An Overnight Educational Transformation: How did the Pandemic Turn Early Childhood Education Upside Down?

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Abstract
Since the spring of 2020, many early childhood education programs (pre-K, K, 1st, and 2nd grades) had to close as governments around the world took serious measures to slow down the transmission of COVID-19. As a result, the pandemic forced many early childhood teachers to start teaching online and continue supporting their students remotely. Unfortunately, there were few lessons that these teachers could learn from experience to cope with this change since online learning in early childhood settings had been scarce until the outbreak of the pandemic. In response, the goal of this interview study was to investigate how early childhood teachers in public and private schools implemented online learning during the pandemic, the challenges they encountered when teaching online, and their suggestions to address these challenges. The results showed that the teachers did not sit still and patiently wait for the re-opening of the schools. Instead, they took assorted initiatives to support their students' learning and development remotely. They faced several challenges on the way but also suggested various methods to address these challenges through developmentally appropriate technology use. The results of this study have implications for teachers when early childhood programs return to normal. The study creates opportunities for future research to gain greater understanding of the design and implementation of online learning activities with young learners.

Keywords: early childhood education, technology integration, online learning, COVID-19 pandemic, distance education

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The shutdown of schools in early 2020 due to the COVID-19 pandemic forced a shift from face-to-face to online and hybrid classes. All educational stakeholders including teachers found themselves during what seemed to many like a dramatic transformation without adequate time to prepare. As a result, they had to ramp up quickly. Although this sudden shift in educational delivery systems foundationally impacted all education levels from pre-school to higher education and beyond, perhaps the most impacted group was early childhood educators with preschool and early elementary children. In response, the goal of this study was to investigate how public and private school teachers experienced online learning in early childhood education during the COVID-19 pandemic. Aligned with this goal, there were three major research questions that the study aimed to address:

RQ1: How did the teachers experience online learning in early childhood education since the outbreak of the COVID-19 pandemic?

RQ2: What challenges did they have when teaching online?

RQ3: What suggestions did they have for addressing these challenges with the technologies they wished to have?

Literature Review

COVID-19 Pandemic Turned the Education Upside Down

As an impact of COVID-19 pandemic, most K-12 school buildings closed in the spring of 2020 in the United States. These building closures impacted at least 55.1 million students in 124,000 public and private schools at the peak (*Education Week*, 2020). Globally, more than 1.5 billion students in over 180 countries (Miks & Mcllwaine, 2020), of whom 155 million children at preschool level, were affected by the largest disruption to education since the creation of the United Nations in 1945 (UNESCO, 2020; United Nations, 2020). More importantly, almost half of the parents started working remotely because of the pandemic, and 75% of employed parents had children staying at home with them during work hours (U.S. Chamber of Commerce Foundation, 2020).

Many early childhood education programs had to close as governments around the world took serious measures to slow down the transmission of COVID-19 (Silverman, 2020). According to UNESCO (2020), the closure of schools and other institutions caused immense threats to young children's development in many aspects including social protection, health, nutrition, learning, and social-emotional development. While facing the unprecedented financial and enrollment difficulties due to this public health crisis (NAEYC, 2020), many early childhood programs made efforts to provide learning opportunities and care to their students at distance. Some programs resorted to online and blended forms of learning, whereas others relied on simple photocopying of materials and printing paper packets as well as offering educational radio, television, and other forms of instruction (Kanwar & Daniel, 2020; Miks & Mcllwaine, 2020; Richards, 2020; Theirworld, 2020).

Certain Effective Teaching Principles Before the Pandemic Did Not Transcend the Medium

Based on a survey study, Jelinska and Paradowski (2021) found out that teachers are more likely to manage the transition to online environments in the pandemic "... if they had prior experience with remote instruction, taught in the higher education sector, or taught using real-time synchronous modalities" (p. 303).

Nonetheless, many teachers in the U.S. were barely required to prepare for remote teaching in case of any public emergencies. Drawing upon their professional training and in-person teaching practices, teachers have their own beliefs of effective teaching principles. However, the implementation of these principles can be significantly different between in-person learning settings and online settings (Kennedy & Archambault, 2012).

These differences were previously studied in the related literature. For instance, in Miller's study (2021), the teachers were concerned that interaction and socialization did not occur in online learning. Seeing students' body language and facial expressions is a way to maintain constant and meaningful communications. When the communication is moved online, teachers must find other ways to connect with their students (Miller, 2021). Other than teacher-student communication, Kim et al. (2014) argued that interaction with peers would play a supportive, social role in students coping with difficulties. In online math learning environments, these researchers found that the students were unable to interact with their peers as they would do in in-person classrooms. Such critical elements in effective teaching principles cannot transcend the medium, which presents challenges for teachers to maintain high-quality instruction in a different modality of learning.

The Pandemic Made the Long-Standing Issues More Visible

Since the pandemic touched most lives around the world in the early 2020, the need for transformative educational practices with rich and thoughtful technology integration has never been more apparent. There are very limited lessons that teachers could learn from their own past experiences to cope with the online learning situation that the pandemic created. Nevertheless, this does not necessarily mean that K-12 online learning research and practice is scant. Since the last two decades, the field has been not only growing rapidly in publication volume but also maturing by including more data-based studies (Arnesen et al., 2019). Nonetheless, the challenges discussed and addressed in these studies are the ones that online learning still faces today including the ones related with technology (Arnesen et al., 2020).

Without a doubt, one critical challenge is unequal access to technology resulting in the digital divide (Basu, 2020; Jaggars, 2021). It is a long-standing issue as online learning or blended learning emerged as an alternative or compensative option for in person learning. Scholars expressed concerns about the inequalities in household income and regional infrastructure (Jaggars, 2021). The divide is exacerbated by the pandemic due to the massive school closures. On one hand, students from low-income households could not participate in online learning because they do not have access to computers and internet connectivity. On the other hand, the situation could be worsened by underfunded districts or schools unable to equip students stuck at home (Basu, 2020). Without effective measures to bridge the digital gap, it is possible that disadvantaged students may fall further behind their peers. Besides access to computers and the internet, Resta et al. (2018) noted the concept of digital equity should be expanded. Other dimensions of digital equity encompass access to meaningful, high quality, and culturally relevant content, access to creating, sharing, and exchanging digital content, access to educators who know how to apply digital tools and resources, and access to research on the application of digital technologies to enhance learning. In such sense, the digital divide issue applies not only to students but also to teachers who attempt to provide high-quality online instruction but with limited access to technology and associated resources.

The digital divide was not the only barrier that teachers faced in this new modality of learning. Although early childhood teachers are the primary adopters and implementers of changing educational paradigms (Jamil et al., 2018), they have still struggled with barriers that prevent them from successfully integrating technology into their teaching (Nikolopoulou & Gialamas, 2015). Blackwell et al. (2014) categorized these barriers into intrinsic and extrinsic barriers. The intrinsic barriers encompass pre-existing teaching beliefs, attitudes toward educational value of technology, and comfort with technology, whereas the extrinsic ones include lack of time, training, professional development, and access to sufficient technological support. Aubrey and Dahl (2014) added that these barriers also involved the lack of vision of an effective technology-embedded learning environment, challenges of transitioning children's use of technology in the home to formal schooling, and various issues of working with parents. Another barrier could be attributed to the administrative level to effectively implement new technology tools and resources. For instance, Blackwell et al. (2014) argued that despite millions of dollars spent on teachers' access to emerging technologies, there was insufficient time and support for teachers to understand how to use technology effectively in their classrooms.

When the pandemic hit the education world in 2020, these challenges and barriers were already there. However, the impact of them was not as visible as when teachers had to fully transitioned to online learning. Despite scattered literature to draw upon, teachers were struggling with both long-standing challenges and newly emerged ones when they were forced to an unfamiliar modality to teach and support their students (Bonk, 2020). The current study can provide practice-based evidence of the teachers' experience in implementing online learning during the pandemic crisis. Concerns regarding young children's development during the pandemic call for a stronger connection between schools and families to support their young learners. The current study was an opportunity to gain more understandings of the design and implementation of online learning activities to support young children's development. As many educators foresee that education will not return to previous norms, patterns, and procedures when schools reopen, the results of this study have implications for teachers to consider a so-called *new normal*, that might bring more online learning opportunities and stronger connections between schools and homes.

Methods

Data Collection and Analysis

To address the research questions of this study, 15 teachers in early childhood education (pre-K, K, 1st, and 2nd grades) were recruited to be interviewed (see Table 1 for a summary of teacher profiles). There were a set of criteria for recruitment such as diverse set of grade levels, locations, types of schools (i.e., private vs. public), and years of teaching experience. The teachers worked in various U.S. states including the ones which were highly impacted by the pandemic (e.g., New York, New Jersey, and California). Eight of the teachers were teaching at private schools while seven of them in public schools. All the teachers had at least eight years of experience as an in-service teacher. There were some teachers with special profiles. For example, Teacher 1 had a specific teaching role as a technology teacher; Teacher 6 was teaching at a public school, but the school was considered affluent; Teacher 12 was already teaching at an online school before the pandemic, so her experience was rather different than the other teachers; and Teacher 15 was teaching students with special needs.

Table 1
Summary of Teacher Profiles

Teacher	School	Grades	Years	State	Remarks
1	Public	K, 1st, 2nd	15	New York	Technology teacher
2	Public	K	20	California	
3	Public	PreK	15	New Jersey	
4	Public	1st	9	Texas	
5	Public	1st	21	New Jersey	
6	Public	K, 1st	13	Florida	With high SES
7	Public	1st	16	N. Carolina	
8	Private	PreK, K	30	Georgia	
9	Private	1st	30	California	
10	Private	PreK	8	California	
11	Private	K, 1st, 2nd	12	N. Carolina	
12	Private	K, 1st, 2nd	15	Maryland	Already an online teacher
13	Private	1st	9	N. Carolina	
14	Private	K	20	New Jersey	
15	Private	PreK	37	New York	Special education teacher for students with special learning needs (the school is free of charge for them)

The interviews conducted online using an audio-conferencing technology by one of the researchers of the study. The semi-structured interview protocol (see Appendix A for the questions) had both experience and opinion questions (Fraenkel & Wallen, 2008; Merriam, 1991). These questions were targeted to understand the teachers' background, the impact of the pandemic on their educational practices, the major challenges encountered with online learning, and suggestions for addressing these challenges. Each interview took around one hour and was audio-recorded for analysis. To analyze the interview data, audio recordings were transcribed verbatim.

Content analysis was implemented by one of the researchers of the study on verbatim transcriptions to detail emerging codes and categories (Creswell, 2009; Krippendorff, 2004; Weber, 1990). These codes and categories were then outlined and summarized in a spreadsheet to identify similarities and differences across the teachers. Corresponding tables and figures were finally created to present qualitative results in a reader-friendly format. Note that, to ensure internal validity (i.e., trust value) and reliability (i.e., consistency) of the results, this study used triangulation by involving multiple teachers from both public and private schools (Merriam, 1991). We presented the results in a way that the readers could see how many teachers or which teachers we derived a certain result from. External validity (i.e., transferability) of the study was enhanced by providing rich description of the qualitative results with excerpts from the teachers (Merriam, 1991).

Findings

Teachers' Experiences About Online Learning After the Pandemic (RQ1)

In this section, we outline the interview results starting with how a typical day looked before and after the pandemic. We then explain the findings related to the teachers' priorities for online learning, role of parents in online learning, and critical learning outcomes along with problems that online learning introduced to address these outcomes. Finally, we describe the results for monitoring student emotions, behaviors, and performance during online learning, implementation of the group work before and after the pandemic, and technology use during online learning.

Typical day before and after the pandemic. In their interviews, the teachers were asked to explain a typical school day before the pandemic. Although there are some differences in terms of the activities based on the school type (public vs. private), student ages, and teacher profiles, there are some common activities discussed by several teachers. These include assembly time, whole-group/small group teacher-led instruction (i.e., mostly targeting math, reading, writing, and science), small group/individual work on various stations, playtime (i.e., inside or outside), and special lessons (i.e., art, physical education, and music).

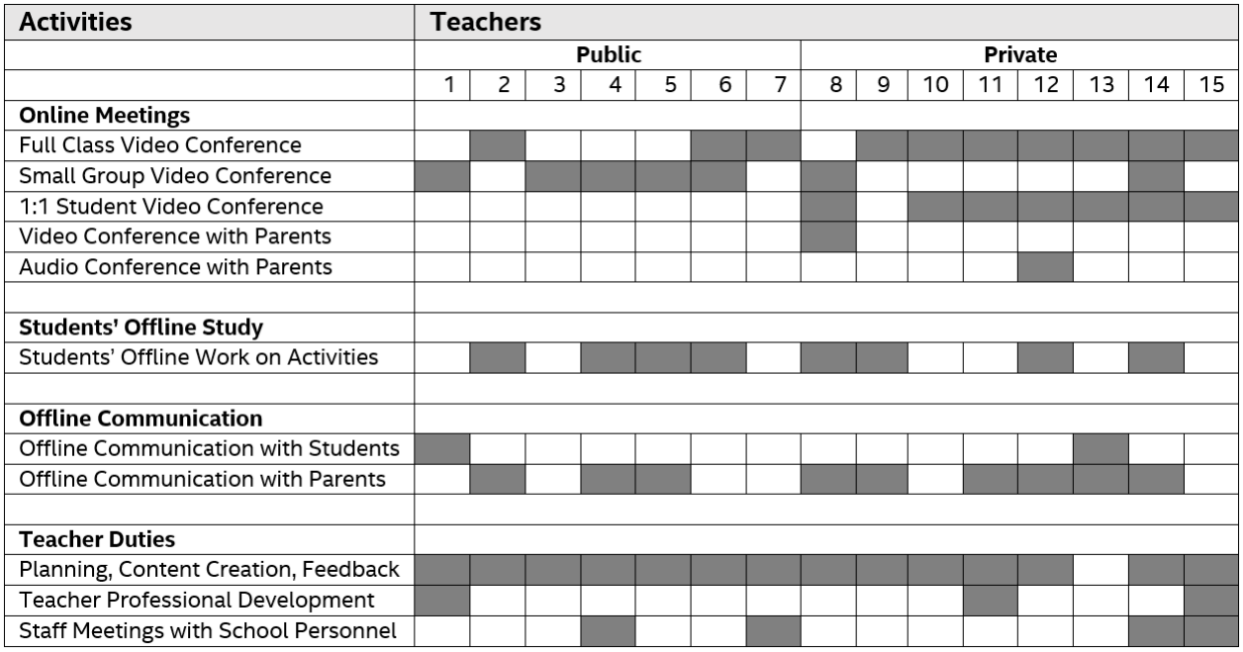
In their interviews, the teachers were also asked to explain their typical day at home after they started working remotely due to the pandemic. An example of the felt chaotic shift in teacher's schedules due to the pandemic is captured in the quote below.

> I tend to run a very organized and scheduled routine [prior to the pandemic] … The children transition very well when there's a set schedule, they know what's coming next, so there're no surprises… [But after the pandemic with online learning], there is no typical day …, it's been challenging in terms of structure and schedule … (Teacher 15, 2020)

Such daily structural challenges and apprehensions about the dynamic and quickly evolving nature of course schedules and agenda were apparent in many of our teacher interviews. During a typical day at home, the teachers indicated that they did whole group/small group/1:1 teacher-led video meetings and expected students to do offline individual work on the learning activities with the parent facilitation. See Figure 1 for a detailed breakdown of the typical day after the pandemic, along with the information about the specific tasks mentioned by each teacher in their interviews.

Figure 1

Typical Day After the Pandemic



Note. This figure and the other figures in the Results section have a similar formatting structure to enable readers to review the key results for each section visually. The teachers are represented with numbers on the x-axis (e.g., Teacher 1, Teacher 2, etc.) along with their school type (i.e., public vs. private). The key results are shown on the y-axis along with high level categories in bold text. A dark shade on the column of the specific teacher indicates that the specific result was reported during the interview. For instance, for Online Meetings category, only Teacher 12 (who worked in a private school) indicated conducting audio conferencing with parents.

As illustrated in Figure 1, while use of small group videoconferencing was pointed out by most of the public-school teachers in their interviews, none of them mentioned that they implemented 1:1 video conferencing with their students. In contrast, almost all private school teachers mentioned that they implemented 1:1 conferences with their students using synchronous video. During these 1:1 conferences the teachers explained that they did tutoring, talked about how the students were doing, asked whether the students had any problems in accomplishing learning tasks, and, more importantly, checked on their students' mental states and attempted to get them back in a positive mindset.

Teachers' priorities for online learning. In the interviews, the teachers indicated that their priorities for online learning included academic progression, social connection, student engagement, and social-emotional development (see Figure 2 for more details). However, the teachers also reported some major concerns around these priorities after starting teaching online. These pervasive social concerns are exemplified in the following quote.

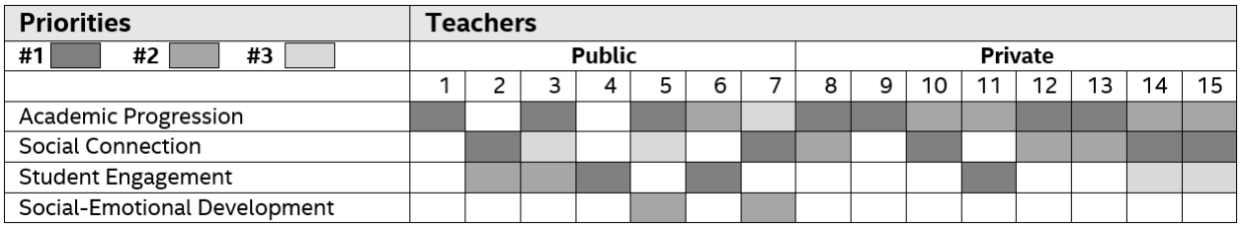
> This is not how I do my job; my job is social, emotional. It's interacting, it is singing songs, it's being silly, it's giving a hug when somebody falls. It's … one to one personal … [T]he kids are missing out on so much. It's not just academic, it's missing out

> on the community that we had in the classroom, they're missing their friends, they're missing interactions... (Teacher 5, 2020)

In addition to such social and emotional priorities, there, of course, were important achievement outcomes that they were held accountable for. In terms of academic progression, the teachers explained that they first attempted to maintain the knowledge especially in the first few weeks of the pandemic, and then they started to teach new concepts. Both Teacher 7 and Teacher 14 indicated that they initially focused on social emotional development or social connection because they thought online learning classes would happen only for a month; however, as the time progressed, they changed their focus to academic progression as well.

Figure 2

Teachers' Priorities for Online Learning with Rank Order



Role of parents in online learning. In their interviews, the teachers were asked to discuss their expectations from the parents concerning student learning during online education. The top three expectations of the teachers for the parents were: (1) supporting their child during assignments, (2) providing technical support to the child, and (3) supporting the child in scheduling their day. See Figure 3 for all expectations indicated by the teachers. However, it is important to note that in their interviews, the teachers also pointed out that living conditions of student families was quite varied. As Teacher 3 explained,

> …[S]ome families live five or six in a one-room apartment. So, that's gonna impact whether or not you can focus on the task that the teacher is asking you to do. (Teacher 3, 2020)

Even if the pandemic were to end, there would still be abundant differences in family backgrounds, expectations, and available educational resources.

Figure 3

Teachers' Expectations from Parents

Expectations from Parents	Teachers														
	Public							Private							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Support the child during assignments	■	■		■				■			■	■	■	■	■
Provide technical support to the child	■	■		■					■					■	
Support the child in scheduling their day				■			■		■	■					■
Inform the teacher about learning progress	■		■	■				■					■		
Attend video meetings with the teacher								■	■						
Motivate the child for learning	■										■				
Read and respond to the emails					■					■					
Check calendar posted for learning activities					■	■									
Monitor the child for being on track					■	■									
Provide feedback for activities to the teacher					■	■									
Get materials ready for the assignments										■					
Monitor the child's emotions and support										■					
Attend the orientation at the beginning												■			

In their interviews, the teachers also discussed engagement levels of the parents and communication methods between the teachers and the parents. The results revealed that engagement varied across different parents with low, moderate, and high engagement. The results also made apparent that the teachers used various methods to communicate with the parents including e-mail, video meeting, and text. See Figure 4 for more details about parent engagement and parent-teacher communication methods.

Figure 4

Parents' Engagement Levels and Parent-Teacher Communication Methods

	Teachers														
	Public							Private							
Parent Engagement Level	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Low ☐ **Moderate** ▒ **High** ■	▒	▒	▒	▒	■	■	▒	■	■	▒	■	■	▒	■	▒
Parent-Teacher Communication Methods															
E-Mail	■	■	■	■	■		■			■	■	■	■	■	■
Video Meeting	■		■	■		■		■	■	■	■	■		■	■
Text (e.g., Phone messages, Bloomz, Remind)				■		■		■			■	■		■	
Phone Call			■	■			■					■			
Message (e.g., Seesaw, Google Classroom, ClassDojo)	■		■		■										■
Announcement (e.g., Seesaw)		■		■											

Important learning outcomes. In their interviews, the teachers were asked to explain important learning outcomes for their students. The teachers indicated that they followed academic standards of their states for specific grades although private-school teachers pointed out that they tend to progress faster than the public schools. To address these learning outcomes, the teachers used various instructional materials during online learning including online videos, teacher-created videos, manipulatives, worksheets, physical puppets (during video meetings), various websites, textbooks, online quizzes, articles, virtual field trips, scavenger-hunt activities,

resources readily available at home (e.g., pennies), modeling clay activities, presentations, online games, songs, books, forms to collect data, whiteboards, etc.

In their interviews, the teachers also discussed the specific subjects that they found the most challenging to teach at distance. Nine out of 15 teachers indicated math as the most challenging subject because of the following: (1) not being aware of how the students solved the questions and how much help they got from their parents; (2) lack of 1:1 guided practice during video meetings; (3) difficulty in providing hands-on learning at distance; (4) lack of resources at home; (5) lack of teacher modeling for abstract concepts; and (6) not being able to assess the students in real-time and provide feedback. As noted in the quote below, Teacher 5 elaborated on these challenges.

> … [Math is] the hardest to teach in distance learning. … [T]he problem is the content and being able to assess in real time what that kid understands in math. … [A]t this level, everything math wise, for the most part, is kinesthetic, it's all hands on, it's build this, [it] is take your tens and ones sticks out, … it's all that kind of stuff. (Teacher 5, 2020)

See Figure 5 for the other challenging subjects (e.g., reading, writing, science, and robotics) as pointed out by the teachers along with their rationale for why they found it challenging.

Figure 5

The Most Difficult Subjects to Teach Online Along with Teachers' Reasoning

Subjects	Teachers														
	Public							Private							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Math			■		■	■	■	■		■	■		■		■
Reading		■		■		■			■			■			
Writing						■				■				■	
Science										■					
Robotics	■														

Math
- Not being aware of how the students solved the questions and how much help they got from their parents - Lack of 1:1 guided practice during video meeting because of time - Difficult to provide hands-on learning at distance (especially for students with special learning needs) - Lack of resources at home (e.g., manipulatives; even virtual manipulatives) - Lack of teacher modeling for abstract concepts (e.g., using manipulatives) - Not being able to assess the students in real-time and provide feedback
Reading
- Not being able to assess students in real-time and provide feedback (e.g., not being able to see where they are moving their fingers while reading; sometimes it is unclear if kids sound right without seeing their video with lip movements) - Not being able to show/demonstrate/model the concepts to the students - Lack of resources at home (e.g., books) - Lack of small reading groups
Writing
- Lack of observation by the teacher while students are writing (e.g., are they holding pencils right?) - Not being able to show/demonstrate/model the concepts to the student - Not being able to provide socio-emotional real-time feedback to the students
Science
- Lack of resources at home (science supplies)
Robotics
- Lack of resources at home (physical robots)

Monitoring student emotions, behaviors, and performance during online learning. When asked what student states the teachers would need to monitor when teaching at distance, 11 out of 15 teachers indicated emotional engagement (e.g., whether a student is confused, frustrated, happy, sad, nervous, shy, etc.). For instance, as Teacher 11 mentioned,

> [W]hen I'm in the Zoom® call with them [as a whole class], I would always look in for their body language, for … their face, facial expressions to see whether they were confused or happy, or sad, or, … sleepy … And when we did one-on-one [on Zoom®], it was very easy for me to, … know whether they were confused or not, … because I could see their face and, or they would tell me**.** (Teacher 11, 2020)

As the above quote signals, assessing student emotional states is critical to online course success. In addition to emotional engagement, 9 out of 15 teachers wanted to understand the level of parent involvement in student performance (e.g., whether a student is completing their assignments on their own or if parents are doing on their behalf). Similarly, 7 out of 15 teachers indicated behavioral engagement (whether a student is on-task or off-task) as another critical state that they would like to track when teaching at distance.

Additionally, the teachers also noted several other student states in their interviews as important to track during online learning. Such states included: (1) performance (i.e., comprehension, understanding instructions/materials, holding pencil/crayon correctly, being able to complete tasks, using instruments correctly, fluency in reading, and how many correct/wrong answers they provide), (2) real-time meeting participation (i.e., asking questions or speaking out during the meetings), (3) social engagement (i.e., level of collaboration/conflicts, bullying, relationships, playing together, etc.), (4) tiredness, and (5) explaining their problem-solving. See Figure 6 for more details on student states when learning online.

Figure 6

Important Student States to Monitor for the Teachers During Online Learning

Important Student States	Teachers														
	Public							Private							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Emotional Engagement	■		■	■	■	■	■	■		■	■	■		■	
Parent Involvement in Performance			■	■		■	■	■	■			■	■	■	
Behavioral Engagement			■	■		■		■		■			■		■
Performance		■				■		■	■			■	■		
Real-Time Meeting Participation				■	■								■		
Social Engagement			■	■								■		■	■
Tiredness				■							■				
Explaining Problem Solving					■										

In their interviews, the teachers also indicated that if they were provided with these states in the form of learning analytics (e.g., amount of time that a child is confused/off-task/bored or times that a parent solve a problem on behalf of a child, etc.), they would leverage these analytics to implement the following interventions with their students: (1) scaffolding (e.g., guiding students to learn); (2) understanding root causes of student states to further support students; (3) adjusting

the difficulty level of content based on performance and engagement; and (4) verbal interventions (e.g., calling out specific students and asking questions).

Group work. In their interviews, all 15 teachers indicated group work as a critical component of learning activities in their classrooms. However, after the pandemic began, none of the teachers were able to implement group work. As one teacher expressed,

> I know as the kids get older, the opportunity to work in groups is even more [possible], because they're more tech-savvy. So, right now, it's hard for a kindergartener to get on, and like search for another student in their class, and try to do something [online]**.** (Teacher 12, 2020)

Of course, there were caveats and options related to group work. For example, five of the teachers (Teacher 4, 6, 9, 12, and 15) indicated that they used breakout rooms to have small group instructional time (e.g., reading based on ability level), while Teacher 13 indicated that if the students wanted, they could do collaboration, but it was student-driven. Therefore, there was no curriculum-driven group work occurring after the start of the COVID-19 pandemic. Despite this lack of curriculum materials emphasizing group activities, as noted above, all teachers indicated that group work was a high priority for early childhood education; however, they were typically unable to effectively foster it remotely. See Figure 7 for the benefits of group work the teachers pointed out as well as the reasoning for why they could not implement it remotely.

Figure 7

Group Work During Online Learning

Subjects	**Teachers**														
	Public								**Private**						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Group Work [Before Pandemic]	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Group Work [After Pandemic]															
Breakout Rooms				■		■			■			■			■
Student-Driven Collaboration													■		

Benefits of Group Work

- Learning from each other
- Learning to work with each other
- Learning to take turns
- Learning to share toys/materials/manipulatives
- Getting peer feedback/tutoring

Why Not Group Work?

- Kids do not usually have a dedicated PC – they use their parents' PCs.
- Kids at this age are not independent learners yet, they need adult support.
- Kids have lack of resources at home (e.g., robotics, manipulatives, Internet speed, etc.).
- Kids at this age cannot navigate with the technologies to collaborate on their own, they need adult support.
- Scheduling smaller groups to work together is difficult.

Technology use. In their interviews, the teachers discussed about the major technologies they were using during online learning. Zoom®, YouTube®, and Seesaw® were the top three technologies reported by the teachers. With an emphasis on the lack of training on these new tools during online learning, Teacher 11 explained:

> I don't feel … tech-savvy ... This was very … difficult for me since I had to learn different platforms and I also didn't wanna overwhelm, not only myself but parents who may not know different platforms. So I kind of stuck with the same things, I did Zoom, I did Google Drive … (Teacher 11, 2020)

The teachers also reported various other technologies they were using which included Learning Management Systems, video-meeting apps, communication apps, game-based learning activities, screen-recording apps, etc. The teachers indicated that they liked these technologies when they are easy to use, involve interactive content (fun and engaging), and provide real-time feedback to students. They also indicated the following points as issues when they were using various technologies: (1) managing multiple tools for different tasks; (2) online access requirement being a barrier for students lacking internet connection; (3) privacy issues reported over some of these apps; (4) difficulty in using these apps; (5) needing to buy a paid version of the apps for using full features; (6) managing the sign-up process—making sure kids do not forget their passwords; and (7) a lack of collaboration features in these tools.

Teachers' Challenges with Online Learning (RQ2)

Many of those we interviewed assumed the role of online instructor despite their marked preference for in person instruction. Such a longing for physical classroom spaces is seen in the following quote.

> … I feel like we did the best we could, 'cause we didn't have a choice … because it was mandated. But as far as, in a normal year, would I choose online education versus school, it's a 1 [out of 10], because they don't get the interaction with me, or their friends, or manipulatives, or anything**.** (Teacher 9, 2020)

Teacher ratings of online learning environments, however, were quite varied. In their interviews, the teachers were asked to rate their current experience with online learning on a scale of 1 to 10 (1 = very bad experience… 10 = very good experience) and explain their reasoning for this rating. As Table 2 illustrates, one of the teachers rated their experience with online learning as a "one" out of ten or a really terrible experience, whereas two of the teachers rated it as high as a "ten." Interestingly, the average public school teacher rating was around 6.7 out of 10, whereas for private schools it was around 5.5. Figure 8 summarizes the challenges described in the teachers' rationales for their ratings.

Table 2

Teachers' Ratings of Online Learning Experience Along with Their Rationale

Teachers (Public)	Rating	Rationale for the Rating
1	5/10	- Lack of student engagement - Lack of teacher knowledge of home context (what is happening at home—e.g., who is doing the work, how much do parents contribute to student work, etc.)
2	7/10	- Difficulty in managing professional (teaching) and personal (parenting own kids) tasks at the same time - Too much screen time - Lack of hands-on experience (e.g., use of manipulatives)
3	5/10	- Lack of student engagement
4	8/10	- Lack of hands-on experience - Lack of physical interaction between teachers and students - Lack of parent support - More personal time for teachers
5	5/10	- Lack of physical interaction between teachers and students - Lack of classroom community and socio-emotional learning - Parents being stressed out - More opportunities for professional development (e.g., tech skills improvement)
6	10/10	- High parent engagement because of established strong relationship with parents - More opportunities for digital social engagement between kids (e.g., lunch together, movie together, virtual field trips, etc.) - More opportunities for differentiated instruction - More 1:1 time with individual students
7	7/10	- N/A
Teachers (Private)	**Rating**	**Rationale for the Rating**
8	7/10	- Lack of physical interaction between teachers and students
9	1/10	- Lack of physical interaction between teachers and students - Lack of hands-on experience (e.g., manipulatives)
10	6/10	- Unpredictable behaviors of younger kids during live meetings (e.g., crying, screaming, etc.) - Parents' conversations with kids out of school context during live meetings (e.g., I will take a shower)
11	3/10	- Too much screen time - Lack of hands-on experience - More 1:1 time with individual students
12	10/10	- N/A
13	8/10	- Online learning working for introvert teachers - Prior experience with online learning
14	3/10	- Too much workload on teachers - Kids' emotional challenges
15	6/10	- Hard to teach new skills through online learning - Online learning being hard for young kids - and even harder for kids with special needs - Parents' being stressed out - Lack of student engagement

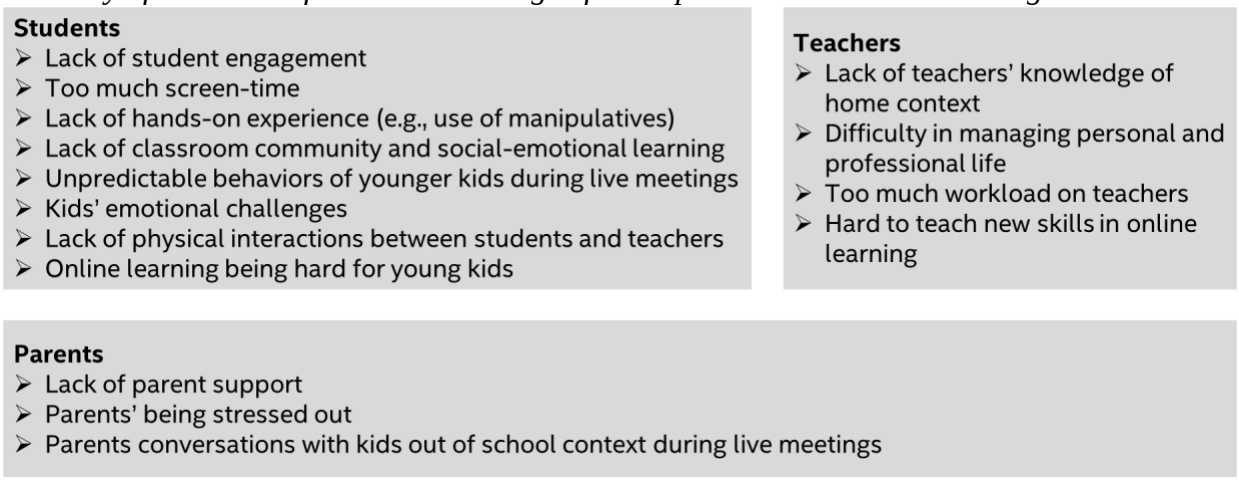
In addition to the synthesized challenges that we gathered from the teacher ratings of online learning experiences, at the end of the interview, we specifically asked the teachers to summarize their major challenges with online learning. Figure 9 outlines these challenges for students, teachers, and parents as reported by the teachers. The top three challenges reported by these teachers for students were: (1) low engagement, (2) lack of socialization/interaction, and (3) lack of hands-on activities/exploration/play. For instance, one teacher stated,

> … [T]he biggest challenge is student engagement. … [A] lot of students are just not doing anything … [and] I don't know what the reason is: … if it's issues that they're having with the work, they're not coming to see me when I have my open hours, they're not communicating with me. … [W]hen I do try to communicate with them, … I'm not getting responses … (Teacher 1, 2020)

Frustration seems imminent felt in the above quote where students were not communicating their problems and challenges with the teacher during online office hours and yet are not making any course progress.

Figure 8

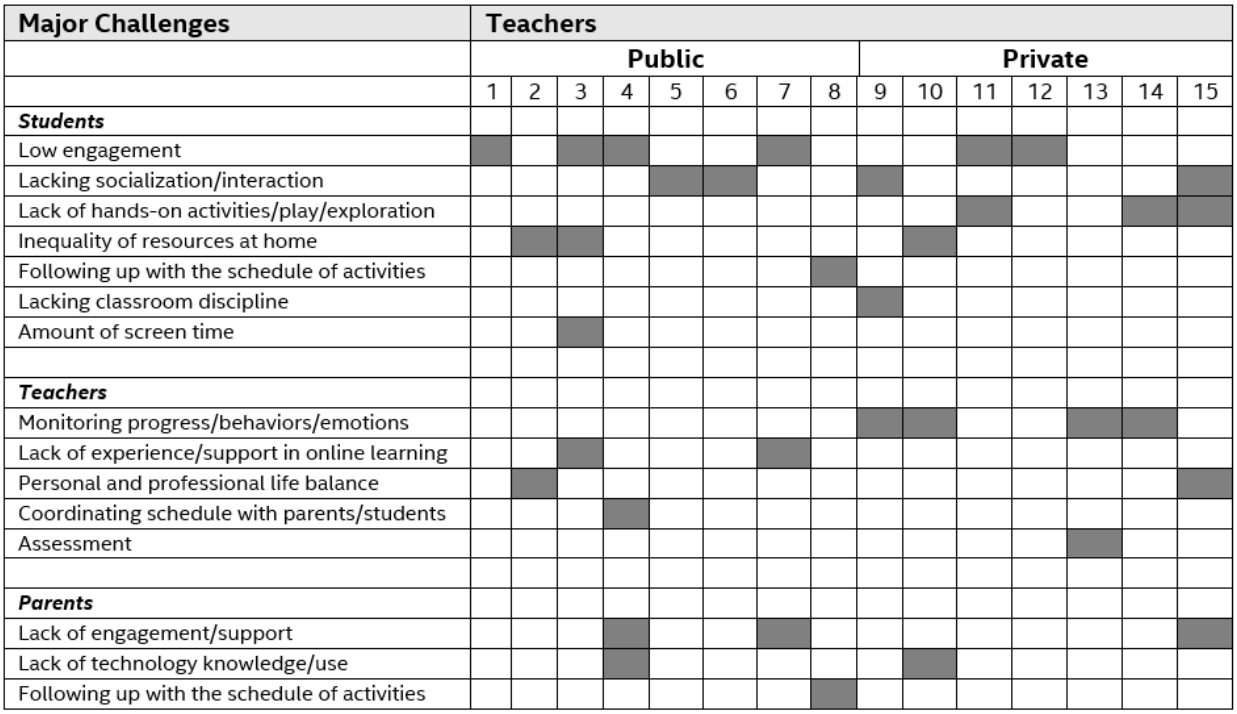
Summary of Rationales for Teacher Ratings of Perceptions With Online Learning



In contrast to the above student challenges, the top three challenges they reported challenges for teachers like themselves were: (1) monitoring progress/behaviors/emotions, (2) lack of experience/support in online learning, and (3) personal and professional life balance. Finally, the challenges that these teachers mentioned that related to parents included: (1) lack of engagement/support, (2) lack of technology/use, and (3) following up with the schedule of activities.

Figure 9

Teachers' Major Challenges with Online Learning



Major Challenges	Teachers														
	Public								Private						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Students															
Low engagement	■		■	■			■				■	■			
Lacking socialization/interaction					■	■			■						■
Lack of hands-on activities/play/exploration											■			■	■
Inequality of resources at home		■	■							■					
Following up with the schedule of activities								■							
Lacking classroom discipline									■						
Amount of screen time			■												
Teachers															
Monitoring progress/behaviors/emotions									■	■			■	■	
Lack of experience/support in online learning			■				■								
Personal and professional life balance		■													■
Coordinating schedule with parents/students				■											
Assessment													■		
Parents															
Lack of engagement/support				■			■								■
Lack of technology knowledge/use				■						■					
Following up with the schedule of activities								■							

Teachers' Suggestions for Online Learning (RQ3)

Online environments forced teachers to contemplate how to make learning engaging and interactive. Teacher 7, for instance, had a vision what online learning for her students would be like if it was more gamified.

> I … wish that I could create … a videogame where I am a character. And I give them [students] explicit instructions on what they need to learn for the day, and their goal, and it's like little games where they are learning, but they're learning through play, because they have to be engaged and motivated to make online learning work, and if they're not engaged, they just turn the thing off. (Teacher 7, 2020)

Such expressions indicate that, despite being overwhelmed with the demands of online teaching and learning, teachers were reflecting on how to be more innovative in their pedagogy and relate better to these young children, even in the early days of the pandemic.

To expand on these innovative ideas, at the end of the interview, we introduced a hypothetical scenario to the teachers and asked them to imagine that they had a magic wand which could create a new technology for them to address some of the major challenges that they discussed during the interview. We specifically asked them to describe features and functions of such a technology to help them as a teacher and support their students' learning. In Table 3, we paraphrased their quotes to succinctly summarize the major points they made to describe the technologies that they deemed useful.

Table 3

Teachers' Wish-list of Technologies to Address Online Learning Challenges

Interview Excerpt (*paraphrased to succinctly summarize the major points*)
For Teachers (Public Schools)
Teacher 1: I wish I had a virtual classroom where me and my students could work together, and I could help in real-time whenever needed. In this virtual classroom, I can create objects (virtual/physical) (e.g., robotics) and these objects can be manipulated by multiple students at the same time.
Teacher 2: I wish there was easy-to-use technology which could serve multiple functions. I also wish that during our live meetings, we could use a technology like smartboard in the classroom for real-time teaching.
Teacher 3: I wish I had a technology which could support online video conferencing with no internet connection issues. I could get inputs from my students in real-time to customize meeting content. I also wish that the students could have more interactive content: They could manipulate physical objects and share their work through a white board. I wish the technology could also enable language translation in real time to support teacher communication using home-language.
Teacher 4: I wish I had a technology which would provide more interactive content: Me and my students could move physical objects around – we could manipulate them together – and we could see who would be manipulating and how (physical to digital). I also wish I could change the camera angle to see other things in the space (e.g., when kids are reading a book, following their finger).
Teacher 5: I do not think there is any way that technology can replace face-to-face interactions because I want my students to do hands-on activities, use manipulatives, hold real books.
Teacher 6: I wish I could have more live lessons with active participation from my students. I also wish my students could have more technology-based hands-on activities and tangibles.
Teacher 7: I wish I had a technology which would enable role-playing video game incorporating academics where I, as a teacher, would be one of the characters providing goals for the day and my students would play little games where they would learn through play. The teacher could be the wizard to give instructions and demonstrate how to do things.
For Teachers (Private Schools)
Teacher 8: I wish I had a technology which could support easy video conferencing with minimum parents' technical support (e.g., for joining a meeting). It enables students to reach their teachers easily if they have any questions. I could change the view of the camera to see their work in details or their faces. I also wish my students would have more interactive content with manipulatives enabling my real-time monitoring and feedback.
Teacher 9: I wish I had a technology which could enable easy online video conferencing with minimum technical support from parents – almost like a simple click for the students to start the meeting. I also wish I could do small group work through breakout rooms but with insights for me to get involved if necessary.
Teacher 10: I wish I could have a technology that would enable my students to provide real-time feedback to their peers or me during meeting conversations: For instance, emojis or thumbs-up to indicate things like "Good job" etc. for positive reinforcement. I also wish that we could have more interactive content.
Teacher 11: I wish I could have an easy-to-use technology that would enable my students to play together. I also wish that this technology could support kids to have side conversations and meet independently to work together without a teacher. I wish my students could have more interactive, colorful, and engaging content.
Teacher 12: I wish I had a technology to support minimizing privacy issues (e.g., student names when creating different account) and it would enable them to work on activities nurturing social skills.
Teacher 13: I wish I had a technology that would give insights about students' hands-on performance during synchronous meeting: I would ask 'show me 2 tens and 3 ones', I would observe them doing, and the technology would detect whether my students doing right/wrong and report back to me.
Teacher 14: I wish I had a technology that would enable my students to easily navigate to their meetings; play together with manipulatives (virtual/physical), get different roles like dramatic play to nurture their soft skills (e.g., use of puppets), play interactive games. I wish I could still monitor them.
Teacher 15: I wish there was a store where I could click and download pre-made lessons with learning objectives. I also wish that there was a technology which would enable me to speak to the other teachers and learn from them.

To synthesize the information provided in Table 3, the teachers' technology wish-list primarily focused on technologies that are (1) easy to use, (2) include interactive, engaging, and customizable content through play-based learning activities, (3) provide real-time analytics (e.g., performance analytics, emotional states, non-verbal interactions (e.g., thumbs-up), etc.) to teachers for monitoring student progress and providing feedback accordingly, and (4) involve physical manipulatives during learning activities. Moreover, the teachers requested technologies which (5) provide advance communication and collaboration tools (e.g., side channel conversations among students), (6) enable teachers to control physical spaces of students (e.g., changing camera angles to see how a student manipulates a physical object on his desk), (7) require minimal technical support from parents, and (8) address security and privacy issues.

Discussion

The COVID-19 pandemic and its impact on the massive closure of schools make research on K-12 online learning much needed. The interviewees in the study were among the myriad of impacted teachers who had not been able to meet their students face-to-face since the outbreak of the pandemic. What is reassuring is that these early childhood teachers did not sit still, patiently waiting for the re-opening of the schools. On the contrary, based on the interviews, all 15 teachers who participated in the study took assorted initiatives to support their students' learning and development remotely. Insights from the 15 teachers in this study shed light on several pedagogical implications for early childhood educators transitioning their conventional face-to-face instruction to online settings. Such implications are based on the know-how gained from the teachers' experiences with online learning, the challenges that they faced since the outbreak of the pandemic, and the suggestions they provided to address these challenges through technologies, resources, and support structures they wished to have both now and in the future during online learning. The remainder of this section will discuss the results with the relevant implications for research and practice.

Teachers' Experiences: Many Changes Occurred, But Learning Objectives Remained

The interview results show that the teachers had experienced several changes after the pandemic disturbed their typical school day. First, they found out that in online settings they could not operate the same organized and scheduled routine with their students as they had employed for onsite learning. Although almost all teachers were caught unprepared for this change, they demonstrated concerted and carefully planned efforts to help their students continue learning remotely. These efforts included creating learning packages with instructional materials for the students to use at home; holding online meetings for maintaining social interactions and tutoring in real-time; creating assignments for enabling students to continue learning and practicing new skills; and constantly communicating with parents to support their children at home. Naturally, there were myriad other tasks and activities that these teachers engaged in to help their students find success online; it was a continually evolving process. This finding is consistent with the recent study by Rodriguez et al. (2021), as they reported 75 rural teachers in Mexico remained resilient and creative to provide the best possible learning environment for their students during the pandemic.

Despite the transition to online settings and many other changes along with it, both public- and private-school teachers attempted to follow the academic standards of their states during online learning. The study found a variety of instructional approaches that were applied in

online learning settings, covering both the methods and materials appearing in conventional face-to-face classrooms and the tools and content that are more commonly observed in online learning (see Hanover Research (2015) for an extensive list of principles for effective online course design at the K-12 level). The diversity of the instructional activities and content indicates that the teachers made extensive efforts and attempts toward effective and engaging online practices, and, accordingly, intended for optimal learning results. Additionally, their pedagogical practices imply that the teachers were aiming for developmentally appropriate and inclusive (Darby, 2020) learning activities when designing and implementing their virtual classes. Such efforts are consistent with U.S. Department of Education's (2016) recommendations for developmentally appropriate technology use and aligns well with the legions of educational resources that have emerged during the COVID-19 pandemic (e.g., Educating All Learners, 2020).

Although both private and public schools shared many commonalities in various mandates to transition their classes to online settings, the results imply some differences in terms of how they handled this transition. There seems to be slight differences in terms of resources, instructional methods, and technologies that the private and public teachers chose to use, their priorities for online learning, and their expectations for parent involvement. The most salient difference found in the present study, however, relates to 1:1 coaching sessions with the students. When examining the data, we found that seven of the eight private school teachers applied 1:1 video conferences with their students to understand their difficulties in carrying out online learning tasks and their overall emotional well-being, whereas none of the public school teachers reported implementing such personalized coaching sessions. We believe that one potential reason could relate to the class sizes given that the average number of students for the public school teachers in this study was roughly 20 students per class, whereas for the private school teachers, it was about 14 students. Other potential reasons for this intriguing difference in the use of video conferencing for learner coaching could include prior training, expectations, incentives, and collegial support. Clearly, this finding and potential implications merits follow-up investigations in larger-scale and more focused studies.

Teachers Challenges: To Keep the Same Teaching Principles and To Commit More

Although the student learning had been moved online, the teachers still wanted to be able to practice the same teaching principles that they used to employ in "normal" school days for high-quality education. First, they intended to provide personalized guidance and hands-on learning experience to enhance students' comprehension, but they discovered that it was highly challenging to do so in an online format, particularly when teaching certain subjects such as math. Second, the teachers pointed out that close-up observations, real-time feedback, and modeling and demonstrations were critical pedagogical strategies for math, reading, and writing, and the teachers felt that online environments made it difficult to conduct such instructional activities.

Third, the teachers recognized the benefits of group work as an effective way to encourage peer learning, collaboration, and sharing. This study revealed that the teachers were not able to implement curriculum-driven group work after the pandemic. A major reason behind this was that the teachers perceived that their young students lacked sufficient resources, tools, technological skills, and independent learning abilities to carry out virtual group work. The challenges to carry out close-up observations and group work in online learning settings were

also identified in previous research (Kim et al., 2014; Miller, 2021). Miller suggested that teachers need to find other ways to maintain constant and meaningful communication with their students. Fourth, the teachers reported that the students did not have the supplies and tools for the experiments and hands-on activities at home, which were critical for science and robotics classes. Therefore, the findings indicate that, despite various technological tools and resources, online learning, at least at present with the current conditions, could not substitute for face-to-face learning in many key aspects.

Not only did these teachers face obstacles to keep conducting what they had done in onsite learning settings, they were also challenged to commit more time and energy to support their students at distance. To address this challenge, the teachers expected more parent involvement and facilitation where and when it was applicable. The interview results suggested that parent facilitation helped to engage young learners in virtual learning. The teachers' reflections also indicated that parent involvement became salient when the students encountered a technical problem at their end (e.g., logging into an online meeting) or when they needed an adult to monitor their learning process and set rules for their use of technologies (e.g., helping with scheduling a stay-at-home learning day). It must be pointed out, however, as the related literature shows, the lack of communication between parents and teachers has been an issue even in conventional face-to-face settings (Aubrey & Dahl, 2014).

In comparison, the findings of the current study indicate that teacher-parent communication became even more critical for online learning environments as the early childhood teachers could only rely on the parents to provide corresponding support and assistance when they delivered learning materials in real-time or offline. In effect, the teachers needed close collaborations with the parents to achieve anticipated learning outcomes. Toward this end, the results showed that teachers had applied various methods to communicate with the parents (e.g., e-mails, video meeting, texts, phone calls, etc.). Unfortunately, based on their ratings, most the teachers were not satisfied with parent engagement in their children's online learning activities. In other words, there was still room for "… building stronger relationships with parents and enhancing their engagement" (NAEYC and FRC, 2012, p. 7). More importantly, while attempting to obtain increased support from their students' parents, the teachers were expected to devote more time to their own families as well. For those teachers who were also parents, they had to switch roles between life as a teacher and life as a family member supporting their own kids. As a result, balancing their personal and professional lives was another challenge that they needed to deal with when teaching from home.

As indicated earlier, most of the interviewed teachers were caught unprepared for the transition. These teachers found themselves in need of professional training and support for online learning. Going through the transition to online teaching and learning due to the pandemic is likely to encourage more teachers to enroll in courses or programs with a focus on online learning pedagogy in the next few years and beyond. Such training demands extra effort and time for teachers who intend to design and implement successful online learning activities.

Teachers' Suggestions: Access to Advanced Technologies and Concerted Efforts of All Stakeholders

Some of the challenges we discussed in the previous section could be solved as teachers, students, and parents become more familiar with online learning settings and current technologies to support those settings. Of course, some of such challenges might be addressed with continued advancements in learning technologies. Towards this end, in their interviews, the teachers expressed their wish-list for advanced technologies which could support some of these challenges by providing enhanced interactive, engaging, and customizable content; play-based learning activities involving physical manipulatives; real-time learning analytics improving the teachers' understanding of the student context; advanced communication and collaboration tools with minimal technical support from parents; and enhanced security and privacy features.

At the same time, some of the challenges have existed long before the onset of the pandemic, and, therefore, require long-term efforts from all associated stakeholders to alleviate. A key challenge is a lack of resources at home including student access to Internet or other resources for accomplishing learning activities at distance (i.e., digital divide). Additional challenges include a need for training and professional development for teachers and parents and finding balance between their personal and professional lives given the heavy workload that comes with teaching online from home.

Limitations and Future Directions

Like all studies, ours has limitations. First, we were able to interview 15 teachers across the United States. Although we attempted to diversify our participants by involving teachers from diverse grade levels, locations, types of schools (public vs. private), and years of teaching experiences, it is important to acknowledge that the results represent the experiences of the 15 teachers involved in this study and are not grounded within a large-scale data set. Nevertheless, we believe that the results of this study provide the basic foundations for future research with larger samples of teachers. Additionally, the results discussed in this study only represent the perspectives of the teachers as key stakeholders. As a future direction, it is important to understand and evaluate these results from the perspectives of other stakeholders including policymakers, school administrators, students, and parents.

Conclusion

More has been likely written and debated about online learning in terms of resources, pedagogical methods, and associated technologies, than the combined history of online learning prior to 2020 (Bonk, 2020). Despite the soaring rise of research in online learning, studies devoted to issues and challenges within early childhood education remain quite rare. This study was one small-scale investigation designed to address this research gap by interviewing 15 early childhood teachers across the United States on their instructional experiences during the early stages of the pandemic, perceived challenges with implementing online learning, and their suggestions for addressing the corresponding challenges.

The study sheds light on the teachers' efforts to implement developmentally appropriate learning activities for their students even though they had to rapidly transition to online instructional environments. Despite substantial advances in instructional technologies related to learning online, no technology can assure learning. More important are the pedagogical skills of early childhood teachers and their refinements and adjustments from various experimentations

and initiatives. This study offers some insights into these pedagogical activities. Follow-up studies might build on the present findings by looking at these challenges in online learning for early childhood and instructional practices from a cross-cultural and longitudinal perspective. Increasing insights can be used for pre-service and in-service teacher professional development and training.

Declarations

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

The authors assert that a privacy plan and a consent form were created and approved by the Privacy and Legal Team at Intel Corporation for conducting this research with human subjects.

The authors declared that they received no financial support for the research, authorship, and/or publication of this article.

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Appendix A
Interview Protocol

Teaching Background

1. Can you briefly talk about your overall teaching experience (e.g., subject area, number of years, grade levels, etc.)?
2. What is the age of your current students? How many students do you have in your class?
3. Can you describe your typical day at school before you started working remotely due to the pandemic?
4. Can you describe your typical day at home as a teacher after you started working remotely?

Experiences about Online Learning

5. On a scale 1–10 (1 referring to very bad experience, and 10 referring to very good experience), how would you rate your experience with online learning? Why?
6. Do you/your school use a specific Learning Management System (e.g., Google Classroom, Moodle, etc.)?
7. What are your major goals for online learning and in what priority (e.g., social connection, engagement, learning new content, maintaining knowledge, play, etc.)?
8. What types of support are you expecting from parents for their child's learning? When answering this question, please consider: What is working well? What is not working so well? What do you wish to happen?—in terms of parent involvement.
9. How do you communicate with the parents?
10. What percentage of parents/students are engaged in online learning activities?
11. What learning outcomes are critical for your age group to teach?
    a. What kind of activities/content do you use to teach these outcomes at distance?
    b. What learning outcomes are the most challenging to teach at distance?
12. When you are in a face-to-face classroom, as a teacher, you are able to observe in real-time your students' cognitive, social, emotional, and behavioral states and if necessary, intervene accordingly. Imagine that somehow you can still be present at their homes and watching what they are doing.
    c. What are the things you would observe and make sure they are doing those? Let's answer this question for two different scenarios: When students are learning synchronously (you are teaching them at distance in real-time) versus asynchronously (they are learning on their own).

Group Learning in Online Learning Setup

13. Before the pandemic, were you having your students get in groups and work together?
14. Do your students continue to work in groups for learning tasks despite of being remote?
15. What efficacies/barriers does online learning create for group learning?
16. Imagine that you want to setup real-time breakout rooms where pairs of students work together and you are on the side, watching a dashboard showing some analytics about what is happening in these rooms. What would be the things you would like that dashboard to show for each group so that you can go and support specific groups when necessary?

Technology Use for Online Teaching/Student Learning

17. What specific technologies are you using for teaching and student learning when working remotely?
18. What do you like/dislike about those technologies and what other technologies do you wish to have to support you when working remotely?

Challenges for Online Teaching/Student Learning

19. What are the major challenges you are experiencing when working remotely for teaching and student learning?

Suggestions for Improvement of Teaching/Student Learning Experience

20. Imagine that you have a magic wand which can create a technology for you to address all of these challenges and do whatever you want when working remotely to help your students learn. Can you describe what features and functions such a technology would have?
21. What kind of content would you like to create for your students with that technology?
22. Do you have any other comments to add before we finish the interview?