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ORIGINAL PAPER

First and Second Order Barriers to Teaching in K-12 Online Learning

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Abstract
While an extensive literature base has focused on online learning, fewer studies have explored the unique implementation challenges in K-12 education. This case study addresses this gap by exploring how an urban, diverse school migrated to a fully online format through the lens of the first- and second-order barriers framework. In terms of first-order barriers, the study highlights the importance of (a) time needed to design and adapt instructional materials, (b) accountability within an online format, and (c) administrator support in the communication process. For second-order barriers, teachers commented on how they perceived online learning to impact important teaching activities (e.g., accountability, timeliness of feedback) and the teacher-student dynamic. Finally, they commented on the challenge to support the socio-emotional component of students and parents in online learning, which is important for school culture and community.

Keywords Online learning · K-12 · First and second order barriers · Technology integration

Introduction

The transition to online learning is difficult for all parties involved, in part because strategies and models used in face-to-face settings may not translate to the online environment (Graham et al., 2019; Ko & Rossen, 2017). Teachers, students, and caregivers assume additional responsibilities (Ahn, 2011; Oviatt et al., 2016). Caregivers often become learning coaches and technology coordinators who encourage and support learners in environments perceived as more isolating than traditional classrooms (Antoni, 2020; Borup et al., 2020; Hasler-Waters et al., 2014). Even with videoconferencing and other synchronous forms of communication, a teacher's ability to view and monitor individual learning environments is reduced (West et al., 2009).

Although several researchers have examined effective practices for online learning in K-12 settings (e.g., Arnesen et al., 2019; Graham et al., 2019; Molnar, et al., 2019), few have examined how teachers navigate large-scale, district-wide transitions and the barriers that ensue during emergency remote teaching. In these situations, an institution must rapidly shift to an alternative format due to the unintended crisis (Hodges et al., 2020). During the initial COVID-19 outbreak in the United States, most K-12 schools provided some form of emergency remote teaching during the remainder of the 2019–2020 school year using an online format (Antoni, 2020). This massive shift to online learning provided a unique opportunity to examine the supports and barriers teachers faced as they provided for the needs of diverse learners who did not volunteer for virtual schooling. Despite several challenges (e.g., accountability, access, and accomodation), many teachers, students, and families navigated this transition. Using Ertmer's (1999) first- and second-order barriers framework, the purpose of this study was to examine challenges, benefits, and lessons learned related to teacher transitions to online learning at an inner-city, K-8 school.

Literature Review

Online learning occurs when students are physically separated from other learners and their instructor and enter learning environments through internet-based tools (Allen & Seaman, 2016; Arnesen et al., 2019). Prior to the COVID-19 pandemic

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that necessitated a sudden shift to online learning, every state in the United States offered online "full-time and supplemental learning programs" for K-12 students (Hasler-Waters et al., 2014, p. 380). Indeed, by 2007, 69.8% of the 867 surveyed school districts from all states in the United States indicated they had "at least one student who had taken an online course," with another 12.3% planning to do so (Picciano & Seaman, 2009, p. 9). By 2019, 39 states provided full-time virtual schools, up from 30 in 2012 (Miron & Urschel, 2012; Molnar et al., 2019). That said, online learning historically attracted niche populations from middle- and upper-class Caucasian backgrounds and provided extensive guidance to help caregivers and students enter the learning environment (Ahn, 2011; Hasler-Waters et al., 2014; Miron & Urschel, 2012; Molnar et al., 2019). Thus, literature regarding best practices in existing virtual schools may focus on different populations than the emergency remote teaching situations (Hodges et al., 2020) faced by many public schools.

While public schools attempted to transition to online learning during the COVID-19 pandemic, they often lacked the technological infrastructure. For example, 27% of Americans lacked broadband Internet access (Anderson, 2019; Anderson & Kumar, 2019; National Academies of Science, Engineering, and Medicine, 2018). Even when homes had reliable internet access, many families competed for help and the use of limited computing resources (Antoni, 2020; Marstaller, 2020). These challenges resulted in transitions to optional instruction and limited learning accountability for the remainder of the 2019–2020 school year (Antoni, 2020); however, teachers continued to leverage resources to provide learning opportunities for students, prepare for the next school year, and make online learning the new norm. This shift in delivery during emergency remote teaching required significant changes in the way teachers provided instruction.

Changing Roles

Moving to online learning is difficult for K-12 teachers, students, and caregivers for a number of reasons. Curricular approaches may not translate into online settings, and teacher, student, and caregiver roles shift (Abrami et al., 2006; Ahn, 2011; Ko & Rossen, 2017; Palloff & Pratt, 2007). While delivery systems reduce some aspects of content dissemination, empirical studies underscore how teachers must focus additional effort on consistent and clear communication, foster interaction between physically distant learners, and troubleshoot technology (Ahn, 2011; Moore, 2007). Data suggest learners' sense of affiliation, connectedness, and comradery may also diminish, placing additional demands on instructors (Linton, 2016; Oviatt et al., 2016; Palloff & Pratt, 2007).

Success in online environments requires learners to be technologically savvy, self-regulated, intrinsically motivated, and able to manage time well (Cavanaugh et al., 2009); yet, given the developmental variability among K-12 students, these skills may not be present in all learners, necessitating additional support (Abrami et al., 2006; Barbour, 2007; Borup et al., 2020). Furthermore, resources taken for granted in K-12 settings (e.g., technology support, reliable internet, scientific probes, art supplies) may be less available in individual homes. Likewise, a teacher's ability to ascertain students' engagement, understanding, and on-task behavior by scanning the classroom is hampered dramatically (Tolu & Evans, 2013; Zhan & Mei, 2013). To compensate for physical distance, caregivers often assume greater responsibility for personal coaching, resource acquisition, and motivation (Ahn, 2011; Borup et al., 2020; Hasler-Waters et al., 2014; Miron & Urschel, 2012). However, the rapid transition to online learning during COVID-19 may have negatively impacted school and caregiver abilities to provide these services while managing employment and maintaining social distance (Antoni, 2020; Gray & Lewis, 2020; Marstaller, 2020).

First-Order Barriers

Teacher viewpoints and access to resources also act as barriers to technology integration and distance education. Focusing on technology integration in K-12 settings, Ertmer (1999) identified two major categories of barriers, extrinsic and intrinsic (see also Davies & West, 2014; Ertmer et al., 2012; Francom, 2016). First-order, or extrinsic barriers, are obstacles to technology integration that are external to a teacher's control. Examples of extrinsic barriers include lack of access to resources, training, and administrative and technical support (Abrami et al., 2006; Kurian & Ramanathan, 2016; Picciano et al., 2012). Historically, first-order barriers were viewed as a primary obstacle to technology integration. For example, a lack of reliable internet access and computing resources within classrooms limited teachers' abilities to leverage some technologies. Yet, most schools have overcome these issues, particularly in larger districts—increasing wireless access and bandwidth within buildings and turning to one-to-one computing initiatives (Francom, 2016; Gray & Lewis, 2020). While the reduction of physical barriers has significantly reduced in school settings, similar trends may not have occurred in home settings where online K-12 education often occurs (Anderson, 2019; Anderson & Kumar, 2019; Antoni, 2020; Gray & Lewis, 2020). Important resource considerations for mentoring, student support networks, and professional development may remain for online learning (Abrami et al., 2006; Barbour et al., 2020; Larkin et al., 2018).

Second-Order Barriers

Intrinsic barriers, or second-order barriers, also influence technology integration and online learning. These barriers stem

from personal beliefs, values, and dispositions regarding the role of technology in education settings (Ertmer et al., 2012; Francom, 2016; Picciano et al., 2012) and may be exacerbated by lack of training or administrative support. Intrinsic barriers may manifest in multiple respects given how online learning differs from face-to-face instruction. For example, teachers are less able to scan the room to ascertain student interest and on-task behavior (Tolu & Evans, 2013), which impacts the perceived role of computers in the classroom. In-person teaching approaches may also need modification for the online environment (Barbour et al., 2020; Graham et al., 2019) and thus plays a role in the established classroom practices that teachers employ during instruction. A teacher's willingness to set aside traditions and beliefs regarding effective instruction in face-to-face classrooms may also influence their ability to foster online learning (Barbour et al., 2020). Even when training, support, and access to resources is offered for teachers, these educators may still be reluctant to leverage technology tools if their uses contradict beliefs about teaching, interfere with established norms, or appear intimidating (Rogers, 2003). Additionally, these barriers are often more difficult to change and overcome (Ertmer et al., 2012).

Research Questions

While K-12 online learning has been explored within specific demographics, few studies have looked at a district-wide implementation of an online learning transition. Furthermore, studies suggest typical enrollments for virtual K-12 schools cater to niche demographics, so less is known about this transition in an urban setting serving diverse students (Hasler-Waters et al., 2014; Miron & Urschel, 2012; Molnar et al., 2019). Moreover, less is known about the transition to online learning in emergency remote teaching settings, which allows for temporary access to learning in response to a crisis (Hodges et al., 2020). While this study examines those challenges, it also seeks to document successes, lessons learned, and teacher perceptions of continued technology use beyond the COVID-19 pandemic and following the return of face-to-face instruction. Addressing these gaps and barriers has important implications for large-scale, accessible public institutions that move towards an online learning format. To examine this from the teachers' perspectives, Ertmer's (1999) first- and second-order barriers were used as a framework. Specific research questions included:

1. What *first-order barriers* did teachers experience as they suddenly shifted to an online learning approach?
2. What *second-order barriers* did teachers experience as they suddenly shifted to an online learning approach?

Methods

Participants

Participants ($N = 6$) consisted of in-service teachers who taught at a public, K-8, urban school situated in the Midsouth region of the United States and located on a large university campus. Teachers taught multiple subjects, including English language arts (ELA), social studies, and mathematics. The elementary portion (K-5) of the school has over 300 students (64% White, 21% African American, 5% Hispanic/Latinx, 7% Asian, 3% multi-racial), while the middle school (6–8) has 80 students (48% White, 35% African American, 5% Hispanic/Latinx, 3% Asian, 3% multi-racial, and 8% non-specified). Additionally, 11% of elementary and 30% of middle school students are economically disadvantaged, and 9% and 37% of students (respectively) have individualized education plans.

Procedure

Given the situated nature of this study, this research employed a qualitative case study approach. Focusing on qualitative analyses helped to determine the internal and external barriers teachers faced during online learning and their transition to emergency remote teaching (Ertmer, 1999). In line with similar qualitative studies that explored perceived teacher barriers (Sockman, 2015), the data were gathered from a sample size of six participants. During the spring of 2020, the present case study employed qualitative data collection in the form of semi-structured interviews using protocols derived from Ertmer's (2013) first- and second-order barriers. Example interview questions included: What were some of the concerns you had as you prepared for this transition to online learning (prior to implementing anything)? How was learning content developed/distributed, and what was your role in the process? What procedures were established to help you and your students focus on their schooling at home? What technologies did you use to transition to online learning? Given the research gap, the questions were semi-structured so as to allow participants the opportunity to elaborate on their shift to online learning. Interviews were approximately 1 hour, though two interviews lasted 1 hour and 45 minutes each. All the aforementioned protocols were reviewed and approved by the Institutional Review Board (IRB) of the university. Interviews were conducted and recorded using Zoom.

Data Analysis

Original interviews were transcribed and later verified for accuracy with the original audio. Upon completion, two research assistants parsed the transcript into line items that represented separate idea units. The idea units were identified as describing a unique idea that aligned with the constructs of Ertmer's

(1999) first and second-order barriers framework. The research assistants did a preliminary round of coding on one interview transcription independently to familiarize themselves with Ertmer's (1999) first- and second-order barrier categories and constructs. The purpose was to familiarize the team with the data and document any potential contextual subthemes. Following that round, the assistants met and discussed any differences in their coded idea units; the discussion was facilitated by the first author. After completing the preliminary round, the research assistants independently applied Ertmer's (1999) framework to all participant interviews (see Table 1). In the subsequent debriefing meeting, the research team reflected on the coding framework, while also identifying emergent subthemes within each of Ertmer's (1999) constructs. In addition, multiple examples from the data were discussed by the researcher team to ensure a common understanding and interpretation of the data, primary code, and subtheme. After three rounds of negotiation, final interrater reliability reached 100% agreement, as suggested by the literature (Garrison et al., 2001).

Results

First-Order Barriers

Technical and Administrative Support

The following subthemes emerged for technical and administrative support when teaching online: (a) need for clear policies and communication of those policies (b) provision of space and autonomy to allow teachers to lead the problem solving process and (c) technological support and training. Of note, is that the administration was described at different levels - the school and district. Whereas the policy by upper administration was clear prior to the migration to online instruction, ambiguity during the transition caused confusion among teachers. Although the local administration was agile within their specific school setting, teachers had to navigate through multiple levels of district policy as they moved to an online format. Participant 2 (P2) commented on the need for clear communication in this uncertain time and how it impacted her approach to online learning:

> It was really frustrating when we're going to be virtual indefinitely or until further notice. And the questions of what does that mean? They told us on the Thursday that we wouldn't be coming back on Friday or for the week after spring break. And then that whole semester. They, you know, information was left to be desired.

Similarly, P6 called the communication from the district level "very minimal, because at that time COVID was new. It was so new, and we just didn't know. There were so many unknown[s]." The district communication to parents and caregivers was equally abrupt. P1 noted that "there was no warning to families" about big shifts away from face-to-face, and that "everyone was kind of figuring it out as you go, which was unfortunate and obviously made it a less smooth process."

Table 1 Alignment of Study Sub-themes with First- and Second-Order Barriers

	Ertmer's (1999) constructs	Salient sub-themes from current study context
First-Order Barriers (External)	1. Inadequate technical and administrative support	• A need for clear policies and communication of those policies
		• The provision of space and autonomy to allow teachers to lead the problem solving process
		• Technological support and training
	2. Lack of access to computers, software, & tools	• Stable Internet
		• Standardized Platforms
		• Communication with students and caregivers
	3. Insufficient time to plan instruction	• Delayed district-level decisions
		• New technology trial and error
		• Collaboration with teachers as problem-solving strategy
Second-Order Barriers (Internal)	4. Beliefs about computers and digital tools	• Appropriate level of screen time
		• Importance of supporting socio-emotional well-being
	5. Beliefs about teaching when online	• Perceptions of 'finding information' as opposed to teaching
		• Challenges of teacher-student interaction
		• Immediacy of feedback
		• Classroom management
	6. Established classroom practices	• Developing structures
		• Developing classroom 'netiquette'

P1 continued, comparing the district response during the initial online transition to the following year:

> This fall, they're much more defined because we have a much better sense of what we need to deal with. But, you know, it's good. Clearly communicated expectations of what teachers needed to do and what the district policy, because we do operate under the City schools (pseudonym) accreditation. And so things like the fact that there would be no grades. That's a mandate that we had to follow. And so we had good understanding of that. And that's definitely something that will be different this fall.

Indeed, some district-level mandates during the early days of the pandemic appeared to work counter to the needs and beliefs of the individual teachers. While the teachers felt some understanding for these policies, they also saw first-hand how policies directly influenced learning. For example, the sudden removal of grades by the district dramatically impacted student participation and accountability. P1 expounded on these consequences:

> There was nothing that we were really allowed to hold them [students] accountable for because grades were immediately optional and testing was canceled, which makes sense that testing was canceled. And it does make sense that grades were not even optional. [...] There were zero grades, just feedback. The problem with that, it didn't mean that school was optional. The fact that we were not giving grades, I mean, unfortunately, people need to realize if you're not ready as a sixth grader to face the world, then you need to keep coming to school just because grades are not happening.

In turn, teachers saw their classroom participation shrink with no actionable items. P4 stated, "Out of my 150 kids I had last year, I had about 40 participants. And that number continued to dwindle." The participants nearly unanimously felt concerns about students falling behind, as P3 exemplified when she stated, "If a child misses a day, that's a lot of instruction to miss. So when they were out for even that month that they didn't get instruction, that's a lot of time loss for them." P2 reflected, "we unfortunately had to leave a lot of learning and teaching, frankly, up to the students … there is a definite lack of accountability. And there had to be."

Whereas the above quotes indicate that some teachers felt conflicted about the 'no grades' policy and its impact on student accountability for learning, other comments noted clear misalignment with district policies about technology, such as administrative decisions to block Google. Teachers who had previously relied on Google tools for technology-enhanced learning were suddenly cut off from their affordances as they migrated to a fully online format. Such decisions caused the teachers to scramble seemingly unnecessarily to find alternatives to teaching online. P2 described how:

> The first two and a half weeks of school, City County [pseudonym], in all of its wisdom, decided to block Google. And that caused a lot of issues for us using Google Classroom. And we always have backup plans and stuff. But our backup plan was 'I guess we can try to email them [students] assignments and material.' But when you're emailing them a Google document or anything through Google Drive, they try to open it, and it was once again blocked.

While participant comments highlighted how teachers struggled with the aftermath of district-wide policy, some comments indicated that the local school-level policies during the COVID transition offered more support. In line with their face-to-face approaches to instruction, the school-level administration appeared to incorporate teacher voices into their decision-making. P5 noted how this support encouraged "freedom to think through it before we implemented anything. And feeling like as a teacher, like our feedback was valued and considered." P5's comments highlighted how the specific school administration went beyond support and seemed to take the lead from the teachers. P6 expanded to describe how:

> The [school level] admin was always available. And that's so important to have supportive admin. Administration was available - they were there, they were there providing recommendations, they were there offering support. A lot of times for teachers, you're trying to make sure you're making the best decisions. So when they're there to actually absorb some of your ideas and to hear your ideas and to say, 'yeah, you know, that's a good idea.'

Administrative-level support was not only seen as important for curriculum but also for engaging the broader campus community. Whereas the local administration deferred parent communication to the teachers in the face-to-face format, P6 called the administration "invaluable" for providing a strong foundation for what the teachers should be communicating to parents about changes at the school, timelines, and technology. The data also indicated that the administration supported teachers in various ways, which speaks to the changing roles and distribution of responsibilities of teachers and administrators in a fully online format. In this case, the administration was not only able to encourage the teachers during the online portion of instruction, but also encourage autonomy and support communication in respect to emergency remote teaching.

Despite some positive feelings toward local administration support, the data suggest that the administration at all levels

could have provided more technical support as the teachers migrated their entire classrooms into the online space. Previously, technical support was provided on an as-needed basis, but more comprehensive support and guidance was needed for all teachers given the degree of the shift. Although teachers had experience with face-to-face instruction, P3 wished for more "online teaching strategies" in general, including ways to keep students more engaged, support for students to access documents, and guidance to navigate the online space. In lieu of limited support for specific online teaching strategies, P2 described how her training consisted of "general tips and tricks and shared knowledge that we did. And a lot of it, I gotta tell you, it's just [...] Youtube tutorials and wikihouse." She continued that there was "a lot of trial and error" and adjusting based on student feedback. P3 noted there was some administrative-based training efforts, but they were insufficient for the teachers' needs:

> They [the school system] gave us Zoom training, and they gave us some online tools to use. But it really wasn't effective. We really just walked through a script with the kids and [told] them they were dismissed for the day. And they did work on their own. And a lot of times they didn't do it. I would have liked to receive ways to keep them engaged online. I would have liked to receive some online teaching strategies.

The administrative support, or lack thereof, appeared to lay the foundation for the transition to online learning amidst the pandemic. Administrative policy played a large role in how the teachers were best able to teach, communicate with caregivers, and organize and operate their online spaces.

Lack of Access to Computers/Software/Tools

In the face of ambiguous administrative policies, teachers found that they needed to rely heavily on technology to support their efforts within their classrooms. Although the data highlighted the importance of access to hardware/software features, the study identified three sub-themes when teaching online: (a) a stable internet connection, (b) a standardized platform to support learning, and (c) the impact of platforms on communication to children and parents to engender accountability.

Participants were not totally without access to computers, software, and other technology tools. Once the migration to online learning was decided, some participants noted that the school district provided students with additional access to virtual study programs, but they expressed doubts about their effectiveness. P3, for example, noted, "They [the school] gave them some online things to keep practicing with, like IXL and I-Ready, but that's not the same thing as a person actually teaching you." During the face-to-face approach to learning, home-internet access was not seen as a necessary component of instruction; however, it became indispensable in the early days of the pandemic when all teaching and learning moved online. P6 described how some parents had to "up their connection" just to accommodate multiple people using the internet in the home at once. P1 explained further,

> Just having the tech alone isn't enough. You have to have the internet as well. And, you know, there were internet problems even for people that had it, like the quality of the internet. There would be days that they couldn't, and that was an additional glitch. And so having hotspots, the district is supposed to be making hotspots available, and that would be helpful.

The participant quotes above highlighted the need for both hardware and stable internet as a foundation for learning, but other quotes pointed toward a need for centralized platforms or learning management systems (LMS) where learning could take place. Some teachers noted that their school did not have an LMS in place prior to the move to online learning. P2 reflected that before a move to Google classrooms, she was "directing students to different areas, different websites, and different resources." She noted how a centralized portal made it easier for students to know where to look, so "It's more of a consistency thing." P1 similarly noted, "We'd been struggling all year because we didn't have a platform. We wanted to have Google classroom or something like that, but we never had gotten it." When asked to elaborate why this lack of access to this tool was an issue, P1 shared:

> Kids stay more engaged by doing it this way. And none of that was easy to translate to virtual. Even the one thing that I knew from my own experience with online learning of the discussion board, I didn't have the tools for it. I had to figure it out. So almost everything. The translation of the practices was difficult.

In this case, the lack of access to a single resource made it difficult to congregate learning materials and thus keep students engaged. P5 similarly indicated how the lack of an LMS impacted their ability to teach and administer content:

> We did not have an LMS of any kind, and so my main concern was the delivery of content and the collection of assignments and student work. We really pushed hard to get some sort of system that we could give documents and receive documents to students. And there was nothing provided to us. For the entire year, that was a struggle.

She continued "We ended up going with Padlet…. But my main concern is how are we going to deliver content and then

receive student work without a platform that was dedicated to doing that?" Some participant comments extended beyond engagement and ease of administering content to note that an LMS simply created a central portal for students.

Beyond the use of an LMS as a portal to instructional material, teachers also identified how a lack of central technology impacted communication channels with students, parents, and caregivers. Before the move to online learning, teachers communicated about student progress within the school or via email; however, the lack of an LMS during the online learning transition impacted how teachers interacted with parents to support learning. When comparing communication with parents in the traditional face-to-face format, P6 commented, "That was one of the primary complaints from parents back in spring.... There was a disconnect in terms of being able to provide the instruction and all of the things that it takes to manage it." P2 expounded:

> Parents have been given tools to hold their kids accountable, which has helped us. So, like, missing assignments are more obviously missing in virtual because it [the LMS] shows it's missing versus me telling a student that they didn't turn something in. Parents can now check out a website.

As teachers became more familiar with the online format, they increasingly employed video-conferencing tools (e.g., Zoom, Google Meet), which helped teachers connect with students and parents on a level that perhaps was not accessible via phone or email. P6 commented, "Zoom saved our lives because it still gave us that face-to-face in terms of being able to at least in some kind of way see each [...] other in terms of our communication." The data suggest the lack of a central communication outlets resulted in an overwhelming information stream from multiple sources, which impacted the degree to which they could engage parents and hold students accountable.

Insufficient Time to Plan Instruction

In line with Ertmer's (1999) framework, the data also identified insufficient time to plan instruction as another first-order barrier. The participants emphasized how a sudden migration to online resulted in several complications and hardships for the teachers. As noted earlier, ambiguity from the administration about what tools and resources the schools would adopt delayed teachers' decision-making about their own virtual classroom design. P6 noted, for example:

> I don't think we were ready mentally in terms of what we were going to have to face. But the actual training - choosing of what resources we were going to use. Are we using Teams? Are we using Google Classroom? Are we using Zoom? That absolutely needed to be more timely. So I think time is where they [administration] could have helped us to be more effective.

Such delayed decision-making caused teachers to feel rushed to get something in place for students. They expressed how minimal guidance from the administration played a role in the time needed to design and adapt their instruction, as highlighted by P5, "I felt rushed, so I put something out and I stuck with it for a couple weeks until I could like catch my breath and like figure out what to do." P2's comments further outlined how instruction and related instructional strategies suffered under such time constraints:

> Because we transitioned so quickly [...] we didn't have the time to think through things. I think what we delivered was okay, but I mean, it didn't have the built-in supports that in-person teaching did. [...] A lot of my stuff wasn't scaffolded well.

Because technology was used in their face-to-face settings as more supplemental resources, additional time was needed for learning how to employ the full slate of technology options through trial and error. Teachers discussed spending more time to plan lessons than before to ensure a good experience for their students. P2 explained the duality of relying on new technologies in the classroom: "It feels like with every tool that's created to make your job easier, it comes with three to four additional [...] responsibilities. Just another [...] platform to be monitoring." Beyond lecture and in-class activities, P6 noted how learning new technology added hours to her lesson preparation in digital formats:

> It took hours, I won't sugarcoat it. The first few weeks of this we were, I think my planning days just learning Google Classroom management, and planning and learning and, and trial and error. And even though you get the training on it, [it] is still trial and error [and a] work in progress until you learn it. So I was spending five and six hour days on my laptop, planning in that, just that.

Again, these quotes illustrate the burden of limited time when transitioning to an online learning format. Other comments showcased how some participants used collaboration among their fellow teachers as a support strategy during this time. Collaboration seemed to be viewed by participants as a key ingredient to problem-solving and surviving the transition. P1's comments share this perspective:

> We probably should have taken one week so that we could have really worked together and come up with ideas, because I think everyone, you know, we have

> different strengths. And some people would have anticipated certain problems. Other people would have anticipated different problems. Probably no one would have anticipated every problem. So putting us together and giving us a little bit more time, as much as we came together, we had three days, including the weekend. So that was such a small amount of time that probably if we had taken one week, it would have made a big difference.

In this case, teachers expressed how the lack of time was exacerbated by the perceived lack of guidance, which impacted their alignment of tools and instructional strategies. The collective data thus indicated how time is perceived as essential to collaborate, design content, select technologies, and iterate their instructional strategies as educators move from face-to-face towards an online format.

Second-Order Barriers

Beliefs about Teaching when Online

In terms of second-order barriers, teachers described their beliefs about teaching in an online learning format. While similar themes documented in the literature emerged (e.g., technology affordances; benefits of connecting students), unique sub-themes focused on the appropriate level of screen time and the importance of supporting socio-emotional well-being during K-12 online learning. Previously, teachers employed technology as a supplement to reinforce the face-to-face component of instruction. However, the pandemic caused a sudden shift during the forced online transition, which revealed additional beliefs about teaching online. In contrast to face-to-face instruction, some noted that the digital format of online learning created a heavier work-load beyond just the content, as typified by the following statement by P6: "There's only so much screen time that any person can stand. Starting out in this process, it was literally physically making you sick to be on the screen." Others elaborated on this to talk about how the length of screen time correlated to perceived increased workload and subsequent curricular decisions. Although teachers were used to providing instruction in a face-to-face format, additional data highlighted how their beliefs caused them to adapt:

> We were trying to limit work to about two to three hours per week, and other programs were giving what we felt like was a pretty heavy load on the student. So trying to work with other programs and other subjects, while also maintaining some sort of balance for the kids [was challenging] (P2).

Beyond perceived cognitive load, teachers highlighted beliefs about the degree to which teaching online allowed them to support students' socio-emotional health. During face-to-face learning, teachers were able to monitor the socio-emotional well-being of students through their daily interactions. However, due to the pandemic forcing schools to go online, teachers had to develop new ways to identify the socio-emotional needs of the students. P6 shared an experience about how technology seemingly increased students' anxieties and limited her ability as a teacher to meet students' needs:

> And so it was disturbing to learn at the end, from an email immediately from the parent, that the child was in tears after that lesson. And I think when it happened, he just became overwhelmed. And that happens at points. You think you're good, you think you're doing fine, and you feel wonderful. And you become overwhelmed. That ... that screen time is still tough, it's still hard. And it does something to you emotionally to sit in front of that screen. And so he was absolutely having a hard time still transitioning to that, that, that that face-to-face screen time rather than that person, in person kind of thing. So what what I found out from the parent, what looked to me as if the child was actually enjoying the lesson, he was just making it through it. He was making it through it, and he was having a rough time.

To that end, P4 stated:

> You have to check on the student's emotional well being more strategically, but also more purposefully have to get to know your students and the needs of your students and their individual struggles, without drawing attention to them in the whole classroom.

This particular school encourages a more holistic view of education that takes into account both cognitive outcomes and socio-emotional well-being, so many teachers noted the difficulty to maintain this element of learning. It also highlighted the unique beliefs about teaching when instruction is solely done online, especially for affective learning outcomes.

Beliefs about Computers and Digital Tools

Beliefs about computers and digital tools were one of the more prominent second-order barriers described in this case study. All educators were required to use computers to maintain their teaching during the pandemic, whereas before teachers used technology at their discretion. It is noteworthy that the findings identified both positive and negative beliefs. In terms of positive beliefs, participants remarked that the migration to

online learning was freeing because they were no longer under rigid district guidelines. Others commented how learners developed self-directed learning skills due to the online format. In terms of regulations, P1 stated:

> There were some liberating aspects of being virtual. It's not really the virtual part that was liberating. It was the fact that there is no rules about how virtual is done. I mean, usually we're so regulated. There's federal regulations, there's state regulations, there's local district regulations, and then there's building regulations and basically, we only had the building regulations during virtual learning. With that in mind, it was very liberating.

She later elaborated on the statement to describe the impact of online learning on perceived learning outcomes:

> "It seemed like they [the students] don't seem necessarily to have good time management skills. And that was why I was like, really worried. 'Oh, this is gonna be a disaster'. But maybe because, you know, in school, if you get off task, you have to do something about it. You can't let students be off task because that's like saying to the class, do whatever you want during my class. So but, you know, if they're just a little tuned out during something that we're doing or if there is no in-person instruction and all they have to do is the work and they can do it at their own time frame, interrupted 15 times if they want to get interrupted 15 times. And it affects no one but them. I actually found that some of those students who really struggle with in-person did great. So that was the biggest surprise.

Even when learning moves back to the building, P6 highlighted that she wants to maintain some aspects of online learning: "Technology will always now be a part of what I do in my classroom every day, every day because... my students now have skills that I don't want them to to stop using."

In terms of the challenges of K-12 online learning, others contrasted the difference with face-to-face instruction. Although a face-to-face setting had minimal use of technology, the fully online format now required hours of screen time. P3 mentioned, "Having them sit there even for an hour. I mean, even though they have screens all day, it's not the same." When asked to expound on that statement, she suggested feeling like a facilitator and directing students to online resources as opposed to teaching in the traditional sense:

> Sometimes I feel like I'm not teaching as much now. I feel like I'm spending time trying to guide them to find documents [or] trying to fix tech problems. Or they're missing half the class because of the internet or my internet is going out. I just feel like it's not teaching anymore.

In terms of instruction, teachers underscored the challenges of instructional strategies, especially around sustained interaction with students. During previous face-to-face instruction, students were able to interact collaboratively with teachers and peers in real-time; however, the following comment by P3 describes how online instruction posed new challenges to how teachers engaged with their students:

> I'm not in front of them to give them that interaction that they need. So it's only so much I can explain online or show you online. But if I'm not in front of you, it's hard for them sometimes. And sometimes they don't understand the instructions. You'll think that you've written it out plainly, as clear as you can, and they still don't get it.

While she felt as though she had given explicit and clear directions, the mediated nature of online learning stunted the teacher-student interaction that could not be overcome in its existing online format. In a similar vein, P4 contrasted the face-to-face and online experience when she said:

> There's a lot of shared work. There's a lot of jigsawing, there's a lot of collaboration, like four corners activities. And a lot of just sharing of materials and building on it. One of the things that I really like to do is these silent conversations where a student puts their response on a paper, and they just walk around the room and they add comments or questions, and they answer other people's questions, and they add onto other people's comments, and you just see this paper flourish with all these ideas that build upon each other. And those are activities that are much more difficult to do in the virtual environment.

Not only did this impact how teachers responded to students but their ability to address emergent problems. Additionally, P4 shared her perceived beliefs when learning with technology in a solely online format:

> From being like in the classroom, you can immediately see their paper, you can see immediately what they're doing. Whereas digitally, I now have to go in and look at each individual student's work. I will miss that they haven't done anything until we're 20 min later... and I'm just now seeing their progression. So I would say that is probably the biggest challenge is not being able to see that students are falling behind as quickly as you would in the classroom.

Another prominent theme was the challenge of classroom management in an online learning setting, especially for

younger students. During face-to-face instruction, teachers were able to use various techniques to curve inappropriate behavior and were quicker to identify off-task behavior. However, behavior management was more difficult in this new online setting. P5 lamented that, stating, "There's only so much behavior monitoring that we can do.". When asked to elaborate, P5 continued, "I was just giving them assignments and hoping they did them because we didn't have any grades, and we didn't take any attendance." She later elaborated saying:

> So we really struggle with how we hold students accountable to whatever it is we're asking them to do. You know. And, and, I think and ultimately, in the end, like, we may say it was one thing, but essentially, what it ended up being was, was that if the if the student was willing to participate, we gave them instruction. And if they didn't participate, there was no real consequences for doing that.

The data collectively highlights beliefs about computers and digital tools as related to classroom management, interaction, and accountability in a solely online format.

Established Classroom Practices

The onset of COVID-19 and the move towards online learning created multiple disruptions to established classroom practices. Teachers could, therefore, no longer rely on past face-to-face classroom practices to adapt as needed to student behavior. Moreover, they lacked the immediacy of student feedback they often received in the classroom. A key element was how they designed learning resources to structure online learning and establish practices that encouraged questions for the students to provide feedback. Interestingly, some noted that the online format was different for kids across the learning spectrum, as evidenced by the following statement: "The other students that I worried about too were the ones who already had attention issues in class. And so worrying about maintaining some normalcy and attention in the virtual world was a concern for me as well" (P2). P1 shared a similar sentiment when she said:

> It was interesting that a few of the kids who really did not do as well in person actually seem to do better when we went to virtual, and then a few people who were very good in person didn't do as well.

However, she later expressed that:

> The biggest concern was the students who normally struggle and the students who are timid, the students who aren't good with tech...But anyway, I just focused on students that really weren't participating and did a lot of reaching out to their families, encouraging, you know.

In this case, she changed her classroom procedures and restructured her allocated time to be more intentional with following-up for those she perceived as falling behind. As time went on and they became more familiar with online learning, the teachers remarked on specific strategies they developed to adapt their classroom procedures to the online space. For example, P3 mentioned, "I created some procedures myself, such as making sure you're logging in, like assure your camera is on. We didn't really have any school wide procedures, it was just kind of me figuring it out with the kids." Others especially commented about the importance of structure and being able to garner feedback for the learner:

> The first thing I did was creating agendas for the day. And in those agendas, I create links to everything in Google Classroom that they'll be using to try to keep you know, so they don't have to search for certain things. I also tried to keep the relative format of my class relatively consistent so that there's never a large amount of time spent explaining basic procedures, once those processes have been established, it makes it go quicker (P2).

In a similar vein, P4 described how she developed structure through interactive notebooks:

> I started to create digital interactive notebooks. Basically what those do is they put all the material for our unit into one place. This minimizes how many things the students have to open and click. And so for those students that struggle with getting distracted or staying focused, it takes away a lot of the opportunities for them to click outside of where they need to be because it's all there. I also created tiered work within the notebooks. Some students are issued one version, other students [are] issued another. They look exceptionally similar, except you have some reduced reading passages. Instead of filling in the blank, they may have moving features where they drag and drop. Instead of typing, maybe they add in images, and that kind of thing.

The data above identified multiple adaptations in an online space, including specifically designed resources that encourage students to focus their efforts during instruction.

Discussion

Online learning has a considerable literature base in terms of how teachers engage students, peer learning, and an array of other student outcomes. Extant K-12 studies often present specific activities or explore technology integration strategies (e.g., Graham et al., 2019; Linton, 2016; Oviatt et al., 2016); however, few studies have explored when a school fully moves to an online learning experience, especially in the case of emergency remote learning when educators have little time to plan (Hodges et al., 2020). Researchers have suggested various recommendations to support emergency remote teaching, such as district frameworks, communication with parents, and others (Barbour et al., 2020). This study sought to address this gap by providing empirical support as to the first- and second-order barriers (Ertmer, 1999) encountered by teachers as an urban school migrated to an emergency online teaching approach during the COVID-19 pandemic.

The study explored first-order barriers in terms of lack of access to computers/software/tools, insufficient time to plan instruction, and technical and administrative support (Ertmer, 1999). In terms of planning, the suddenness of the transition to online learning was a noteworthy barrier and its impact on the design and adaption of instructional materials for an online format. Although lack of time has been discussed in in-service teacher studies (Ertmer, 1999; Ertmer et al., 2012; Francom, 2016), our findings further affirmed that time constraints play a crucial role in terms of technology training and integration as teachers transitioned to online learning during emergency remote teaching. Specifically, tool adoption increased teacher responsibilities in terms of monitoring access, technology troubleshooting, and communication. These added responsibilities seemed to transcend issues associated with the pandemic and align with research suggesting that teacher roles expand when supporting online learning environments. Some teachers characterized themselves as guides to help students obtain resources; others sought approaches to sustain student interaction. In doing so, these findings resonate with those of Ahn (2011), Ko and Rossen (2017), Moore (2007), and Tolu and Evans (2013) who found that approaches used in face-to-face settings often need extensive modification to fit online environments. Time also factored into stated needs to develop contingency plans for technology failure. Despite teacher familiarity with certain tools, access to these tools was not always reliable, regardless of access to high-speed internet. Although time for training and implementation dominated discussions, several time constraints existed independently of the abrupt transition to online learning.

Furthermore, our findings reiterate the need for administrator guidance and support to overcome technology integration barriers (Ertmer et al., 2012; Francom, 2016). Although some teachers expressed discomfort with their changing roles, they appreciated the support of local administration and desired training regarding effective instructional strategies for online learning. In line with recommendations for emergency remote teaching outlined by Barbour et al. (2020), teachers looked to administration for consistency in communication, tool recommendations, policy, and professional development. Although they did not always agree with the provided guidance, they recognized the need for common deployment during the pandemic. This finding is not surprising given the disruptive nature of the pandemic; yet, our findings also highlight the need for concerted efforts at the school and district level. Similar to findings in higher education, adequate policy, support, and guidance may be missing to direct local initiatives (Bolliger et al., 2019). While research has previously focused on the changing roles of teachers and caregivers in online settings (e.g., Hasler-Waters et al., 2014; Linton, 2016; Oviatt et al., 2016), our findings suggest a need for additional administrative inclusion and changed administrative roles in terms of communication and establishing policies. That said, more research is needed regarding those desired changes and how they support the student and teacher transitions to online learning.

Despite the first-order barriers identified, teachers showed resilience and resourcefulness with available tools. In terms of access to computers and digital tools, participants discussed challenges with software and broadband access as well as limited ability to share resources. Similar to the assertion by Barbour et al. (2020), the lack of centralized and standardized tools created challenges to disseminate and collect learning artifacts and to communicate with students and parents. However, the teacher's resourcefulness is a noteworthy finding as the field looks towards more K-12 online implementations. In the current case study, the lack of a central LMS or the ability to use Google tools at the beginning of the pandemic did not prevent teachers from transitioning to online learning. Instead, they identified other tools (e.g., interactive notebooks, Padlet) to meet communication and dissemination needs until district policies were established. With minimal training, limited time, and little prior experience, teachers were able to establish online learning environments. Consistent with recommendations by others (Barbour et al., 2020; Palloff & Pratt, 2007; Shepherd & Bolliger, 2011), participants recognized the need to limit the number of software tools to reduce student and caregiver anxiety and cognitive load. They also quickly realized and leveraged the help of parents and caregivers to provide academic, emotional, and technical support. These findings align with best practices that suggest family-based coaches facilitate the transition to online learning for both students and instructors (Antoni, 2020; Borup et al., 2020; Hasler-Waters et al., 2014).

On a related note, teachers found it important to collectively problem-solve when moving towards online learning as they were confronted with first-order barriers. They specifically discussed how critical collaboration was for sharing

materials, refining instructional approaches, and impacting learning outcomes. Because some teachers expressed different opinions regarding how much time students should spend on activities and assignments, participants desired additional teacher and administrator communication to refine policy and guide practice. This drive to teach effectively demonstrates the professionalism of these teachers, their expertise in the field, and their ability to determine what tools best meet their students' learning needs (Kimmons, 2020).

Another research question focused on second-order barriers to online instruction, entailing beliefs about teaching, pedagogy, technological resources, and classroom practices. Teachers perceived that a fully online approach was excessive for the K-8 students they served. This may be in part due to the perception that the online format decreased teacher-student interaction for important teaching activities (e.g., accountability, timeliness of feedback, content explanations), especially for vulnerable students. They also commented on the challenge to support the socio-emotional component of students and parents, which is important for school culture and community. Moreover, teachers worried about the time students spent online, which was magnified by the challenge to manage classrooms as they did in face-to-face contexts.

Teachers also worried that they were not supporting the cognitive and affective needs of students, which was especially important for the culture of this school setting. These worries are consistent with findings of other researchers regarding technology integration in classrooms (Ertmer et al., 2012; Francom, 2016). Indeed, studies show that transitions to online learning can be more isolating for teachers and students (Borup et al., 2020; Moore, 2007; Palloff & Pratt, 2007). As interaction moves from face-to-face to online, dynamics between learners and the instructor change, yet some barriers seemed psychological. When P4 described the inability to conduct "silent conversations" online, for example, she described a discussion board or chat room without realizing it. The belief that online instruction is inferior to face-to-face instruction is well-documented, though poorly supported (Bernard et al., 2004). It is no surprise that teachers forced to transition online made similar claims. Ertmer et al. (2012) thus concluded that second-order barriers may be more difficult to overcome than first-order ones and that they are often connected with administrator attitudes and support.

Despite these reservations, the study highlights the potential benefits with the transition to online learning. Teachers noted that some students performed better in online settings than they had in face-to-face contexts. In addition, they further recognized the value of online tools to foster home-school communication and prepare learners for future online courses in high school and college. It is noteworthy these educators indicated that they would continue to use these tools when face-to-face instruction resumed. Although they desired additional pedagogical support and tools, they recognized the value even though the transition complicated their instructional approaches. In doing so, these data support the assertion of Kimmons (2020), who suggested that expert teachers recognize when technology adds value to their classroom and select tools that benefit instruction. These findings thus point to a more nuanced consideration of technology integration. Whereas teachers are often lambasted for their unwillingness or inability to integrate technology, these teachers demonstrated considerable ability despite limited policy and training–even adapting instructional approaches to meet learners' needs. Another noteworthy finding was the design strategies that teachers used as part of their classroom activities. This 'teacher-as-designer' and learning resources approach seemed to structure the classroom as well as set the stage for self-directed learning.

Future Studies and Limitations

While this study addresses the barriers associated with teachers attempting an initial transition to online teaching, there are many future research possibilities. One limitation is that this study focuses on the first- and second-order barriers teachers faced during emergency remote teaching (Hodges et al., 2020) brought on by the COVID-19 pandemic. This may have especially impacted specific constructs such as perceived administrative support and time to plan. More research is needed as teachers have an opportunity to gain additional comfort and experience with online learning. Future studies could thus explore the degree to which the present findings align when compared with more systematic implementation strategies to K-12 online learning. Additional empirical data around this area could support our understanding of how teachers adapt to online teaching over time, which is currently lacking (Abrami et al., 2006).

An additional limitation is that the study only looked at the perceived barriers from one group - the teachers. Therefore, a future study could apply the same constructs related to first- and second-order barriers to examine the impact on students and parents transitioning to online learning. Although teachers in this study mentioned some impacts on their students (e.g., emotional, psychological), their ability to observe and capture practices in the home was limited. Additional studies could explore these barriers from the home perspective, an underrepresented viewpoint in existing literature (Hasler-Waters et al., 2014). Teachers remarked about the decreased teacher-student dynamic and how this impacted learning outcomes. A future study might ask students about their perceived interaction with teachers, the content, and other students. It might also measure standardized tests on specific domains, such as math, science, and reading to compare perceptions and consider impacts on learning.

Additionally, this study focused on barriers teachers faced in an urban setting. Considering the barriers seen in this study, future research is needed to see how these findings are sustained in different settings. For example, if this study was set in a rural school district, would there be an impact on first and second-order barriers? Smaller schools may use less technology in the classroom and have less planning time and administrator support (Francom, 2016); however, they may rely more frequently on distance education to provide advanced and specialized courses (Ahn, 2011; Arnesen et al., 2019; Picciano et al., 2012). Teachers and parents may have less access to high-speed internet and other resources in rural settings, increasing frustration and decreasing engagement. Conducting this study in a rural setting would allow for a more well-rounded perspective of the challenges students, parents, and teachers faced across the country during this transition to online learning.

Declarations

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