "*have access to fewer devices and lower-quality internet than students who are not disadvantaged. Inequitable access to electronic devices and effective internet connections contributes to opportunity, achievement, and equity gaps in education*" (p. 8). Additionally, a recent report found that more than 50 districts in the U.S. spent less money on high-poverty schools than lower-poverty schools, indicating that districts can play a role in determining which students get access to which technologies for learning (Mathewson, 2020). While President Obama's

ConnectED Initiative (2013) aimed to deliver broadband access to all schools and libraries in the U.S., this study showed that economic and geographic factors continue to create barriers for teaching and learning outside of school. The lack of efforts by politicians, organizations, and schools to create equitable access to technology for all students was made apparent by the global pandemic and the shift to emergency remote teaching. As a result, educators faced an uphill battle of trying to create equitable learning opportunities for all students in an inequitable society.

The ability to use technology for teaching and learning also served as a barrier for many. The shift to emergency remote teaching illuminated how ill-prepared educators, students, and students' family members were for supporting technology-rich teaching and learning. The number one emergency remote teaching challenge, as listed by participants, was learning how to use technology, including identifying technologies for teaching and learning and troubleshooting or setting up digital tools and apps. These findings align with the data from *Project Tomorrow's Speak Up Research Initiative* survey (Evans, 2019), in which teachers reported needing more professional development opportunities and just-in-time support in order to use technology more effectively in class. Participants also noted that students and their family members were similarly ill-prepared to learn, or support learning, with technology and this proved to be a considerable barrier for emergency remote teaching. While it is clear from the data that educators, students, and their families could benefit from more learning opportunities to develop their technology skills and knowledge, it is also important to note what was missing from the data. Only two participants identified concerns about student data privacy, while three participants mentioned the need to learn how to create accessible digital materials. At the onset of the pandemic, more than 400 edtech companies offered free access to their tools (THE Journal, 2020) and many teachers jumped at the opportunity to try out new tools without evaluating them for safety, privacy, and inclusivity. Some of the companies then eliminated the free or low-cost options after educators became reliant on these tools and/or collected user data for marketing or selling to third party companies for a profit (Teräs et al., 2020). Meanwhile, zoombombing and accessibility issues plagued educators who jumped into new tools too fast (Krutka et al., 2020; Trust, 2020). The findings from this study indicate that educators, students, and their families need opportunities to learn how to evaluate the values, aims, and objectives of edtech tools and how to use technologies in safe, accessible, equitable, and inclusive ways, as Teräs and colleagues (2020) noted that *"the realm of digitalization is never neutral but one with a value dimension oriented towards objectives decided by human beings. It is important to be aware of those values, aims, and orientations that influence ed-tech decision-making"* (p. 874). Krutka, Seitz, and Hadi's (2020) framework for a discriminatory design technology audit is one such tool that educators can use to investigate and critically examine technologies before adopting them in their practice.

Two additional first-order barriers that repeatedly came up in the data were lack of communication with students and families and lack of student engagement. While lack of access to devices and the Internet played a role in influencing both barriers, this was not the only influencing factor. Participants tended to see lack of communication, access, and engagement as something out of their control. In an earlier analysis of a subset of the data (Trust & Whalen, 2020), we found that educators who used technology often in their practice had an easier time shifting to emergency remote teaching because students and families were already using technology for engaging in learning outside of school time. While it is clear that across the board, students and families need more equitable access to technology to learn at a distance, it is also worth exploring whether teachers' in-school practices, like setting up a class website with information for students and families, using a learning management system for communication, or engaging students in using multiple technologies to drive their learning, might have alleviated some of the communication and engagement concerns.

Participants' underlying beliefs about teaching and learning (i.e., second-order barriers) also seemed to

influence their use of technology for emergency remote teaching. While educators did increase their use of digital tools and apps to support student learning at a distance, the technology they reported using, including video conferencing tools, educational videos, learning management systems, and quiz tools, typically replicates traditional classroom practices, such as delivering content, disseminating information, presenting “live” classes, and grading. The findings from this study align with the *Project Tomorrow Speak Up Research Initiative* survey (Evans, 2019), the *Common Sense Census: Inside the 21st-Century Classroom* report (Vega & Robb, 2019), and *Edtech Top 40 Report* (LearnPlatform, 2020), which illustrated that teachers select and use technologies that reinforce traditional teacher-centered practices. Ultimately, when educators were put in a situation requiring the use of new technologies, they held tight to what they knew worked (e.g., in-person teaching) rather than shifting their thinking about what might be possible with technology (Cox & Prestridge, 2020; Greenhow & Chapman, 2020; Tondeur et al., 2017). Educators could benefit from experiencing learner-centered blended, online, and remote learning environments and from evaluating and reflecting upon their K–12 Blended Teaching Readiness (using the instrument designed by Graham, Borup, Pulham, & Larsen, 2019) during teacher preparation and in-service training so that they are not simply drawing on the models traditionally provided to them during professional development (i.e., in-person teaching) when confronted with shifting their practice.

In summary, this study revealed that educators, students, and their families were ill-prepared to use technology for remote teaching and learning and that social, political, economic, and cultural contexts played a significant role in shaping emergency remote teaching. The COVID-19 pandemic seemed to illuminate and exacerbate the barriers to teaching and learning and the inequities within these contexts. Looking ahead, Teräs and colleagues (2020) recommend that we need to “*actively engage people, networks, projects, research, and public discussions to promote critically and reflectively informed praxis. We need to apply and develop critical applied research methodologies and create design principles for democratic and emancipatory digitalization of education*” (p. 874). That is, scholars, teacher educators, and administrators need to create opportunities for teachers, students, families, and community members to deeply investigate the interconnected relationship between context and technology in order to create “*better futures—meaning imaginative, equitable, accessible, sustainable, and decolonial*” (Veletsianos & Houlden, 2020, p. 2).

6. LIMITATIONS AND FUTURE RESEARCH

The data from this study present a limited view of teachers’ use of technology for emergency remote teaching. While teachers reported which digital tools and apps they used, they did not share how they used these tools. It is possible, for example, that some educators might have used Google Apps for Education to support real-time, collaborative, student-centered learning via HyperDocs (Carpenter, Trust, & Green, 2020). Therefore, additional research is needed to examine how educators used technology to facilitate emergency remote teaching during the COVID-19 pandemic. Furthermore, due to the convenience sampling methods, the data may not be representative of the general population of educators. Given that participants were recruited from a few different digital professional learning spaces, such as Twitter and ISTE online forums, it is possible that the educators in our study were more inclined to use technology in their teaching prior to the pandemic. Even still, the results paint a dreary picture regarding educators’ experiences with technology during emergency remote teaching.

Additionally, participants’ responses came at a time of intense stress as they had to learn how to reconfigure their teaching to support students remotely. Therefore, their responses reflect “emergency remote teaching” (Hodges et al., 2020, para. 5) rather than traditional remote or online instruction. While the findings yield new

insights regarding the role of technology in emergency remote teaching, there is more to learn. For instance, how might we examine and understand the interconnected relationship among technologies, conceptions of teaching, context, and enacted emergency remote teaching practices (Cox & Prestridge, 2020)? How might the decisions about edtech made during the COVID-19 pandemic influence schooling and societal inequities in the future (Teräs et al., 2020)? How might we move beyond comparing dichotomies (e.g., online vs. emergency remote teaching; teaching with technology vs. teaching without technology) to look holistically at the design and application of instruction in different situations and settings (Moore & Hill, 2020; Teräs et al., 2020)? How might we better prepare teachers, students, and families to use technology for teaching and learning in the wake of disruptions to schooling in the future? The world is changing “*and the causes of interruptions to education are not limited to pandemics; wars, local conflicts, and other types of natural disasters are issues that should be kept on the future agenda as potential sources of interruption*” (Bozkurt & Sharma, 2020, p. iv). Future research is needed to examine how teacher educators and administrators can prepare, train, and support the current and future teaching workforce so that they do not feel like novices (Cox & Prestridge, 2020) when using technology for blended, online, and remote learning. Additionally, as Kimmons’ (2020) study revealed, the mismatch between edtech research and practice and the lack of research focusing on critical edtech topics, including accessibility, privacy, race, gender, and equity, point to the need for researchers and practitioners to work together to identify, examine, and understand the role edtech has in education.

7. CONCLUSION

This study shows that at a time of immense need, educators were ill-prepared to use technology for emergency remote teaching. Worse still, more than half of the participants identified technology as a barrier or significant challenge when, ideally, technology should have made it easier to ensure continuity of learning for students at a distance. The findings from this study reveal the need for:

1. improving in-service and pre-service teacher training and support for learning how to identify, critically evaluate, and use technologies to facilitate learning in any situation or format (e.g., blended, online, remote);
2. increasing access to high quality technology devices and the Internet for all educators and students;
3. providing opportunities for students and their families to develop their technology competencies as part of schooling to prevent further exacerbation of the digital divide;
4. providing educators, students, and families with opportunities to learn how to uncover the aims, values, and objectives of edtech companies and their interconnected relationship with social, economic, political, and cultural contexts;
5. creating blended and online learning opportunities for educators and students alike to become familiar with these formats given the potential for future disruptions to schooling.

While this study paints a dreary picture regarding the use of technology for teaching and learning, it also presents a call-to-action for educators, scholars, and school communities to collaboratively examine, envision, and redefine the role of technology in schools to create a better future for learners.

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Appendix

Table A1 Codebook for common themes

Code	Description	Example	n	% of 159
Teacher Learning	Difficulties in learning how to find, evaluate, and use new digital tools and applications.	“Feeling overwhelmed at all the options for remote teaching/learning. Steep learning curve for how to use them.”	57	36%
Access (Teacher & Student)	Lack of access to reliable devices and/ or Internet.	“Many students had no internet access at home. Many students had no devices at home.”	53	33%
Teaching Concern	Difficulties with figuring out how to teach remotely with technology.	“Direct teaching and prompt fading is challenging online.”	51	32%
Technology Concerns	General issues of concern related to technology, such as troubleshooting problems, too much screen time, accessibility, and privacy.	“1. Computer got completely messed up using Loom so I stopped using video and went to virtual class. 2. Fatigue for being online so much.”	33	21%
Student Use	Issues regarding student interaction with and appropriate use of technology for learning.	“Getting younger students that hadn’t used Google Classroom before, signed on.”	25	16%
Parental/ Guardian Support of Student Technology Use	Issues pertaining to parent or guardian understanding, implementation, use, support, or monitoring of technology.	“Providing tech support for parents. I spend more time everyday answering parent emails and calls about how do we log into this, where can I get books to read, did you get this assignment, we don’t know how to use Google forms, how do I create a document.... It’s never ending.”	24	15%

Table A1. Q65 - What were the 3 biggest challenges you faced once you started emergency remote teaching?