

A Retrospective of Teaching, Technology, and Teacher Education During the COVID-19 Pandemic

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Where there is no guidance the people fall,
But in abundance of counselors there is victory.
- Proverbs 11:14 (NASB)



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PREFACE

Introduction

The COVID-19 pandemic resulted in immediate and necessary changes to many aspects of K-12 and postsecondary education. In order to support teachers and teacher educators during this challenging time, a call was released in April of 2020 for short articles to be published in a special issue of the *Journal of Technology and Teacher Education* (JTATE). The process mirrored what was happening in medicine at the time; in other words, chapters were short (1000-2000 words), the timeline for submission was compressed (2 weeks), and reviewers were given limited time to critique (1 week). While the fast-track publishing was relatively new to education, the goal was to quickly identify and then share best practices for teaching and learning during a very challenging time.

The call resulted in an overwhelming number of manuscripts ($N = 266$) describing important and innovative work around the globe. After careful but rapid peer review, and in consultation with the *Association for the Advancement of Computing in Education* (AACE), a decision was made to publish both an open-access special issue in JTATE titled *Pre-service and Inservice Professional Development During the COVID-19 Pandemic* (Hartshorne et al., 2020) and an eBook titled *Teaching, Technology, and Teacher Education During the COVID-19 Pandemic: Stories from the Field* (Ferdig et al., 2020). There were thirty-three articles in the special issue and 133 chapters in the eBook that were all submitted, reviewed, and published in 8 weeks (Ferdig et al., 2021).

Existing data to measure the success of either publication, at least quantitatively, include the number of downloads and citations of the book, the editorials for both publications, the articles, and the chapters. Having said that, anecdotally, authors and readers have shared that the publications gave them both specific strategies and hope during a difficult time. The hope came from ideas for moving forward and the knowledge that they were not alone in their frustrations, needs, and concerns.

While such quantitative and anecdotal outcomes are desirable, and while the rapid publication process was relatively novel for many in the field, there was one significant and acknowledged weakness. The speed at which the pandemic swept the world meant that there was limited time to propose a research project, gain institutional review board (IRB) approval, collect and analyze data, and then prepare an article or chapter for submission. There were a few articles and chapters that did have data because they were working in areas related to pandemic solutions (e.g., online learning). However, most of the writings lacked their own empirical data to support their claims. Authors wrote about their ideas and current work and then used other research to attempt to triangulate and theoretically support their proposed solutions.

At the time of conception in 2020, the value of supporting educators outweighed empirical needs (vs. theoretical or conceptual publications). However, it did provide an opportunity to be able to return to the topic two years later. In April of 2022, authors from both the special issue and the book were invited to share the research they had conducted since 2020 on the issue they presented in either of the earlier publications. They were asked to be transparent about what had worked, what had not worked, and what direction they had taken since their previous initiative. And, as with both earlier publications, they were asked to draw implications related to technology and teacher education.

The General Outline of Chapters

The goal with this retrospective was to offer authors the opportunity to share brief research chapters based on data they had collected (or theoretical developments they had made) since their initial publication in 2020. As such, and in order to promote rapid review and publication, authors were asked to keep their chapters to ~2000 words. Authors used various processes and methods to conduct their research or further their theory. To support readability, they were also asked to adhere to the following overarching section headers (although some chose to add subheadings):

- **Abstract** (150-250 words).
- **Historical Review** (300-400 words). First, authors were asked to provide a broad overview of the work they reported in 2020. They were specifically asked to describe how the pandemic impacted this work from March 2020 to April 2022.

- **Process/Methods** (300-400 words). This section asked authors to include a full description of the research and the methods that were utilized to collect data (including research questions if applicable). Papers that were more theoretical or conceptual in nature were asked to provide theoretical support for their work.
- **Results** (300-400 words). In this section, authors were asked to report their empirical results. Most of the chapter authors had empirical results. As such, and unlike the first book, this section was expanded in size to allow authors an opportunity to share evidence they had collected since 2020.
- **Implications** (600-800 words). Finally, authors were asked to consider the direct implications for preservice and/or inservice teacher education (both for teacher educators and researchers). They were encouraged to consider if and how their implications might be enacted as educators and schools begin to transition back to face-to-face or hybrid practices.
- **References**. There was not a minimum or maximum number of references requested (nor did they count towards the overall word limit). However, authors were asked to provide triangulation back to existing research (including their own earlier work).

The Sections of the Book

The consistent theme or topic for this book is work that is at the intersection of technology and teacher education. However, within that large theme, authors wrote chapters on very diverse topics. This book, therefore, was divided into six sections to help organize the content for readers. It is worth noting that a chapter might have fit into multiple sections; however, it was placed into a section that was most relevant to the presented content.

Online Pedagogical Strategies

The events of 2020 forced teacher educators to modify their pedagogy for online instruction. The eight chapters in this section offer important implications and strategies for online teaching, teacher education, and professional development, particularly as educators return to face-to-face or hybrid instruction. The chapters presented in this section show evidence that teacher education and professional development can be taught online provided there is engagement with the learners. Maher (2022) indicates that it is important in an online environment for teacher educators to understand how to support preservice teachers throughout their degree. This can be done with video conferencing to increase social presence between students. Korte, Upola, Paksuniemi, Väättäjä, and Keskitalo (2022) echo the recommendation to support students in online environments. They suggest providing clear instructions, offering choices in assignments, and encouraging a network between students. Creely, Henriksen, and Henderson (2022) focus specifically on hybrid education and advise teacher educators to design and orchestrate learning in ways that integrate different types of learning and engagement. To help teacher educators who transitioned online, Szente (2022) recommends strengthening digital skills and focusing on strategies for learning remotely.

The next two chapters in this section focus on subject-specific teacher education and online pedagogical strategies. MacDonald, Coleman, Healy, and Diener (2022) suggest that art educators need to practice pedagogical slipperiness and "open possibilities for new knowing" between pre- and post-pandemic (Coleman, in press). Foye and Grenier (2022) argue that the key to teaching physical education online is ensuring learning systems are organized, keeping assignments simple, and providing brief videos for activities. Song, Koehler, and Farmer (2022) shift attention from working in specific content areas to working with parents. They offer ideas for preparing preservice teachers for partnerships with future parents. Specifically, they suggest engaging parents with eLearning and offering diverse design experiences. The final chapter in this section, by Barbour (2022), emphasizes the importance of not just focusing on preservice teachers but on school leaders as well. Barbour found school leaders were not adequately prepared for the shift online. He uses interviews to encourage school leaders to adopt tools to support professional learning.

Community and Collaboration

Authors in this section discuss different ways of building online communities for both preservice and in-service teachers. Professional learning communities (PLCs) are one solution to building a community of faculty, especially during a pandemic. Communities can also be built utilizing Massive Open Online Courses (MOOCs). Shin, Borup, and Kim (2022) discuss creating local course communities in global MOOCs. Specifically, they highlight that MOOCs can provide a freely accessible way to provide professional development. Additionally, they suggest that having shared language, culture, and context is helpful in providing supportive spaces for global MOOCs. Song, Cai, Hong, Liu, Jin, and Li (2022) collected data on a PLC since 2020. They share that there are important issues for discussion in groups such as anti-racism, diversity, equity, and inclusion. Additionally, PLCs can succeed when members are communicating frequently and can help provide support for teaching skills and mental health. Boutelier, Leal, and Ubik (2022) also explored digital spaces with PLCs in higher education and teacher preparation. They recommend organized synchronous learning environments to develop accountability and identify the need for worklabs to support learners. The final chapter of this section, by Carr and Riegel (2022), discusses teacher encouragement during and after the pandemic provided by text messages. Carr and Riegel found weekly text messages may support and boost inservice and preservice teachers' mental health and confidence during times of stress.

Preservice Teacher Education Methods and Pedagogy

The pandemic forced teacher educators to generate new strategies and explore innovative technologies for teacher education methods and pedagogy (e.g., conducting field experiences). Evidence in these chapters show the pandemic encouraged new ways of instruction for preservice teachers (PSTs) and many achieved high learning outcomes. For instance, Kosko, Zolfaghari, and Heisler (2022) describe how 360-degree videos can be used to conduct immersive virtual field experiences. Their research provides evidence that PSTs have higher perceptual capacity in noticing when using 360-degree videos. Keefe and Marin (2022) worked with a teacher candidate program that was forced online during the pandemic. They learned that effective instruction can be conducted online and confidence with utilizing technology can improve. However, they recommend that teacher educators consider how teacher candidates' online experiences translate to the classroom. Similarly, Coyne, Thompson, and Hollas (2022) discuss the importance of teacher educators preparing PSTs to teach online while receiving mentorship during the experience. They explored these issues in the context of an online residency for instructors specifically focusing on computational thinking education. Computational thinking and mathematics education was also studied by Bennett and Ray (2022) who collected data on teacher candidates' masteries online while allowing student autonomy. The authors found that students appreciated the autonomy in their own assignments and indicated they understood the material better, though some indicated they were debilitated by choice.

Continuing with the theme of online pedagogy focusing on PSTs, Buttler and Scheurer (2022) examined how online PST courses can support student-centered pedagogy while working with a professor who shifted from teacher-centered to a student-centered, constructivist approach. Findings revealed that online PST courses can support student-centered pedagogy and suggest identifying student needs, conducting meetings with students, and modeling the pedagogy utilized. To understand more about student experience with the transition to online learning, Haslam, Smith, and Sandberg (2022) conducted a PST survey after classes went online. They found that communication between peers and instructor to student differs depending on the environment (i.e., in-person vs online) and offer that there is no one-size-fits-all solution to online learning. Continuing with the trend of the transitions to online learning, Nisiforou and Evagorou (2022) explored the e-readiness of PSTs who participated in online or in-person STEM fairs. They found that PSTs improved their e-readiness based on their ability to design and deliver STEM fair activities utilizing new technological tools. The final chapter of this section explores online pedagogy for PSTs who were tasked with helping ill children learn. Kelley, Bagot, and Grysko (2022) created professional development for PSTs to teach chronically ill children in hospitals. While there was no indication of improved content knowledge, they share that PSTs developed self-confidence in the material and are likely to use the PD content in their future classrooms.

K-16 Educator Professional Development

Professional development (PD) for in-service teachers is essential to ensuring faculty stay up to date with the latest trends and pedagogical strategies. The six chapters in this section discuss online strategies for PD as well as how PD has continued since returning to in-person activities. There is evidence that PD can still be effective and efficient through online delivery. Darbee Muelthaler (2022) looked at supporting teachers in underserved districts during the pandemic. In her work, she emphasizes the importance of PD that has concrete examples of instructional practices. Findings indicate that a model remote learning classroom for professional learning is an effective support for teachers during remote and hybrid teaching. Wenzel, Williams, Trenta, and Kay (2022) hosted a remote learning community (RLC) during COVID-19 that offered professional learning for teacher educators involved with emergency online teaching. They share that teacher educators were able to identify and implement technology to meet student learning outcomes after being involved with the RLC. Moreover, the learning opportunities positively impacted faculty. Jin, Redish, and Maddox (2022) also discuss PD in describing a program to support the transition to online that included webinars, interviews, and discussions. Specifically, Jin and coauthors emphasize the importance of high-quality PD and suggest conducting needs assessments prior to implementing PD programs.

Ervin-Kassab (2022) introduces a faculty sandbox for support during emergency online teaching for faculty. She found that the sandbox can be useful for sustained PD and a space for sharing content. She also suggests it can be especially helpful for adjunct faculty who are not always available for in-person PD. Ko, Law, and Liu (2022) looked at an existing School-University partnership (SUP) and engagement in redesigning online PD throughout the pandemic. They suggest motivation and encouragement from school leaders can assist in increasing participation and progress in online programs. They also note that schools that fell behind were able to catch up with the model utilized. Research within teacher education and supporting teacher-driven research is the goal of a project that Connolly, Jones, Hall, and Procter (2022) introduce. They highlight the need for easy access to resources supporting teacher research and introduced a mobile application to support this project and offer other implications to support teacher research.

Digital Tools

While the use of digital tools for education is not new, the nature of teaching during the pandemic helped to increase the appreciation for and use of digital tools among teachers and teacher educators. Nine chapters in this section discuss using digital tools (e.g., simulations, screencasting, QR codes), their implications, and how they have facilitated instruction since 2020. New tools have been utilized throughout the pandemic and several instructors continue to use them as courses return to in-person format. The opening chapter by Baumgartner (2022) discusses the importance of combining online simulations with in-person, hands-on instruction, keeping in mind that the topics of the two approaches need to be aligned. In the second chapter, Schrodtt, FitzPatrick, and McKeown (2022) share how completing assignments using QR codes expanded content knowledge, increased research skills, and fostered parents' involvement during in-home learning. Kearney, Burden, and Schuck (2022) provide evidence that teachers' confidence with using digital tools has increased since the outbreak of the pandemic. Moreover, teachers were able to design and implement tasks involving digital tools which, in turn, foster students' collaboration and agency. FitzPatrick, McKeown, and Schrodtt (2022) discuss the impact of PD in which in-service teachers offered their students asynchronous audio feedback on writing tasks. Indeed, FitzPatrick and coauthors confirm that although the teachers appreciated and enjoyed implementing asynchronous audio feedback, in the end, they stopped using this type of feedback due to being overwhelmed with having to prepare both online and in-class instruction during the pandemic.

The growing use of multimedia since COVID-19 outbreak has simultaneously required an increased use of multimedia assessment techniques. For instance, Baleja (2022) describes screencasting as one technique that can facilitate formative and summative assessment. The author recommends screencasting to promote deeper learning and to offer detailed and personalized feedback. While Baleja focused on assessment facilitation, Tochelli-Ward (2022) explored modes of communication. Specifically, she reports on a project involving PSTs who shared multimodal reflections on their literacy and schooling experiences. The author found that when given a choice of using various modalities, the majority of teachers opted using narrated slideshows, which typically incorporate multiple modalities. The recommendation is to incorporate multimodal reflections in teacher education, simultaneously stressing the importance of early introduction of multimodality theories to students. McKeeman and Oviedo (2022) suggest using digital performance-based projects to strengthen resilience, relationships, and rigor in online learning. The authors found that performance-based projects not only motivated the students but also offered them opportunities for communication, connections, and engagement; con-

sequently, allowing them to stay resilient throughout the semesters. Tocci (2022) suggests that teacher educators should incorporate creating educational websites in their curriculum. He provides evidence that websites can be helpful with the distribution of information and social engagement. Twitter was another social media tool that was used to cultivate social interactions since the pandemic. As discussed by Chatterjee and Parra (2022), Twitter can promote engagement and student-centered design in online teacher preparation courses. The study yielded implications which include the continued significance of student-centered design, the regular employment and integration of digital tools, and fostering community growth based on the Community of Inquiry framework.

Equity Issues

While critical issues of equity have been a concern in teacher education for a long time, the pandemic and the renewed effort to fight racial inequality in 2020 made those issues more evident than before. Preservice and in-service teachers' training lacks addressing emotional and mental health needs and teacher training rarely focuses on anti-racism matters. Furthermore, teachers are unprepared in case of future, possible emergencies. The three chapters in this section provide lessons learned when introducing the discussion on those gaps in teacher education related to equity issues. First, Roman, Edwards, Dias, and Brantley-Dias (2022) recognize that due to the negative impact of the pandemic on mental health, addressing the emotional needs of students and teachers has been essential. Driven by this need, Roman and colleagues (2022) highlight the importance of the implementation of trauma-informed teaching approaches involving social justice principles for pre-service and in-service teachers in an online setting. Second, Kerkhoff, O'Daniels, Mardi, and Parton (2022) report on experiences of teachers who participated in a series of workshops focusing on anti-racist community building in online environments. Some identified successes include building trust, cultural awareness, and learning accountability. Moreover, teachers were able to successfully implement instructional technologies that foster the growth of communities addressing emotional and social needs. The third, closing chapter by Trikoilis and Papanastasiou (2022) recognizes that in 2020, educators worldwide were unprepared to teach online. With this lesson learned, Trikoilis and Papanastasiou (2022) organized a series of interviews in which experts shared their advice on how to proceed in case of a follow-up disruption. The authors suggest that educators should: (1) survey parents to identify students' needs and access to technology; (2) adopt tools that are standardized and integrated within one system; (3) conduct professional development; and (4) form collaborations and partnerships with other schools and districts.

Conclusion

This eBook provides readers with well-conducted research and important implications for teachers and teacher educators who are coming back to in-person or hybrid courses as the pandemic slows down. These chapters also show that teacher education virtually is possible and can be effective provided there is proper pedagogy and engaging content for learners. There is evidence that digital tools have contributed to more rich experiences for learners and higher possibilities of engagement. Online pedagogies have changed throughout the past few years, but evidence points to similar learning outcomes as before. While the pandemic forced many to have to adjust to a new way of teaching and learning, the chapters in this book indicate that many schools were able to overcome and adapt to the new way of teaching. The editors are pleased to share this eBook with you.

Respectfully,

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Online Pedagogical Strategies

The Use of Video Conferencing to Support Pre-Service Teachers during COVID-19

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Since COVID-19 swept across the globe, it has impacted on the ability for pre-service teachers (PSTs) to attend face-to-face classes, and the use of video conferencing has become common in many universities. This chapter focuses on the use of video conferencing to support teaching and learning for pre-service teachers at an Australian university. This chapter expands on findings from a chapter published in 2020. The historical review section outlines the original research. The qualitative methodology and the theoretical framework, which is a Community of Inquiry (CoI), are set out in the process/methods section. The results section sets out key findings using the CoI framework. Issues that were identified include the importance of social connections, professional learning groups, and the use of multimodal resources. In the final section, implications for teaching/learning using a Technological Pedagogical Content Knowledge (TPACK) framework are considered and future research and policy are set out.

Keywords: Video conferencing, COVID-19, community of inquiry, pre-service teachers, TPACK

HISTORICAL REVIEW

The use of video conferencing (VC) has supported the training of teachers in universities for some time (Wright & Cordeaux, 1996). Its use has become more significant since restrictions put in place by universities, because of COVID-19, moved learning online. In 2020, a chapter was published by this author in the 'Stories from the Field' book (Ferdig et al., 2020) where the focus was on the use of VC where two projects were discussed, one being the use in a hospital school and the other on the use in a pre-service teacher (PST) course (Maher, 2020). In focusing on the PST course, the original chapter concluded that using VC allowed PSTs to interact with one another in large and small groups settings analogous with the process that would be undertaken in a face-to-face class. Explicit instruction was provided for tutorial groups and the use of break-out rooms via Zoom allowed for PSTs to interact in pairs.

Outlined in this chapter are the findings from an extended investigation into the use of VC that was undertaken as COVID-19 restrictions continued and classes stayed online. This chapter focuses on content that was planned, compared to the emergency remote teaching (ERT) reported in the 2020 chapter. As Hodges et al. (2020) explain: "Well-planned online learning experiences are meaningfully different from courses offered online in response to a crisis or disaster" (para. 1). This chapter adds to the literature (e.g., Henriksen, 2020; Maher, 2021) on ways VC can be used during lockdowns to support PSTs, for blended classes and for classes that are conducted wholly online.

PROCESS/METHODS

The questions used to guide the research were:

- How does the use of VC support PSTs' socially and cognitively?
- How do teaching practices support PSTs' understanding?

The study used qualitative methodology (Lincoln & Guba, 1985) to understand the experiences of participants, which is suited to the research questions asked. The methods used for gathering data included participant observation, informal discussions with tutors, and polls conducted via Zoom with the PSTs. The research spanned five semesters over a 30 month time frame. A total of 10 Zoom sessions, lasting approximately one hour each, were recorded for analysis.

A total of 10 informal discussions with two tutors in two different subjects lasting approximately 20 minutes each were recorded. The use of informal discussions enabled emerging issues to be focused on in a naturalistic manner (Reeves et al., 2008). In the context of the university setting, such discussions were useful for informing further practice. As online delivery continued over a period of two and a half years it was important that initiatives that were trialled early were able to be assessed and modified with a central focus on the suitability of the approach/es for optimal PST learning.

The theoretical model, which is a Community of Inquiry (CoI), model comprises three key elements: Social Presence, Cognitive Presence, and Teaching Presence (Garrison et al., 2000). Social Presence is defined as the ability of participants to project their personal characteristics, thus presenting themselves as real people. Cognitive Presence is the “extent to which the participants in any particular configuration ... are able to construct meaning through sustained communication” (Garrison et al., 2000, p. 89). Teaching Presence explains the design of the educational experience, as well as facilitation for the purpose of constructing meaningful and worthwhile knowledge. In analysing the data, a thematic analysis approach (Boyatzis, 1998) was utilised.

The data were transcribed, coded, and then developed into the themes using the three categories of CoI (Garrison et al., 2000). To diminish the possibility of subjective interference with the emerging results, measures were adopted including cross-checking the codes emerging from the responses, and discussion of emerging themes.

RESULTS

Social Presence

One aspect that became apparent as COVID-19 and Zoom sessions continued was the importance of creating opportunities with the PSTs to engage with each other’s ideas and the importance of social connections. In the first semester of online delivery, where there was a whole class structure, the tutorials tended to be teacher-centred with a lot of tutor talk. This increased talk was because of some hesitation by PSTs to contribute to discussions in an online environment. This aspect of extended online tutor talk has been found in other studies (e.g., Moorhouse, 2021).

As COVID-19 restrictions continued there was an increased use of breakout rooms to support social connections. There was a demand for this from PSTs and discussions with tutors supported this. In one subject three classes consisting of 87 PSTs were asked to respond to a poll with the statement being: I find using breakout rooms helpful in supporting discussions with 80% of the students responding yes. The two tutors agreed that social connections were important, and the use of the breakrooms facilitated such connections. A tutor was asked about the use of the breakout rooms: *They allow students to discuss their ideas in a similar way to group work in a face-to-face setting and they can give and receive feedback to each other. This helps them develop ideas which helps to refine assignments.*

As mirrored in the quote by Darling-Hammond and Hyler (2020), “... it is increasingly clear that PSTs’ social and emotional experiences influence their learning—and that teachers must learn how to integrate these areas of development to be effective” (p. 457). One of the skills that PSTs need to develop to become an effective teacher is communication skills (Khan et al., 2017). These skills can be developed through discussions in tutorials where PSTs are encouraged to present and argue their points of view and critically engage with other PSTs’ ideas. The use of the breakout rooms facilitated such discussions.

One observation made during VC sessions was that PSTs tended to be reluctant to turn their cameras on when speaking to the group which limited social presence. This observation was reported by both tutors during discussions. As with Schwenck and Pryor’s study (2021), there was no policy in relation to having a camera on during tutorials, but in semester 2, 2021, PSTs were asked to turn their cameras on when speaking to everyone. PSTs were happy to turn their cameras on when reminded and it assisted in developing social presence. One of the tutors noted: *The students respond to each other with more enthusiasm when they can see each other. The non-verbal cues help them to understand each other better.*

Cognitive Presence

One of the initiatives enacted to support cognitive presence was the establishment of professional learning groups (PLGs). These groups were organised so that PSTs who elected a focus of study similar to other PSTs could work together and share ideas and resources during tutorials. The focus of the subject where PLGs were embedded was on the teacher as researcher and the PSTs were able to nominate their own research focus. Both tutors reported that the online PLGs supported the PSTs. During discussion with one of the tutors I asked about the effectiveness of the PLGs. The tutor's response was *the PLGS have been effective in allowing the PSTS to bounce ideas off each other which is helping to shape their study*. An analysis of the textual interactions indicated all students read messages posted although only 70% posted comments.

The Learner Management System (LMS) allowed PSTs to discuss the focus for their study and then communicate it amongst themselves, both during and after tutorials. The ability to communicate in their PLGs when desired gave the PSTs of great deal of agency. The tutors also had access to these groups and were able to make suggestions to the PSTs regarding the research question and the methodologies they were planning to use. As all the PSTs could see the tutors' comments, this added to cognitive presence. As noted by a tutor: *The use of Canvas [the learning management system] allows the students to see the way each other's ideas are developing based on discussions during tutorials. This facilitates discussion during breakout sessions*.

Teaching Presence

In planning the subjects there was an emphasis on including more multimodal resources such as short instructional movie clips. These clips were chosen by the tutors to support the content of the tutorials and were provided to the PSTs before and during the tutorials. Discussions with tutors indicated that PSTs felt prepared for tutorials and supported during tutorials by watching the clips. One tutor commented: *The videos are focused on the topic and are presented by a range of organisations which adds credibility. Watching them has facilitated some good discussions during tutorials*. In using the analytics function of the LMS, the majority of students (76%) accessed the videos prior to the tutorials. In working with the students there was frequent reference to the videos during discussions.

Another way that teaching presence supported PSTs' understanding of assignments was through one-to-one discussions, which were facilitated via Zoom. In feedback from tutors, they both commented that they communicated with a greater number of PSTs as the online teaching continued during the COVID-19 lockdown and it was clear they were effectively supporting PSTs both cognitively, and as suggested as being just as important by Stenbom et al. (2016), emotionally. One tutor noted: *Being able to speak with some of the students individually helps me to understand where they are at pedagogically and they find it useful to discuss the assignment and their prac [professional experience placements]. Some of them also discuss their concerns for the future which helps them to be settled*.

IMPLICATIONS

As the COVID-19 restrictions are rescinded in universities, there will be fewer VC-based tutorials as PSTs return to campuses. However, there are implications for teacher education where classes are exclusively online and where they are blended, which Smith et al. (2021) believe will characterise a new norm.

In considering teacher educators' TPACK knowledge (Koehler & Mishra, 2009), an increased use of VC has implications for teacher education. In research conducted by Amhag et al. (2019), results showed that teacher educators do not use digital tools primarily for pedagogical purposes. Thus, teacher educators will need extensive pedagogical support in creating digital teaching environments that incorporate the use of VC. In working in a one-to-one environment, Barker and Walsha (2021) suggest that the pedagogy of online environments in higher education is ripe for further investigation. The move to an online environment will necessitate the need for a greater understanding of how teacher educators can support PSTs' cognitively, socially, and emotionally throughout their degree.

In moving to an increased use of VC there are implications for teacher education in relation to teacher educators' and PSTs' technological knowledge. Learning to use VC technology has become more important with many teacher educators and PSTs using VC technologies for the first time, such as Zoom, as a result of online delivery. In using Zoom, some

of the functions that can be accessed include “chat, screen annotation, polling, non-verbal feedback, break-out rooms, ... and virtual whiteboards” (Fackler & Sexton, 2020, p. 8). The ability to use these functions contributes towards PSTs’ understanding of content during tutorials so it is important that teacher educators and PSTs are provided with support to learn to use these functions, and functions of other VC systems.

There are differences in VC discussions compared to face-to-face discussions, which has implications for research on teacher education. Some of the differences in synchronous online discussions are that they are “fast-paced, socially demanding, and attention consuming...” (Belt & Lowenthal, 2021, p. 422). Teacher educators should understand the differences for their practice. PSTs will need to be supported to understand these differences, both for their learning and for their teaching. Mpungose (2021) suggests that further research is needed focusing on interactions mediated by VC in PSTs courses focusing on issues such as Zoom digital fatigue, autonomy, and emotional connectedness.

As noted by Demuyakor (2020), learning and teaching practices in teacher education are changing. An increased use of technologies in PST courses has implications for policy in relation to infrastructure that supports such courses. In moving towards VC classes there is an expectation that PSTs will have access to associated technologies (Hill, 2021). As suggested by Kumar (2008), before any ICT-based program is launched, policymakers and planners must ensure the availability of resources. In considering the use of VC in teacher education courses, such resources would include VC software for all staff and PSTs, sufficient bandwidth to support the online traffic and technical support. Consideration by planners would also need to be provided, focusing on the curriculum and how the use of VC would align with it.

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A Model to Support Students' Psychosocial Well-Being: Promoting Student Self-Efficacy in Remote Learning

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This paper presents the findings of a study aimed at developing an interactive and participatory remote teaching model. The specific objective of this study was to support teachers in their use of exclusion-prevention teaching practices that take into account the psychosocial well-being of learners in upper secondary education and those in their last year of basic education. The need for this study arose due to increased student drop-out and burn-out rates during the COVID-19 pandemic. An online survey was conducted among students ($N = 189$) to identify their experiences of distance learning, and three workshops were held, during which students ($N = 45$) conducted a SWOT analysis of their learning experiences. The results revealed the students' diverse needs, including support for their sense of agency and self-efficacy, and the significance of social interaction in remote teaching. Based on the students' voices, the study identified effective supervision strategies and teaching organization as key issues to ensure no student is left behind. Consequently, the key features of interactive and participatory remote learning were used to design a model that can assist educators in planning and delivering remote education.

Keywords: remote teaching, youth, psychosocial well-being, learning environment, student voice and agency, self-efficacy, survey, workshops

HISTORICAL REVIEW

The COVID-19 pandemic initiated a global transition to remote learning in early 2020. A study conducted by Frangou and Keskitalo (2020) among preservice teachers during the early stages of the pandemic recommended dialogical and interactive teaching and learning practices for remote education delivery and highlighted the importance of developing preservice teachers' technological and pedagogical competencies and content knowledge. These results and recommendations are still current. Indeed, the need to develop the recommended dialogical and interactive teaching and learning practices has become even more urgent. Research on experiences of remote teaching and learning after two years of

the pandemic (Kestilä et al., 2022; Valtioneuvosto, 2021) has revealed the diverse effects it has had on youths' everyday lives and psychosocial well-being, including increased drop-out and burn-out rates and a greater need for support among young people (Lavonen & Salmela-Aro, 2022; Tan & Chua, 2022). It has also highlighted the importance of developing teacher education that enhances preservice and in-service teachers' exclusion-prevention competencies for both remote and classroom activities. In this study, the researchers draw on their involvement in several development projects regarding remote teaching and learning since the beginning of the pandemic to expand knowledge on these timely themes.

This article presents a study examining young people's experiences of distance teaching and the development of a model based on these experiences. The pandemic has changed and diversified education delivery methods in many contexts and heightened educators' awareness of the need to adapt to changing teaching situations. In Finland, schools went into total lockdown in spring 2020, and further local (classrooms and schools) lockdowns were imposed from time to time until recently. The goal of this article is to determine the factors that promoted students' psychosocial well-being during distance learning and identify practices that should be retained as we attempt to return to normal. Hence, this study seeks to answer the following question:

1. What kind of remote teaching practices promote well-being and self-efficacy according to students?

To achieve this goal, we first present students' positive and negative distance learning experiences and then examine how students described their well-being during extended distance learning.

METHODS

This article is based on a development study conducted as part of the eOPE (eTeacher) project, which was conducted in Finnish Lapland, in Northern Finland, and funded by the European Social Fund. The project connects scholars from the University of Lapland and Lapland Education Centre REDU. The overall study (Upola et al., 2022) is aimed at informing the Finnish-speaking research community about factors that affect distance teaching, while the paper at hand contributes to the international debate on distance teaching by reflecting on lessons learned and next steps.

For this research, we chose a participatory, qualitative approach based on data-driven content analysis (Johnson & Christensen, 2020). The data were collected between May 2021 and January 2022 through an online survey and workshops. The researchers became acquainted with the data by reading through the materials and abstracting key phenomena (see Johnson & Christensen, 2020).

The participants in the study ($N = 234$) were final-year students completing basic education and students completing upper secondary education. In the first phase of data collection, the students were asked to describe their experiences of distance learning through an online survey ($n = 189$) based on Salmela-Aro and Näätänen's (2005) measurement tool for youth school burn-out indicators. This paper presents the findings derived from the responses to the open-ended, qualitative survey questions.

The second phase of data collection consisted of three workshops for upper secondary students ($n = 45$). In the workshops, the students conducted a SWOT analysis to assess youth actions and experiences in pedagogical settings (van de Vijver, 2017; see also Madsen, 2016) and classified their remote learning experiences into four categories: strengths, weaknesses, opportunities, and threats. In total, 173 definitions of distance learning were obtained.

FINDINGS

The students' responses showed that they regarded distance learning as a multidimensional phenomenon that can be examined with respect to two dimensions. The first concerns the learning environments, and the second relates to students' own experiences of coping, and third relates to well-being. Students were found to have heterogeneous personal learning environments, which either supported or hindered the learning process by affecting their sense of self-determination and self-efficacy (Figure 1).

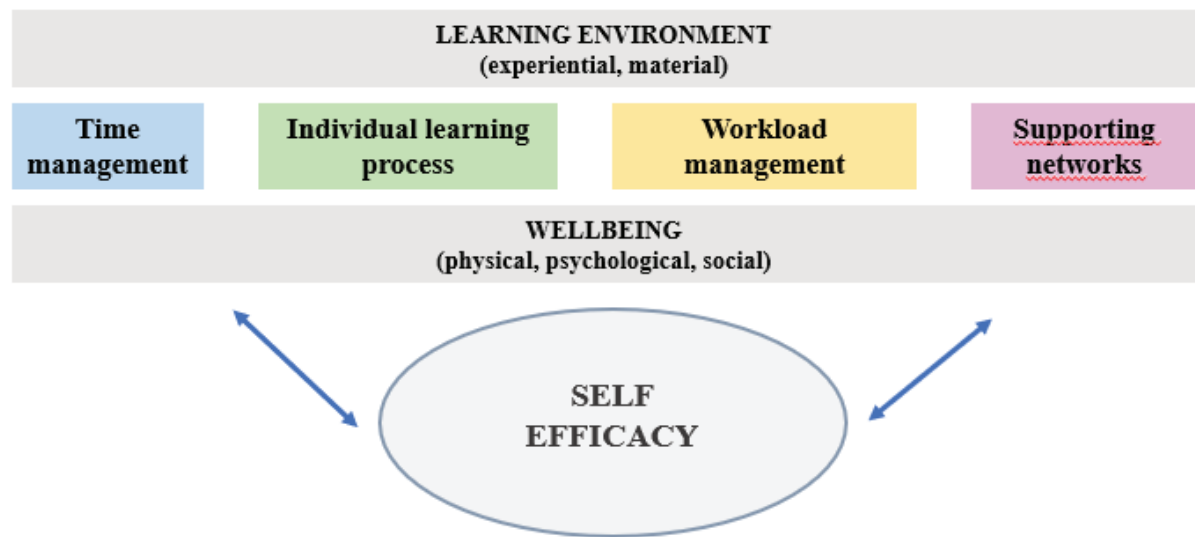


Figure 1. Factors Affecting the Meaningfulness of Distance Teaching, Based on Students' Experiences.

Learning environments were seen as a cross-cutting factor affecting the entire distance learning process and one that had both material and experiential dimensions. It is important to understand the learning environment in a holistic way because students' learning experiences are affected by both the material environment, e.g., the reliability of the Information and Communication Technology (ICT) infrastructure, and the experiential or psychosocial environment. The students' well-being was found to be dependent on social, psychological, and physical factors. Their self-determination skills were dependent on four factors: time management skills, workload management, individual methods of studying, and a network to support learning. Success in these four self-determination factors was found to have a positive effect on the students' experiences of self-efficacy. Self-efficacy was seen as closely connected to the overall distance learning process because a considerable number of experiences of success and failure were mentioned in the data. Positive and negative factors were reported for each category of psychosocial well-being.

Students reported many positive aspects of distance learning, with many seeing it as a new opportunity to foster enthusiasm, flexibility, and a sense of control. However, they also reported negative and discouraging features of distance learning, namely stress, loneliness, and passivity. Successful distance learning includes both interactivity and the ability to study in one's own way and according to one's own schedule. At the same time, it is important to provide students with proper support and offer them a safe atmosphere in a cooperative learning environment.

IMPLICATIONS

Many of the responses to the open-ended questions in our survey described negative remote teaching experiences. However, all categories of analysis included positive aspects, such as the ability to increase time at home and work in the peacefulness of one's own home. Consistent with a study by Petillion and McNeil (2020), the principal concerns reported by the participants related to challenges in managing time and workload, as well as a loss of social interaction.

Methodologically, the researchers learned that workshops are a useful arena for establishing connections with young people and enabling them to share their ideas (see Vassiliou & Dragonas, 2015). The researchers encourage educators and other researchers to use participatory approaches to facilitate interaction between learners and supervisors so that they can share their realities and discuss challenging situations. Our discussions with learners enabled us to identify risks and gaps related to distance learning, many of which are aligned with the findings of Mason et al. (2013).

In sum, we identified many short- and long-term consequences of the implementation of remote learning during the pandemic. However, the key finding of our study is that the learning environment affects the entire distance learning process and encompasses not only the equipment used for the provision of teaching but also the socioemotional experiences that influence students' well-being. Thus, as we attempt to return to normal, we should not forget that this matter is multifaceted. We should keep in mind the positive aspects of remote learning, e.g., flexibility, as well as the challenges faced

by youth during the pandemic. We are currently in a crucial phase, one in which we must redress the disruption to young people's education due to the pandemic and learn from the challenges it brought. This article highlights young people's own experiences of remote learning and identifies what factors should be considered in future education and educational policies.

Based on our findings, the researchers offer the following recommendations for preservice and in-service teacher training, as well as policymaking related to remote teaching practices that promote well-being and self-efficacy. These recommendations reflect the key features of interactive and participatory remote learning and are formulated as a model to assist educators in planning and delivering remote education that supports the psychosocial well-being of students (Figure 2).

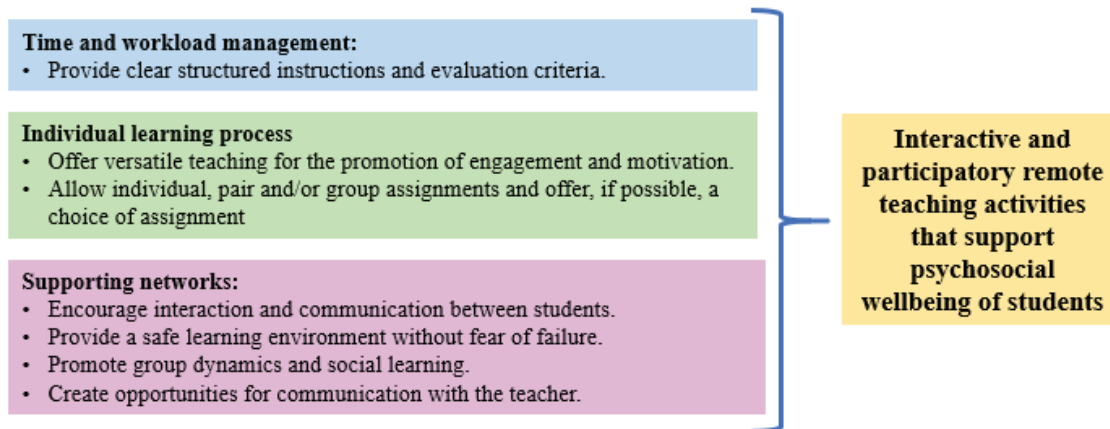


Figure 2. Interactive and Participatory Remote Teaching Activities that Support the Psychosocial Well-Being of Students.

Figure 2 presents a set of recommended interactive and participatory remote teaching activities. These recommendations are aimed at supporting students, promoting interaction through group-based activities based on social learning, and promoting self-motivation and a sense of flow during the learning process. This requires that teachers plan and conduct their learning activities by drawing on in-depth knowledge of learning theories and pedagogies, as well as how digitalization can be used in teaching. In addition, the importance of supervision should not be underestimated. Discussion should be promoted, and the supervision and facilitation skills of teachers should be developed.

Negovan (2010) identified several dimensions of psychosocial well-being: subjective well-being related to everyday events, subjective well-being related to the actions of education institutions, psychological well-being, and social well-being. Conscious actions are necessary to support students' psychosocial well-being during distance learning because a lack of interaction with peers and supervisors can have detrimental effects on students' well-being. By taking conscious actions to further distance teaching, educational professionals can support students' psychosocial well-being by being conscious of the fact that, if students are left alone, without interaction with their peers and supervisors, often, their well-being begins to move in a negative direction. Furthermore, activities that are flexible and support students' individual learning styles and help them to manage their time and workloads begin with clear and structured instructions and evaluation criteria, as well as a choice of assignments. Versatile teaching practices that take advantage of both digital tools and non-digital methods are motivating and engaging and can, therefore, help prevent student passivity.

These recommendations, summarized in Figure 2, are largely in line with those of Petillion and McNeil (2020). However, the latter highlighted the significance of adapting assessment for remote learning and creating flexible assessment systems, which were not mentioned by our participants. The needs and ideas reported by students in the workshops are also in line with current research on learners and learning organizations engaged in distance learning (Nummenmaa, 2011).

Today, many technical solutions are available to facilitate remote learning. These solutions offer a variety of ways in which to increase interaction between learner groups, as well as between learners and teachers, to enrich the learning situation. In Finland, virtual and digital learning have been promoted in national strategies for over 10 years. In practice, however, many hindrances exist that hamper the efficiency these strategies (Nummenmaa, 2012). Among these are teachers' hesitance regarding digitalization and a shortage of available digital devices (Mikkonen et al., 2012). Thus, policy-

makers should ensure that there are enough digital resources available to teachers and that teachers understand how to use these devices.

Another issue is the need to increase the understanding of and competency in digital teaching content among both in-service and preservice teachers, sensitize and train educators in the use of digital tools, and keep them updated on emerging remote teaching and digital pedagogies.

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Moving Beyond Folk Pedagogies Towards Hybrid and Blended Practices: A Reflection on Teacher Education Post-pandemic

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In our 2020 JTATE article we proposed using Bruner's (1996) frame of folk pedagogies to consider pedagogical approaches suited to synchronous digital online learning in pre-service teacher education in COVID-19 times. We argued for the need to move beyond outdated pedagogies long-used in teaching practice and often oriented to face-to-face instructor-centred contexts. That article offered new pedagogical thinking and practical implications based on existing literature about online and distance education and drawing on experiences from our own practices that reflected the realities of teaching at that time in the pandemic, and the need to use technologies more proactively. In 2022, our thinking has evolved to consider hybrid forms of educational delivery that reflect newer realities that have even greater emphasis on the effective use of technologies to mediate learning. To investigate these new and emerging hybrid forms we draw on autoethnographic data and evaluations of our practices as educators in teacher education. We bring attention to the role of the teacher educator in purposeful design decisions through an examination of our own practices in teacher education. In this chapter we revisit and add to Bruner's folk pedagogical frame, pointing to implications for practice, including the need to design for learning that considers the nature of delivery with and through technologies. Through an autoethnographic exploration of our use of pedagogies in emerging hybrid learning environments within teacher education programs in 2022, we emphasize the use of asynchronous resources with synchronous learning and the facilitation of student agency.

HISTORICAL REVIEW

The 2020 JTATE special issue on "Preservice and Inservice Professional Development During the COVID-19 Pandemic" sought to support innovative pedagogical practices stemming from the initial rapid COVID-19 shift to online education. Our piece in that issue used the construct of Jerome Bruner's (1996) folk pedagogies as a taxonomy to guide online pedagogical designs—particularly in the use of synchronous online video teaching (Henriksen et al., 2020). This work was driven by the immediate need of the pandemic to have applicable pedagogical frameworks to support the shift into online synchronous spaces. As we pointed out then, moving pedagogically from one mode of educational delivery to another is not necessarily a smooth transition, and the COVID-19 pandemic necessitated a rapid pivot, without adequate opportunities to engage in careful pedagogical design.

Many instructors in initial teacher education in 2020 were struggling with the unprecedented move to online teaching. Their existing pedagogical approaches did not always easily translate to the new learning environment: from curriculum delivery to engaging with students including supporting social and collaborative learning environments. It was clear that a new approach to the roles of the instructor in online environments was needed. In thinking this through, we turned to Bruner's notion of folk pedagogies as a critical construct for teacher education and professional development. Figure 1 outlines the four kinds of roles that instructors might adopt according to Bruner's folk pedagogical stances.

do	know	think	manage
demo of skills	teacher as authority	reciprocal student/teacher relationship	teacher as consultant
proximity to professional practice	required foundational principles	critical and reflective thinking	multiple perspectives
industry partnership	presentation of examples	discussion and communication	critical reasoning and choice
	clear predetermined objectives	collaboration	one to one consulting relationship
		student-centered	
		emotional intelligence	

Figure 1. Bruner’s Four Folk Pedagogical Stances (as represented by Christensen, 2020).

Bruner’s frame is descriptive of four different pedagogical approaches (do, know, think, and manage), and educators may personally gravitate toward specific approaches out of the four naturally (though most educators will have encountered all of them at some point, depending on the context/task). Our goal in the 2020 article was to point to how moving from face-to-face contexts, with their embodied non-verbal cues (gestures, co-located spaces and objects, synchronicities, and familiarities), to online environments (where these aspects may be lacking), can challenge or disturb our assumed roles and strategies. Understanding folk pedagogies is particularly relevant when training teachers to use technologies to design learning spaces (online, hybrid, or otherwise).

Some of the key implications of our 2020 article centred on the notion of viewing teacher educators (and teachers overall) as designers—of curriculum, coursework, lessons, and of learning experiences more broadly. Technologies have a kind of agency and affordances of their own and represent key materials and building blocks that facilitate content teaching and learning across contexts. Thus, aiming to think like a designer means considering what the desired goal/purpose or outcome is for any synchronous/asynchronous lesson, what tools are available (and what their affordances are), and how to deploy them to fit with the designed learning goals.

While the initial contentions in that 2020 article still hold—our thinking since that time has extended to further build on the notion of Bruner’s folk pedagogies for teacher education and online learning. We have expanded the role of folk pedagogies in going beyond the video-conference synchronous focus of our first piece and shifting into more hybrid spaces, which may contain remote, online, face to face, synchronous and asynchronous, and blended modes of working with students and their needs (El-Gayar & Dennis, 2005; Miranda, & Molina, 2020; Raes, 2022).

Our guiding question is this: What additional pedagogical understandings do we need in the face of emerging hybrid forms of educational delivery? We contend that there is a post-COVID need to fluidly move between asynchronous and

synchronous spaces, and between physically-together spaces vs. remote virtual spaces (Bennett, et al., 2020). This ability to transition across spaces underlines the “teacher as designer” implication of Bruner’s original folk pedagogies. It may also suggest that the four original pedagogies could now require a fifth category (or perhaps a meta category)—that of ‘transition’ itself that sits across the other four. We examine several different online or hybrid illustrative cases from our own teaching, to develop implications for teaching and teacher education regarding the use and extension of folk pedagogies into remote synchronous and asynchronous spaces.

PROCESS/METHODS

This shift in our thinking was more than just conceptual. It is based on our autoethnographic reflections which stem from teacher education experiences after the 2020 article was published. The notion of hybridity as a fifth folk pedagogical stance to conceive and manage the relationships, learning, sequence, and control in the hybrid spaces emerged in our practices and our discussions in 2021 and 2022.

In this chapter we report our experiences of designing and implementing learning for hybrid delivery of teaching and learning in initial teacher education in 2021 and 2022, in the wake of COVID-19 and lockdowns. As such our data are our own reflections on practice, including our design decisions which undergirded practice beyond the thinking in the 2020 JTATE article. This approach to data collection is in the tradition of autoethnographic research (Ellis & Bochner, 2000; Ellis et al., 2011). Autoethnography also reflects our dialogic collaborations about our pedagogical decision-making and experiences as academics and educators such that they might be considered to fit within the methodological approach of collaborative autoethnography (Chang et al., 2013; Hernandez et al., 2017). These decisions included dialogue about the following design elements, post-2020, and provided an extension of our 2020 article:

1. *Structure.* The development of structural features of hybrid learning environments, such as the intersection of online and face to face synchronous learning with asynchronous supportive resources (Kay et al., 2019).
2. *Pedagogies.* The transformation of pedagogical approaches in response to hybrid teaching and learning environments (Akçayır & Akçayır, 2018).
3. *Care.* The need for consideration of the personal needs of students and establishing and maintaining connections of care in online and hybrid environments (Henriksen et al., 2022).

RESULTS

In this section we report our discursive reflections as results based on some of our experiences with designing and working in hybrid spaces in 2021 and 2022 and our subsequent dialogue about our practice experiences. Each reflection incorporates the elements of structure, pedagogies and care that are central to the shifts in practice that we have noted in the last two years.

Michael's Reflection on Practice

With the tentative shift of students back to on-campus learning came the reality that not all students were able or prepared to be on campus. Some of my students remain isolated for health reasons, some unable to travel across borders, and some who have grown anxious about such tight social settings. However, the situation is even more fluid with students (and teachers!) falling victim to COVID-19 and needing to be isolated. Not only does it mean that students and teachers may - from one week to the next - change in their physical location of engagement (on campus/off campus) but also their synchronicity of engagement (e.g., a student who falls ill or who is in a different time zone may engage asynchronously to other learners in the course). This fluidity of engagement (location and time) has necessarily required my colleagues and I to rethink the assumed structures of teaching and learning.

As an educator I planned (2021 and beyond) for meaningful and connected synchronous learning moments that work for both co-located and distributed students. I use videoconferencing technologies to bring them together in a shared social experience, mindful to develop resources and activities that allow all to not only participate but also to interact

with each other. In any synchronous learning activity, we are building on the curriculum and interactions that have gone before. However, in hybrid courses I also need to plan structurally for the meaningful engagement of students who are interacting asynchronously.

In addition to the need to plan for here and now, as well as there and then (future), the mediation of technologies in communication and collaborative activities meant that the sequence of the lesson needed to be reconsidered, with a particular focus on supporting transitions. In doing so I found it most useful to incorporate in my design thinking the notion of locus of control and mediation as key structural elements.

Danah's Reflection on Practice

Shifts to hybrid or online settings necessarily require adaptability—a fluidity in moving between different mediums is critical, while also always keeping the design purpose. For example, in redesigning a course about systems change for online, which had previously been taught face-to-face, I had to keep the course content and outcomes foregrounded, while figuring out what elements should look different in an online medium. For instructors moving between media, we must creatively take advantage of the affordances of a medium while working with constraints. For some of the course-work, this might mean finding new ways to do the same assignment, based on a more independent and flexible context where people are no longer together at the same time and space. In other cases, it might mean coming up with new assignments that cover content but take advantage of the medium and supporting technologies.

For example, in one assignment from the prior face-to-face class, students conducted weekly observations of local educational sites together and independently wrote a weekly journal document about these. Students enjoyed this and it offered opportunities to practise informal research observations. But in shifting online, students could not jointly visit and observe the same local sites. So, the assignment became more open-ended, and students could choose (over five weeks) five different local sites (physical or virtual) of their own choosing, where learning occurred. Rather than turning in a journal paper at the end, each student created their own observational blog, which they would update weekly with entries about site observations and their own scholarly reflections about connections to course content. The diversity of sites they shared expanded, to not only include school sites, but also sports practices, ballet classes, museums, libraries, college campuses, or virtual sites. They now included more links and images to enrich the work. More importantly, the fact of using blog sites and sharing them in an online course meant that students could share and read each other's work all around the world (and on their own time), to make their writing and thinking more visible in a public forum on the web.

Edwin's Reflection on Practice

In 2022, a student teacher in a graduate initial teacher education program contacted me to say that she had visited her mother in another state but had now contracted COVID-19. She intended to return to Melbourne to attend her class in the unit that I lead but could not because of her circumstances. She wondered if she could attend my class, which is face to face, via Zoom. I considered this and agreed to her proposal. At the time of the class, I explained to a student in my class the circumstances and she agreed to buddy up with the student for the session. This also meant that the remote student was part of a group in the class. It appeared to me that the student seamlessly became a part of the group and the class, and I went to her from time to time to get her ideas about the content.

The unpredictable nature of post-COVID times means that there needs to be flexibility in caring for students and in using technologies for meaningfully connecting students. Care and the integration of the student into a group learning context were paramount. The unit was designed to facilitate such hybrid connections between students in the class, the instructor, and the remote student.

IMPLICATIONS

In this section we offer three implications for practice in teacher education as conducted in hybrid learning environments. These implications emerged from our autoethnographic data, collaborations and reading of the current literature

and extend the thinking of our 2020 article. These implications also point to potential areas for future research and considerations of policy about pedagogical practices in higher education.

Implication 1: Instructors as Designers and Orchestrators of Learning

Often instructors in initial teacher education will have a folk pedagogy of storyteller, provocateur, facilitator, co-creator, etc. In each of these approaches the teacher has an idea of the sequence or flow of the actions. However, when working in a hybrid context where there is unpredictability there is a need to bring to the fore thinking about the orchestration of technologies, and the capacity to ensure co-located and distributed learners are equally engaged (Henriksen et al, 2014). This does not undermine the previously mentioned folk pedagogies of teaching but adds the layer of orchestration in which locus of control and mediation become design heuristics or challenges (Christensen, 2020). This is a type of adaptive pedagogical process that pivots on the situations of learning. The notion of adaptive pedagogies for hybrid environments has implications for the practice of teacher educators as designers of learning (Crawford & Jenkins, 2017).

Implication 2: Re-imagining Learning for Diverse Spaces Across Time

Considering the design of such learning instructors need to re-imagine the experience of learning from multiple perspectives, especially from the point of view of students (Norton & Hathaway, 2015). In a ‘traditional’ classroom experience we can plan on all learners being together at the same time which allows us to directly manage their learning behaviours and ensure there is coherence and consistency in their experiences of the curriculum. However, in a fully hybrid context we cannot use “here and now” as an assumed principle of learning design (Hua & Liu, 2021). Instead, we are challenged to design for ‘learning together’ as occurring both “here and now” and simultaneously “separated by space and time”.

Implication 3: Bringing A Group Focus, With Care, Belonging and Agency, Into Learning

Hybrid learning means a level of difficulty in maintaining social cohesion and a sense of care, connection, and student agency (Burke & Larmar, 2021). Folk pedagogies for hybrid environments should be designed for integrative group work, overt measures for engendering care and opportunities for students to experience agency in their own learning. Instructors need to challenge the view that students in diverse hybrid environments act in solitary ways (Moorhouse & Tiet, 2021). There needs to be the promotion of the forming of purposeful groups who engage together (in place or time), with the recognition that students may move across these engagement modes over the course of a semester. This group focus is not just a practice outcome in light of the new hybrid environments but needs to be reflected in university policy positions about teaching and learning.

FINAL THOUGHT

We contend, in answering our guiding question, that a fifth layer should be added to Bruner’s folk pedagogies to reflect the new reality of hybrid learning. This layer straddles the other layers and focuses on transition as a key pedagogical consideration in designing for learning.

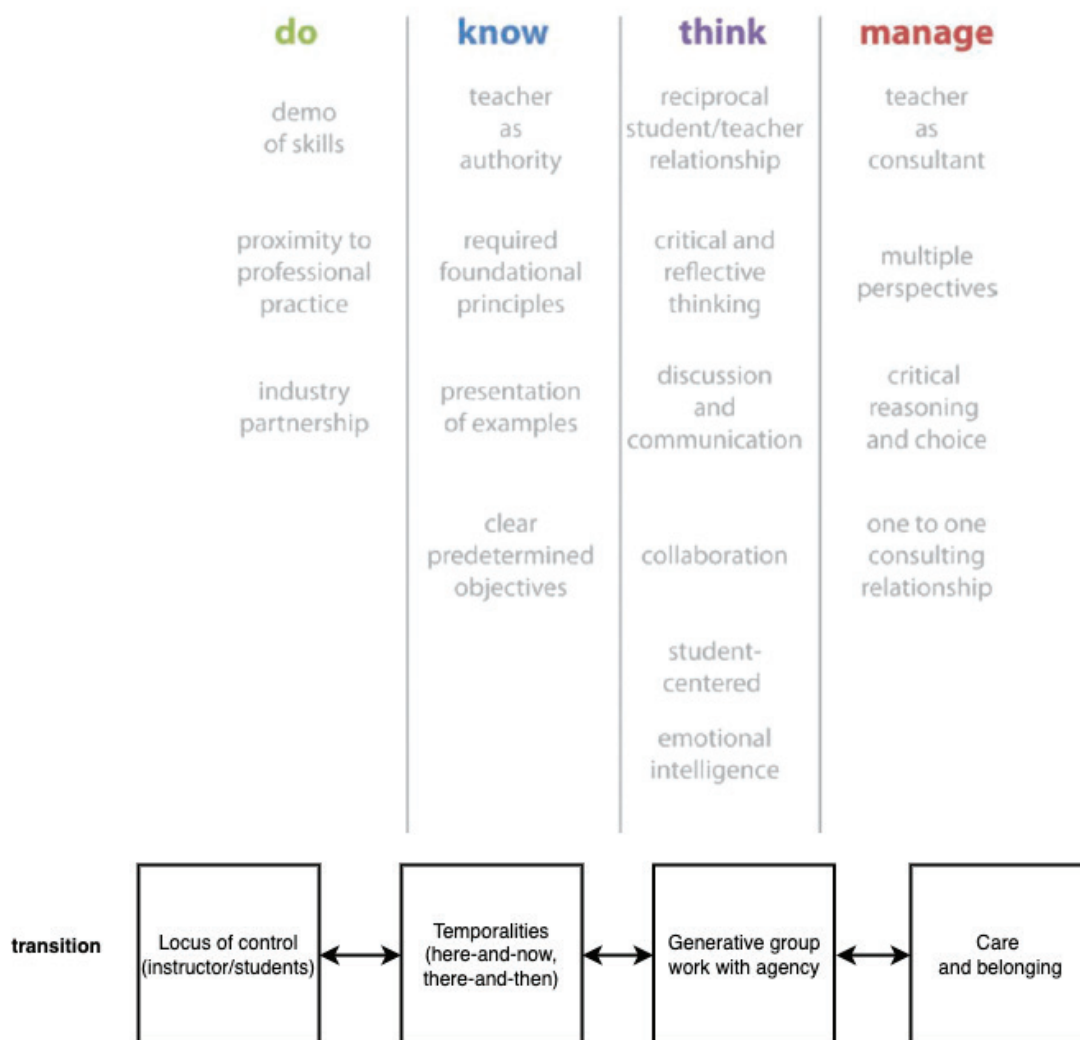


Figure 2. Bruner’s Four Folk Pedagogical Stances with a Fifth Category.

As part of the new horizontal transition layer, we include fluid shifts between control, the temporalities of students, the levels of generative group intersections with agency, and overt structures of care. This fifth category, “transition”, would involve pedagogical skills and assumptions around moving from one kind of activity to another (or indeed, from one folk pedagogy to another). While the inclusion of a new pedagogical layer in hybrid learning environments is consistent with our experiences as instructors, more research is clearly needed to understand the wider experiences of instructors across institutional and national contexts (Rose & Adams, 2014).

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Retrospective on Live Virtual Sessions with Toddlers and Preschoolers amid COVID-19

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This paper shares a retrospective on an original study that was published in JTATE two years ago entitled, “Live Virtual Sessions with Toddlers and Preschoolers amid COVID-19: Implications for Early Childhood Teacher Education” (Szente, 2020). A historical review of the original paper is presented first including results and implications for early childhood teacher preparation programs and in-service professional development (PD) opportunities. In order to illustrate the impact of the pandemic, a literature review was conducted and recent articles were utilized to support claims made in this paper. Results are presented in light of teachers/teacher candidates and families. Implications are drawn for both pre- and in-service teacher education in the areas of 1) strengthening the digital skills of teachers/teacher candidates and 2) addressing the remote learning gap caused by the pandemic.

Keywords: remote learning, teacher preparation, early childhood teacher preparation, COVID-19

HISTORICAL REVIEW

In Spring 2020, the original paper focused on over 50 live Zoom instructional sessions with toddlers and preschoolers during the first three weeks of school closures in Florida due to the COVID-19 pandemic. All sessions originated from teachers of a private early childhood center that remained open during the pandemic but offered a virtual option for learning. Half of these sessions were held for toddlers and the other half for preschool-age children. The sessions lasted for 20-30 minutes at a time and were held in the mornings and in the afternoons. Each session was analyzed in terms of what worked well, what did not work, and what implications these sessions had for early childhood teacher preparation programs. Qualitative methodology was implemented to study the notes and identify recurring themes. Three themes resulted from the analysis: “1) implementing digital sessions with young children; 2) establishing and maintaining home-based child engagement through technology; and 3) ensuring family involvement/engagement through technology” (Szente, 2020, p. 375). The themes led to the establishment of the Taxonomy for Developing Online Learning Opportunities for Young Children (Szente, 2020) that had key implications for early childhood teacher preparation programs as well as in-service professional development. This taxonomy is presented in Figure 1.

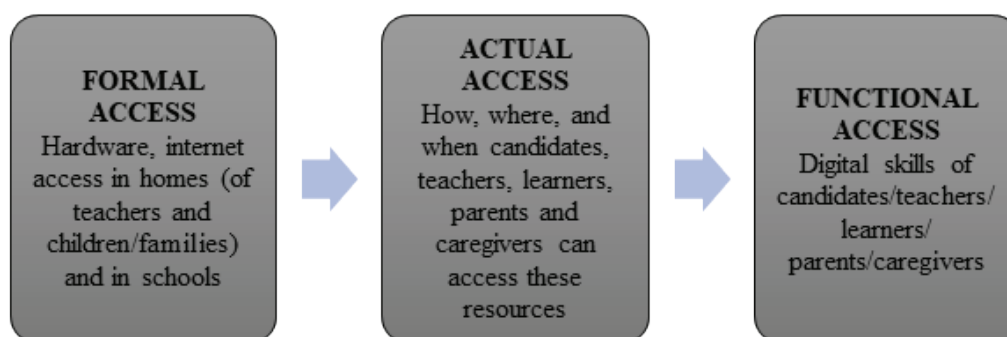


Figure 1. Taxonomy for Developing Online Learning Opportunities for Young Children.

As the figure indicates, there are three access levels with specific content/components within each. *Formal access* also includes recommendations for pre-/in-service teachers to assist families with access to technology, some suggestions for collaborations, and utilizing government resources for digital access. *Actual access* includes information about recommended adult-child ratios while teaching online and should take into consideration the appropriate lengths of such sessions. Lastly, *functional access* also recommends embedding digital knowledge, skills, and competence in methodology courses, familiarizing teacher candidates/in-service teachers with various digital platforms, and appropriate ways to use these platforms with young children. It was also indicated in the study that the three access levels built upon each other and “without *formal access*, *actual access* and/or *functional access* cannot happen” (Szente, 2020, p. 377). The current paper provides data about the various access levels over this period of time and what implications these data have for teacher education—specifically early childhood teacher education.

PROCESS

Although the majority of schools moved to a distance learning format utilizing some type of online resources rather than the traditional in-person instruction like before the pandemic (National Center for Education Statistics [NCES], 2021), the private school that was utilized for the original paper returned to in-person instruction after the initial school closure in Spring 2020 and did not offer a virtual option for the 2020/2021 school year. Therefore, for this retrospective the researcher utilized a review of current literature to support claims made within this paper. More specifically, the researcher studied literature within the past two years in the areas of: 1) education statistics regarding the previous two school years (e.g., percentages of students in virtual vs. in-person traditional classrooms); 2) statistics regarding access to technology in homes (e.g., access to computers and internet); 3) teaching/learning practices in PreK-12 settings during the COVID-19 pandemic; 4) challenges of remote learning for families (e.g., home-based educational and social/emotional challenges during social isolation); 5) preparation of teacher candidates for digital teaching and learning; and 6) national initiatives and support for teaching and learning during the pandemic. These six search focus areas closely relate to the three access levels described in the original paper and organized in Figure 1.

The researcher then reviewed each piece of related literature and organized it based on the various access levels. Findings were then reported in light of families, teachers, and teacher preparation programs as they were key components of the taxonomy. Implications were also drawn for both pre- and in-service teacher education in the areas of 1) strengthening the digital skills of teachers/teacher candidates and 2) addressing the remote learning gap caused by the pandemic.

RESULTS

Access to Technology (Formal Access)

The 2020 Household Pulse Survey (HPS) data (NCES, 2021) revealed that there were increases in access to technology and internet in the homes since the beginning of the pandemic. In April 2020, when most of the first school closures happened, 88% of adults who had children under the age of 18 enrolled in school reported that children had access to computers for educational purposes. This number grew to 91% by September 2020. Further, 91% of adults reported that internet access was available for their children in their homes for educational purposes in April 2020 which increased to 93% by September 2020. When looking at racial/ethnic groups in September 2020, these numbers range from 97% for Asian adults, 93% for White adults, 90% for Black adults, and 88% for Hispanic adults. The access to internet percentage pattern was the same as indicated above (NCES, 2021). In some cases, schools or school districts also paid for families' internet access as 7% of Black adults and 3% of White and Asian adults reported. In April 2020, only 39% of adults reported that computers were provided by their children's school/school district (NCES, 2021). As the 2020/2021 school year started, this reported number increased to 59%. This information suggests that over approximately six months, *formal access* improved and in-service teachers were able to reach children in more homes than at the beginning of school closures.

How Teachers/Parents Access Technology (Actual Access)

According to Brennan (2020), over eight out of ten parents said that their child was learning remotely through an on-line distance learning program that was sponsored by a school. Such sudden shifts to remote learning required teachers to prepare all their classes for remote instruction. These emergency remote teaching modalities “ranged from hybrid to blend to fully online” (Boltz et al., 2020, p. 1378). This information suggests that in-service teachers were able to access and apply digital resources in order to provide children and their families with *actual access*. In-service teachers also provided teaching/learning activities in a variety of modalities.

Digital Skills of Teachers and Teacher Candidates (Functional Access)

As the unexpected shift to remote learning started in Spring 2020, many teachers were understandably surprised, stressed, unprepared to switch all their instruction to a new modality. The emergency remote teaching activities differ greatly from quality online teaching “which requires much more proactive and intentional planning, education and time to develop a robust and sustainable learning experience” (Boltz et al., 2021, p. 1378). In addition, Slykhuis (2022) indicated that “prior to the pandemic, most teacher education programs prepared candidates to go into brick and mortar schools, so their emphasis on teaching online was minimal” (para. 3). Marshall et al. (2020) stated that out of a total of 328 teachers they studied, 92.4% said that they never taught online and only a few had any meaningful trainings from their school/district.

The recognition of the major challenges that teachers faced with offering emergency remote teaching activities and adjusting their instructions urged schools and other educational entities “to offer support and professional development (PD) that took various forms—from papers, to webinars, to repositories of resources for remote teaching” (Boltz et al., 2021, 1379). All teachers were expected to quickly develop digital skills for a variety of formats for what most of them were not fully prepared during their pre- or in-service years. The educational modality shifts during the pandemic alerted teacher preparation institutions to study their programs and see how they could better prepare candidates for such digital and instructional needs in the future. As this section indicates, the majority of in-service teachers did not feel prepared to provide remote instruction for students, yet they still created a variety of remote learning activities and held remote instructional sessions with children on a daily basis. It appears that *functional access* has the most implications for both in- and pre-service teacher preparation.

IMPLICATIONS FOR PRE- AND IN-SERVICE TEACHER EDUCATION AND RECOMMENDATIONS FOR FUTURE RESEARCH

The original paper (Szente, 2020) indicated that since both pre- and in-service teachers needed to be able to engage in activities in all three access levels, teacher preparation programs also needed to assess their courses and practices to ensure that the candidates were being prepared for such knowledge and skills. The results of this retrospective indicated that within a short period of time, teachers were reaching more and more children in their homes through a variety of remote teaching/learning activities (*formal* and *actual access* levels). The quality of such experiences and the preparedness of teachers (*functional access*) varied greatly, therefore, this prompted some specific implications for pre- and in-service teacher preparation and policy in the areas of: 1) strengthening the digital skills of teachers and teacher candidates and 2) addressing the remote learning gap caused by the pandemic.

Strengthening the Digital Skills of Teachers and Teacher Candidates

Since the majority of teachers indicated that they had very few prior experiences with teaching online and had not received meaningful training from their school/district (Marshall et al., 2020), it was important to see what improvement had been made at teacher preparation programs to mitigate these issues. According to Slykhuis (2022), many teacher preparation programs have started to reevaluate their curricula to better integrate technology across the entire programs rather than just offer one course on technology to candidates.

The United States Department of Education, Office of Educational Technology (2017) is expected to revise its 2017 National Education Technology Plan which should reflect the current changes and digital learning practices and should also provide updated technology competencies for teacher educators who prepare teacher candidates. The revised document, along with the current policy brief that focuses on teacher preparation (The United States Department of Education, 2016) could aid teacher education programs in ensuring that their candidates receive their technology training while in their preparation programs and would not need in-service trainings on how to embed technology in their everyday teaching (whether it is in-person or remote).

Teacher preparation programs and schools should then be able to integrate important components of digital teaching and learning into their curriculum and would be able to provide parents with necessary training on digital literacies as well. Once the revised document is published (potentially both will be revised) and teacher preparation programs had some time implementing the recommendations, future research could target the type of changes made in teacher education programs and how those impacted the digital preparedness of teachers to plan, offer, and evaluate virtual instruction. Such information would be important for both practice and policy purposes.

Addressing the Remote Learning Gap Caused by the Pandemic

As indicated above, teachers moved all their classes online within a very short amount of time to engage in hybrid, blend, or fully online activities (Boltz et al., 2020). Due to the lack of time to prepare quality remote learning experiences for children, lack of formal preparedness of many teachers to offer remote lessons, and the varied resources that teachers had available, the type and quality of instructions that children received varied greatly. Such differences in instruction along with the varied support teachers received from the homes of the children all resulted in what the literature calls “a remote learning gap” (e.g., Goudeau et al., 2021). Some children may have received outstanding, well-planned, and well-implemented remote instruction with strong home-based academic support, while others did not receive quality remote instruction at all. Such a remote learning gap presents the need for renewed focus on preparing teachers to develop and implement quality remote learning experiences for children and preparing teachers for differentiated instruction—most specifically for differentiated instruction in a variety of modalities. This differentiation must also focus on instructional designs, strategies, instructional delivery and facilitation, as well as assessment in a variety of modalities.

To further study the remote learning gap that resulted from the pandemic, future research may focus on data regarding children’s school readiness scores over a period of time (e.g., beginning of 2019/2020, 2020/2021, and 2021/2022 school years) along with achievement scores and study how the pandemic and emergency remote learning may have impacted children’s academic development. In addition, future research could study the variety of modalities (e.g., hybrid, blend, and fully online) and their effectiveness regarding children’s academic achievement. Such data would be important for both teacher preparation programs and in-service teachers.

Overall, it is encouraged that all schools and teacher preparation programs continue to reflect on the past two years and evaluate the programs and services they offer to address various new challenges that were brought up by the pandemic. It is also recommended that teacher training institutions and schools reflect on the Taxonomy for Developing Online Learning Opportunities for Young Children (Szente, 2020), so all three access levels can be addressed on an ongoing basis. Further, it is helpful to develop an interdisciplinary collaboration with various teacher preparation programs, schools, various businesses, policy makers, agencies, mental health professionals, and families. With such connections and preparations, all parties would be better prepared should another emergency teaching/learning situation arise in the future.

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How Does Pedagogical Slipperiness Enable Speculation in/for Teacher Professional Learning?

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This chapter reports on data generated through a process of COVID-19 attuned metho-pedagogical innovation established in the chapter "what are artists and art educators teaching us about how we can conceive and deliver teacher professional learning into the future?" Analysis of data reported in Coleman and MacDonald's (2020) chapter articulates how movement between temporal and latent space enables teachers to attend to professional learning during times of COVID-19 driven interruption. The act of moving between the temporal and latent creates what can be described as Deleuzian *slippage*; a productive act that yields new possibilities for becoming differently. This follow-up chapter reports data generated via a widened lens of slippage enacted by an expanded authorship team. In so doing, this chapter elicits an example of methodological and pedagogic interchange – with methodology and pedagogy mutually constituting each other, becoming metho-pedagogy. With a/r/tographic documentations of change occurring individually, collectively, and collaboratively, we propose *slipperiness* as a generative catalyst for change in pedagogic ways of knowing.

To evidence this, this chapter enfolds metho-pedagogic data to explore four art educators' pedagogic ways of knowing. Metho-pedagogic data includes artifacts created in response to a provocation through artistic, research or teaching practice. On this occasion data were created through the practice and process of writing a/r/tographic hundreds, comprised of 100-word blocks of text. To create the hundreds, we engaged in collaborative playdates for distilling pandemic-attuned, speculative metho-pedagogies. Informed by Gert Biesta's 'critical look at the idea of evidence-based practice' (2007), this chapter draws out implications of metho-pedagogic data to illustrate how slippage enables new pedagogic encounters in and with the (post)pandemic world. The expanded authorship team test how slippery speculation regenerates thinking about teaching and how we teach teachers. Our critical engagement with data pertaining to slipperiness leads us to assert a need to prompt teachers to move between latent and temporal spaces for pursuing visual and metaphoric thinking about their worlds - questioning, critiquing, and wondering with curiosity and imagination. From this, we argue the need to support and safeguard art teachers' attendance to practice pedagogical slipperiness between pre-COVID and COVID normal education experience.

HISTORICAL REVIEW

Coleman and MacDonald's initial 2020 chapter reported data generated through collaborative playdates (Grocott, 2012). These prompted reflection upon art educators' COVID attuned sense-making and collective 'figuring out'. Analy-

sis of the 2020 data revealed increased diversification of the places where teacher educators engaged inquiry models that artfully situate, site, and reshape social and technological relations. The utility of digital technologies, modalities, and relational tools to mediate speculation and slippage between old and new ways of knowing, doing, being and becoming were explored and substantiated.

A significant contribution of the 2020 research was the conception of future directions for speculative a/r/tographic (Coleman & MacDonald, 2020) research-creation. A/r/tography is a metho-pedagogy that “transforms the traditional relationship between theory and practice by recognizing the movement found within a rhizome” (Irwin, 2013, p. 199) of practice and theory. By emphasising the relations and meanings that emerge through knowledge sharing, it is a methodology that inquires with attendance to the spaces in-between research, art, and education. Our adoption of a/r/tography across both chapters involves slippage between establishment (2020) and interrogation (2022) of *speculation* for teacher professional learning. Our subsequent datawork and knowledge sharing illustrate how convergence of process and product concurrently fosters experimentation *with* and examination *of* artists’ and art educators’ slippery practice.

This chapter builds upon the 2020 offering through further interrogation of *slippage* for how we attend to teacher professional learning in times of ongoing global upheaval. According to Guyotte and Kuntz’ (2018) uptake of slippage, paradigmatic positioning is located not as static but as fluid; not as product but process (*positioning*, not *positioned*) (p. 257). MacDonald and Coleman identified how artists and arts educators diffractively (Barad, 2007) make and seize speculative space for COVID resonant, responsive, and relational pedagogies. This extended to entanglements of arts-based methods and pedagogies into metho-pedagogies (Gallagher et al., 2022).

MacDonald and Coleman invited two new colleagues, Healy and Diener, to play in rendering four new perspectives of lived pandemic art/research/teaching experience using a/r/tographic hundreds for dataworking. This chapter re-articulates the speculative gaps between metho-pedagogic practice and process adopted between 2020 and 2022 as identified by this expanded authorship team. As a collaboratory of a/r/tographers working in different sites in Australia with artists and pre-and in-service educators, they partook in data playdates and figuring exercises to illustrate how slippery and risky speculation becomes a catalyst for shifts in visual arts education/s. From the time between March 2020/April 2022, data working playdates and subsequent creative analysis of data found cause for the convergence of speculative process, slippery practice, and creative product to bolster pedagogic endurance, survival, resilience, and risk (Dow, 2020).

In this chapter, the authorship team discuss the results and possible implications that have enabled them to elaborate on how successive art teaching and learning in crises might be accomplished. Initial figuring exercises showed signs of hope that the pandemic might be a reflective pause; a stop button – an opportunity to look around and see why art and artists matter in times of crisis. Within the writing as method playdates, the research located a ‘stop button’ (whether pressed or not). The inter- spaces between artist/researcher/teacher or the slant ‘/’ presented itself in new pedagogic situations. They found that when teachers embrace the slant space / between contexts, practices, methodologies, and pedagogies, they percolate in a slippery/speculation that fosters comfort in and with not knowing, unknowing, risk, ambiguity, and tension.

PROCESS/METHODS

Over the last two years, the authorship team have worked in slippery pedagogical spaces with both pre-and in-service educators across several sites. Our pedagogic practices have necessarily leveraged a loss of footing in the world which accentuated a commitment to change and engagement in making another kind of world (Berlant & Stewart, 2019). Speculative methods are situated in a space between knowing and not knowing, where not everything can be said. This invites a process of interpreting and making-meaning that reflects what the authorship team collectively determine to be worth saying (Berlant & Stewart, 2019). In this way, speculative turnings of the data slip between inferences of influence, contradiction, expansion, reflexivity, dissensus, speculation and change (Kalin, 2014). Doing data differently through a/r/tographic hundreds as method afforded time to distil moments of pedagogic speculative slipperiness. Results are subsequently written using this method of collaborative digital w/riting to render the winds of change that are conducive to and contingent upon the generativity of crises in education.

Speculative a/r/tography is highly evocative and located in lively sites of possibility as research-creation (Truman, 2022). It is a form of practice-related research within the arts and education and loads tension upon pedagogic fault lines in ways that big data driven, and evidence-based methods cannot. Speculative a/r/tography with both pre-and in-service educators cracks open new possibilities and places for research-creation in education. It is in and from these places that

this chapter offers novel insights from data sites that include transindividual movements of affect, when different bodies work together creatively (Roussell et al., 2022).

Metho-pedagogic data in the form of a/r/tographic hundreds (see below) demonstrate what happens when arts-based educational researchers reflect in and upon slippery spaces for creating pedagogical interventions from the human, non-human and more-than-human places we find ourselves in (Coleman, 2018). The process and product of these playdate's hundreds yield 'weighty images' (Berlant & Stewart, 2019, p. 291) of how a pandemic-borne loss of footing facilitates generative and expansive pedagogic dis/rupture. The expanded authorship team ensues from a fold (Deleuze & Strauss, 1991) of navigating and negotiating snap lockdowns, swift shifts between digital and in-person, hybrid and blended educative experience and creative practice. Our shared acts of slippery speculation are contingent on them providing means to "crack open the pedagogy afoot and open possibilities for new knowing and making to emerge" (Coleman et al., in press). These four a/r/tographic hundreds render the connective tissue between the authorship teams' individual and shared account of working with artists and pre-and in-service educators in speculative metho-pedagogical process.

RESULTS

1. When a gap is presented in learning, there is space for a speculative inquiry, experimenting with new ideas and finding connections to your individual path. This type of experience is essential in teacher professional learning. We need these slippery spaces to motivate and prepare us for the volatility and constant changes in the classroom. Creating a teaching practice is a sort of pedagogical bricolage, where meaning is constructed from several different elements. These elements are speculatively sourced and founded on beliefs. Looking beyond the boundaries of the coursework, we have found our voice and the ability to see what is possible.
2. At the discretion of disaster, standards, accreditation and more, teacher education stakeholders determine place and path for teachers' attendance to professional learning. The stakes are high/hammered; connective wires threaded and tensioned; carving space to cultivate teacher specialisation and proficiency. Perhaps we mis/take limitation as an antithesis for possibility. We are teaching/teachers capable of more than cohesive alignment and compliance. Bravery, risk, and creativity are required. Can we do something beyond what is offered/available? Yes. In befriending the spectre determining our becoming/pedagogical/curricular/professional, we practice relational/requisite/co-inquiry. Treading ahead with gaze trained behind, we create a gait/gate for speculative not knowing.
3. Pedagogies and subjectivities unravelled in the extended lockdowns of 2020 and 2021, prompting artful inquiry for uncertain times. The post-pandemic teaching profession asks them (us) to design learning that can take-off in an array of directions. Hybridised sites for teaching-learning subjects to re-form arise in slippery spaces between the physical studio and online environments. With and in these hybrid spaces bewilderment becomes a precursor for asking 'What if?'. Asking 'What if?' opens a safe space for shared speculative inquiry where pedagogical risk-taking can be embraced and learner-teachers can lean into uncertainty as they (we) become subjects worthy of post-pandemic times.
4. Pedagogical slipperiness enables a responsive, playful criticality for educators in an ever-shifting space. Slipping between knowing, doings, sayings and relatings open cracks for unknowns to be found by learners seeking slippage. A speculative a/r/tographic creative ecology is attuned to knowns and unknowns. It pushes and pulls at conventions, modalities and innovates rhizomically. The last two years have invited us to design within this slippery space a *curre* (Pinar, 1975) response-ably; listening carefully to the affects of change in the community, ourselves and our responding with care and kindness as a look back and forward speculating on what might be.

IMPLICATIONS

The team began this research as a collaborative play date (Grocott, 2022) wondering "what are artists and art educators teaching us about how we can conceive and deliver teacher professional learning into the future?" (Coleman & MacDonald, 2020). Teasing out the implications for pre-and in-service art teacher education across sites of speculative a/r/tographic inquiry is attuned to address the question 'how pedagogical slipperiness enables speculation in/for teacher professional learning.'

As the team considered the implications for preservice and/or inservice teacher education more broadly, analysis of data reveals how the cloak of COVID-19 shepherded a shift to artful practices characterised by experimentation, play,

uncertainty, and risk. They found that while many educators may reminisce and yearn to re-turn, the space between sees us press onwards with ever accumulating layers of experience. This chapter posits process and products to evidence deployment of pedagogical slippage, and how this can fortify teachers' reimagining of pre-COVID education to locate new learning and make new meaning from past lessons.

The contribution of speculative metho-pedagogies opens new temporal and latent opportunities in and for education beyond the walls of the studio or gallery or digital platform. As Biesta (2007) suggests, research can only provide an understanding of possibilities as we speculate on what the problem *might be* - it does not tell us what to do. Working with Biesta's 'critical look at the idea of evidence-based practice', this chapter distils implications of, from and for new encounters with/in the pandemic world. This enables a speculative kind of pedagogic unlearning (McLeod et al, 2020) that looks critically into and curiously out of pre-COVID educative experience that no longer exists as it did (Wise et al., 2022).

Slippery metho-pedagogies are shaped by a porosity (Lee, 2018) that asks us to resist the distraction of attempting to define or contain our experience in the known. The temporality of 2020 saw many educators slip between fight and flight modes as we became acquainted with COVID climate discourse. Australian educators locked down, pivoted, quarantined, home-schooled, isolated in parallel to remote emergency learning and teaching. Choice and necessity saw them retreat, carve out and make ourselves anew in myriad ways; the uncertainty shakes us free from the familiar, tried, and true.

To enable slippage (Deleuze & Guatarri, 1988) between teaching and learning in times of crisis, speculative practices, and pedagogies of unknowing allow articulation of insights relating to lived experience of working in and from the threshold space between things (past/present; teaching/learning; teacher/learner; practice/process; being/becoming). As the team played in this in-between space, new ideas surfaced and they wondered, 'how we might continue to do our work knowing that the skills and capacities we teach might have no place in a future that seemed so bleak?'

Across the world creative practitioners lived/are living in a time and space where the visual arts, its artists, and arts workers - who create, curate, and connect us as humans to the non- and more-than human- had no place to practice, no livelihoods, no funding, no space to innovate, imagine and wonder. Through dataworking playdates the team speculated as to how they might continue to show up and teach artists who are becoming teachers via digital and virtual spaces, who would go out into schools and teach young people about the place and role of art in the same ways. These research-creation speculative potentialities (Truman, 2022, p. 2) show how we might rethink responsive, caring and kind metho-pedagogies that enable pre-digital, digital and post-digital slipperiness.

To do speculative boundary crossing work for a new world yet to become, this encounter has shown that teachers must be supported to play, fail and risk taking in slippery spaces as they explore new complexities to wonder about what *might* unfold. Listening closely to the polyphony of voices and stories of teachers during the pandemic shifted this authorship teams' vantage point to the landscapes in which pedagogy and practice are encountered.

The shift toward pedagogical slipperiness and speculative methods can, as Biesta (2017) suggests, demonstrate why there is a "need to widen the scope of our thinking about the relation between research, policy, and practice, so as to make sure that the discussion is no longer restricted to finding the most effective ways to achieve certain ends but also addresses questions about the desirability of the ends themselves" (p. 21). A focus on 'what worked' pre-pandemic makes it difficult if not impossible to ask the questions of what education could be, and who should have a say in determining what it becomes.

Hybrid practices and pedagogies that enable slippage is an onto-epistemic turn to what we as educators might be and what might become. Education and educational research must shift its focus away from a pre-pandemic 'evidence-based' approach toward a slippery speculative bundle of (post)pandemic methods to imagine and wonder what might come next *with* teachers.

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Reflections on the Successes and Challenges of Teaching Physical Education During the COVID-19 Pandemic

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Amidst the COVID-19 pandemic, physical education teachers across the country unexpectedly worked to transition their programming from an in-person to an online format. This research sought to examine the pedagogical strategies that fifteen, Kindergarten-Grade 12 (K-12) physical educators employed as a means to accommodate this transition, as well as their perceptions surrounding the effectiveness of these strategies. Data for this research consisted of semi-structured interviews and was collected at three points during the physical educators' teaching experience: June 2020, March 2021, and June 2021. Results showed that the sample relied on asynchronous teaching during the spring of 2020, but shifted to synchronous models during the 2020-2021 school year. The sample unanimously preferred synchronous instruction to asynchronous instruction. The participants shared two keys to lesson planning that were perceived as successful: keeping lessons simple and providing students autonomy with their assignments. In the spring of 2020, participants shared significant concerns surrounding the lack of student accountability and inadequate opportunities for students' social engagement. However, these concerns waned during the 2020-2021 school year. This was attributed to the inclusion of synchronous classes and the provision of hybrid models for learning which allowed students to attend school partially in-person and partially online.

HISTORICAL REVIEW

As the COVID-19 pandemic surged in the middle of March 2020, schools around the world scrambled to devise plans for educating students remotely. Many with the means, resources and technological infrastructure in place opted to utilize online instruction. While undoubtedly challenging for all educators, the transition was arguably more complicated for physical education teachers, whose curriculum consists of cooperative games, shared sports and activities, and student interpersonal socialization (Graham et al., 2020). While the practice of teaching physical education online has existed for more than two decades, limited empirical research exists to support best practices for online instruction (Daum & Buschner, 2018). Because of this, many teachers found themselves in a period of trial and error.

With these considerations in mind, the researchers conducted a qualitative study (Foye & Grenier, 2021) examining the experiences of a sample of New England K-12 physical educators who were teaching online in the wake of the pandemic's arrival. Very simply, the study sought to identify what sorts of teaching strategies the sample utilized, how their pedagogies evolved over the spring of 2020, and what they viewed as their greatest successes and concerns. The results proved insightful into the lived experiences of these teachers.

The pandemic did not conclude with the culmination of the 2019-2020 school year, however. It continued on into the academic year of 2020-2021. As a result, a second phase of this study commenced in the winter of 2021. This phase utilized similar research questions as the original study, however it was hypothesized that results would differ in this second iteration. The participants' previous experience with online teaching, as well as the potential for receiving professional development over the summer months provided contrasting conditions from the previous spring. Additionally, all of the participants' school districts transitioned to hybrid models – where the students split time between attending school in-person and virtually – at varying points during the 2020-2021 school year, which added another dimension of complexity to their experiences.

METHODS

Fifteen K-12 physical education teachers were recruited for this study. Convenience sampling was conducted through a combination of personal contacts and snowball sampling (Goodman, 1961). An emphasis was placed on recruiting teachers from a variety of New England states, as states had varying requirements for teaching during the pandemic. The sample consisted of five elementary teachers, two middle school teachers, four high school teachers, three K-8 teachers and one adapted physical education teacher. Notably, the sample shrunk by one for the second iteration, as one of the middle school teachers resigned days before the start of the 2020-2021 school year. He cited his distaste for teaching online as the catalyst for his resignation.

Data collection consisted of semi-structured interviews which were conducted over Zoom videoconferencing software by the primary researcher. Interviews for the first phase occurred in June of 2020. Participants were asked to reflect on their experiences from March of 2020 through the conclusion of the school year (see Table 1). The second phase of the study commenced with interviews in March of 2021 and participants were asked to describe their perceptions of teaching from August/September of 2020 through March of 2021 (see Table 2). A final round of interviews was conducted in June 2021 with similar questions asked to participants regarding their teaching experiences from the period of March 2021 through the conclusion of the school year. Additionally, participants were asked to identify any aspects of their online teaching that they anticipated would carry into their future in-person teaching. Interviews from the first two rounds were conducted at the convenience of the interviewees and generally lasted 45–60 minutes. The final round interviews typically lasted 30–45 minutes.

Interview data was subjected to thematic analysis (Braun & Clarke, 2006) with a constructivist lens grounding the analysis. Data analysis began by transcribing the interviews, followed by open and axial coding. Category construction was the next step, with themes developing from the coded categories. To generate themes, broad umbrellas were created, representing each of the three research questions. Each code was placed under one of the umbrellas and when appropriate, some codes were placed under multiple umbrellas. Following this step, the researchers returned to the transcripts to search for disconfirming evidence. Member checks (Merriam & Tisdell, 2016) were the final step in the data analysis process with the aim of ensuring internal validity.

Table 1
Interview Protocol: March 2020

1. Tell me about yourself. How long have you been teaching physical education?
2. Describe your comfort level using technology prior to COVID-19?
3. How prepared did you feel when your school first closed? What sort of direction were you given? What did your first remote teaching lessons look like?
4. Did your lessons evolve over the course of the spring term as you continued to implement remote teaching? If so, how?
5. Did you receive any specific training to help you better serve your students? Did you rely on any colleagues for support? To what extent did your administration provide support?
6. Did you have any interactions with the students during OLPE? What did this look like?
7. Did you require students to send you evidence of learning or completion of assignments? If so, what did that look like? Were there any repercussions for students who did not submit evidence?
8. When you think of marginalized populations, do you think they were successfully able to access and implement your lessons?
9. Can you describe elements of your remote lessons that seemed particularly useful to you?
10. Did you find any elements that were not particularly useful to you?
11. Are there benefits of OLPE that students do not typically get in a traditional P.E. setting?
12. Are there benefits of OLPE that students do not typically get in a traditional P.E. setting?
13. Are there aspects of a traditional P.E. setting that can't be replicated by OLPE?

Table 2
Interview Protocol: March 2021

1.	Which learning model is your school currently utilizing (remote, hybrid, in-person)? Has this been the case all school year, or has this changed? Are your classes synchronous, asynchronous or a blend?
2.	Can you describe what a typical online lesson looked like <i>at the start of the school year</i> ?
3.	At the start of this school year, in what ways was your approach to remote teaching similar to last year? Different?
4.	Has there been an evolution in your online teaching throughout this school year or has it remained similar? If so, how?
5.	Can you describe what a typical online lesson looks like for you now?
6.	What virtual platforms/programs do you use with your classes? What do you think is effective about these programs? What do you think is ineffective about these programs, or what do you wish was different?
7.	If you have experience with synchronous and asynchronous classes, can you talk a little bit about which you prefer and why?
8.	How does the content you're delivering now compare to what you would be teaching in a typical school year?
9.	Can you discuss your interactions with your students?
10.	How have student participation rates been this school year? How do these compare to last year? If there has been a change, why do you think that is?
11.	It's my personal hunch that following this pandemic, we will see growth in the field of online physical education. Being an experienced online physical educator, what advice would you give to future online P.E. teachers?
12.	If the opportunity arises in the future, would you consider applying for a full-time online physical education job? Why or why not?

RESULTS

Three main themes emerged in the first iteration of the study (Foye & Grenier, 2021). The first theme was titled *Effective Strategies for Learning*. Within this theme, two sub-categories emerged. The first sub-category was *Simplicity*. What this finding revealed was that participants perceived a correlation between a lesson's accessibility and students' likelihood of completing the assignment. Participants concluded that if lessons were perceived as convoluted or confusing, students would not complete the assignments. Thus, an emphasis was put on streamlining material to maximize accessibility to students. The second sub-category was *Student Autonomy*. Participants perceived that it was important to afford students the opportunity to provide input on how they would complete an assignment. For example, rather than telling a student their assignment was to go for a walk, a teacher may have allowed them to select from a choice of a walk, jog, bike ride or swim. By granting students the opportunity to incorporate individuality within the assignments, it was believed that higher completion rates would result.

The second theme that emerged was *Lack of Student Accountability*. Participants expressed their frustration regarding the notion that participation in physical education was viewed as an optional educational requirement in the wake of the pandemic's arrival. One elementary teacher estimated that her participation rate was as low as 5%. One high school teacher shared that 90% of his students were completing their written assignments but estimated that only 20% were completing the physical task requirements.

The final theme that emerged was a concern regarding *Inadequate Student Socialization*. 13 out of 15 participants spoke about this concern, with one participant going so far as to say, "socially, this is a disaster for these kids." Given that this came at a time when the United States government was espousing "social distancing" (Mandavilli, 2020), concerns about students' feelings of social isolation were at the forefront of participants minds.

The follow-up study conducted during the 2020-2021 school year revealed a significant shift in findings. The first theme that emerged was *Synchronous Classes*. Unlike the spring of 2020 when participants relied almost entirely on asynchronous classes, during the 2020-2021 school year, districts had the expectation that teachers would provide synchronous teaching. This was a welcome change for study participants, as all 14 study participants unanimously stated a preference for teaching synchronously. Teachers described a more effective learning environment for the students, as well as a more fulfilling teaching conditions for themselves. As one participant noted, “I got to see them working on their skills [...] I mean every single box of every single screen, the kids were all moving and smiling and so that’s wonderful”, while another who referred to himself as an “edutainer” stated that he loves “being live with the kids and just being able to perform”.

The second theme, *Blended Learning*, afforded participants the opportunity to identify positive attributes of all learning models including teaching synchronously, asynchronously and using a hybrid model. Participants cited the benefits of each of the models. While it was noted that synchronous models allow the teacher “to keep that personal connection and that relationship with the student”, others cited the flexibility to complete assignments as a significant benefit of asynchronous models. Others felt a hybrid model offered the best of both worlds.

Addressing Previous Concerns was the final theme. Here, participants were asked to reflect on the lack of student accountability and limited social interactions that occurred during the spring of 2020. Overwhelmingly, participants reported that these concerns largely subsided in the 2020-2021 school year. One participant stated: “I might have only gotten between one and eight assignments turned in the spring and this past fall would be 10 to sometimes, the whole class would respond.” Support from school administration, the inclusion of synchronous classes and the use of hybrid models – allowing for some in-person interactions – were credited with this shift. As another participant commented, synchronous and hybrid models allowed “the kids to interact and problem-solve together.”

IMPLICATIONS

Effective Strategies

This research offers several actionable pedagogical strategies for future physical educators who are teaching in an online setting, in addition to teacher educators who are working exclusively in an online setting, or merely incorporating online elements into their pedagogy. A primary finding of this research is the need for teachers to make assignments simple, consistent, and easy for students to navigate. This can appear in a variety of forms such as: keeping online platforms (i.e., Google Classroom, Blackboard, Canvas, etc.) easy to navigate and properly maintained; incorporating routines into online classes to establish consistency; and when creating instructional videos/greetings, keep videos brief and focused. These ideas are supported by other pandemic-related research into online physical education, as well (Cruickshank et al., 2021; Erwin et al., 2021). Furthermore, participants in this study, supported by the work of Centeio et al. (2021), noted a preference for creating personalized videos, rather than posting links to previously created YouTube videos. The perception was that personalized videos allowed an opportunity to connection with students that generic workout videos would not.

Another strategy for student engagement is to offer opportunities for students to provide input into their assignments to personalize learning (D’Agostino et al., 2021; Erwin et al., 2021; Vilchez et al., 2021). This recommendation is also included as one of SHAPE America’s *Appropriate Practices for K-12 Online Physical Education* (SHAPE America, 2020). It is recommended that future practitioners survey individual students’ interests and tailor activities to align with their preferences. Allowing for student input into assignments is a strategy that can be offered not only at the K-12 level, but in teacher education programs, as well.

Online Models

When teaching online, the participants gained experience teaching both synchronously and asynchronously. Unanimously, participants stated a preference for teaching in a synchronous environment. This is supported by the findings from two other studies (Centeio et. al., 2021; Johnson et al., 2021). Study participants found that teaching synchronously provided them an opportunity to establish rapport with their students that did not exist when teaching asynchronously.

Participants viewed this as an essential element of the profession. That stated, it should be remembered that when teaching synchronously, students lose some of the flexibility to complete assignments at their convenience, which has long been an advantage of online classes (Daum & Buschner, 2012). Given these findings, it is recommended that practitioners consider experimenting with both elements in their future online classes.

Similarly, participants in this research also had the opportunity to experience teaching in a fully online and hybrid setting with teachers expressing a preference for teaching in a hybrid setting. These teaching conditions allowed them to meet with their students online part of the time and in-person the remainder of the day. Teachers expressed the ability use online learning to focus on cognitive concepts associated with the curricular content and utilized in-person time to allow students to apply their learning in game settings. For this reason, it is recommended that when feasible, schools consider offering hybrid online options. This suggestion is supported by Zheng et al. (2021) whose study of physical education during the pandemic found that students who participated in hybrid learning models outperformed their peers whose learning was limited to synchronous models.

Addressing Concerns

One concern that arose during this research was that teachers reported a lack of student accountability during the spring of 2020. Notably, however, these concerns shrunk during the 2020-2021 school year. Participants credited administrative support with this change of course. This underscores the need for physical educators to act as advocates and ambassadors for the profession. It is recommended that physical educators have regular communication with their school administrators regarding the quality work that they are performing and the significance of physical education on students' well-being (Vilchez et al., 2021). Enlisting administrative support can lead to policy statements and recommendations regarding learning conditions, reasonable class size and equipment needs. Furthermore, this underscores the importance of physical education teacher education programs to continue to reinforce the importance of teacher candidates advocating for value of the subject, as it can frequently become marginalized within a school's ecosystem.

Finally, student social-emotional well-being should be a primary consideration for online instruction. This was evident in the findings of this research and supported by the work of colleagues in the field (Howley, 2021; Johnson et al., 2021). The risk of isolation is high for students engaged in on-line learning and we suggest that instructors emphasize the link between physical activity and a student's mental well-being during these conditions. Vilchez et al. (2021) suggests offering intentional times for students to reflect on their mental well-being. In the realm of teacher education, this suggestion becomes twofold. First, teacher educators should heed this advice themselves and provide opportunities for their students to reflect on their own mental well-being. Secondly, teacher educators should encourage teacher candidates to incorporate this practice into their own teaching routines.

Fortunately, within the context of this research, participants reported a decrease in the concern about student social-emotional well-being, a trend that was largely credited to the addition of synchronous classes and hybrid offerings. As previously mentioned in this chapter, these are additional benefits of these types of online programs.

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Preparing Preservice Teachers to Intentionally Include Parents in eLearning

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Teaching and learning through a global pandemic have significantly changed PK-12 education. As a result, consideration is necessary to determine how these changes impact how preservice teachers are prepared to effectively design and implement eLearning, especially as a tool that works cohesively with face-to-face learning experiences. While eLearning has great potential for enhancing traditional approaches, many challenges exist, including how to productively include parents and guardians as a part of the learning process. In this systematic literature review, we considered articles focused on the experiences of parents or guardians during the COVID-19 pandemic of supporting young learners during eLearning. By analyzing these articles, themes were identified across experiences. Implications for preparing preservice teachers to meaningfully engage parents during eLearning are provided.

HISTORICAL REVIEW

Over the last several years, the necessity for preservice teachers to gain skills in effectively integrating eLearning as a strategy infused with face-to-face efforts has become apparent (Koehler & Farmer, 2020). After all, blended and online initiatives (e.g., eLearning days to address school closures, IDOE 2020) and technologies (e.g., learning management systems as a common tool in classrooms, Graham et al., 2019) have continually increased in recent years. Results from a 2020 survey of parents, teachers, and administrators indicated that challenges of eLearning included issues related to access; technical problems; guardian supervision, support, and frustrations; design and navigational issues; administration and facilitation concerns; and student motivation and execution (Koehler & Farmer, 2020). Across these challenges, a common consideration for the role of parents or guardians in the eLearning process was apparent. That is, from the educators' perspective, they experienced difficulties with trying to meaningfully engage parents, while parents experienced frustrations with learning new technologies, navigating assignment instructions and learning management systems, and balancing workload and other responsibilities. These challenges can be compounded for young learners and their parents, as younger learners completing eLearning depend more heavily on their parents' to help them navigate the experience (Fontenelle-Tereshchuk, 2021; Kolak et al., 2021; Lau & Lee, 2021).

eLearning with young children has long been a controversial topic among scholars, educators, and policymakers (Aubrey & Dahl, 2008; Elkind, 1998). While eLearning offers a space for young learners to comprehend abstract concepts and engage in problem-solving learning activities (Dong et al., 2020; Kolak et al., 2021), it has also been criticized for hindering the development of their social and emotional skills (Dong et al., 2020). Because of young learners' age and digital literacy level, their need to develop psycho-motor skills, and social and emotional competency, the switch from face-to-face learning to eLearning requires parental involvement (Kolak et al., 2021; Sonnenschein & Stites, 2021).

Parental involvement refers to parents' or caregivers' investment in their children's education (e.g., helping with homework, reading with children, supporting school events; Larocque et al., 2011). Parents' perceptions and attitudes toward distance education significantly impact young learners' eLearning experiences (Dong et al., 2020). For exam-

ple, parents' guidance with digital technologies and media environments is inseparable from young learners' eLearning. Therefore, parental beliefs and attitudes toward the role and potential of eLearning for young children shape the quality and quantity of eLearning, opportunities, and learning experiences children receive at home (Dong et al., 2020).

Overall, additional research is needed to more deeply understand the challenges experienced by parents and guardians with eLearning to more effectively prepare preservice teachers to intentionally include these stakeholders in the eLearning process—especially when working with young children who rely on the support of adults to successfully complete eLearning experiences (Dong et al., 2020; Lau & Lee, 2021). In this research, we identified and critically evaluated existing studies on parents' perceptions of eLearning for young learners during the COVID-19 pandemic to consider the following research question: What are parents' perspectives towards eLearning for their children during the COVID-19 pandemic?

PROCESS

To locate literature about parental perspectives on eLearning for young learners during the COVID-19 pandemic, we completed an electronic search. First, we targeted articles focused on young learners (PK-6). To increase the number of reviewed studies, we included studies addressing both primary and middle schoolers. Studies only addressing middle school or high school parents' perspectives were not included.

An initial search was performed in September 2021 in the EBSCO Education Full Text database using the following descriptors: distance education or online learning; parents' perceptions or perspectives; young learners or elementary schoolers or PK-6 students; and COVID-19 pandemic. To be included in the study, articles had to 1) be empirical in nature, including data capturing parental perspectives, 2) consider perspectives of parents of learners in grades PK-6, and 3) have taken place during the COVID-19 pandemic.

The initial search yielded 115 results. After excluding non-journal, non-peer-reviewed, and non-English articles, 82 papers remained for consideration. Researchers next examined the titles, abstracts, and keywords of these articles, and 68 articles were removed because they focused on educators' perspectives, students' perspectives, online teaching pedagogies or technology integration, emergency distance education or challenges or opportunities of distance education, or middle school or high school students or adult learners. This resulted in 14 articles meeting the criteria for further analysis. Next, the lead researcher searched Google Scholar to increase the number of all relevant studies. Using the same process as described, the researcher reviewed the first 20 pages of results, which resulted in 17 articles meeting the inclusion criteria. Finally, the researcher searched the references of each identified article and located 8 additional articles that met inclusion criteria. Once duplicates were removed, 21 articles were included in the final analysis. To ensure the validity of the search process, researchers consulted a university librarian and discussed the data selection process.

To analyze parental perspectives on eLearning for young learners during the COVID-19 pandemic, the lead researcher reviewed the findings and discussions of the 21 included articles. In each article, quotes capturing key takeaways were noted. Next, these quotes were grouped into themes. Table 1 shows a summary of the reviewed articles.

Table 1
Summary of Reviewed Studies

Researcher(s)	Research Design	Findings on Parental Perspectives
Abuhammad (2020)	A qualitative study analyzing 248 Facebook posts from nine local parents or child Facebook groups in Jordan	Four types of barriers were identified in assisting young learners' eLearning: personal, technical, logistical, and financial. Personal barriers were the most prevalent including lack of training, lack of support and technical expertise; inadequate communication with professionals, and lack of qualifications.
Ahbabi (2021)	A quantitative descriptive study with 130 parents of young children in the UAE	Parents were satisfied with their children's eLearning, especially working parents and mothers. Most parents believed eLearning helped prevent the spread of the pandemic and provided a great alternative to in-person learning.

Table 1 continued

Researcher(s)	Research Design	Findings on Parental Perspectives
Bates et al. (2022)	An open online survey with 2,509 responses from parents of primary school aged children across Northern Ireland	Parents reported various challenges in supporting their children's eLearning, especially those with one or more children with special needs. The main challenge identified was keeping young children focused on schoolwork. Also, it was difficult for working parents to organize their own work while supporting their child's learning.
Cui et al. (2021)	Two-stage questionnaire with 867 parent-child pairs of Chinese elementary school students and their parents in the first stage and 141 parent-child pairs in the second stage	Parents felt pressure while supporting their children's eLearning, and stress levels increased with younger school kids. However, they were satisfied that eLearning provided an option for their children to continue school. Most parents hoped their children would return to in-person learning because they were concerned with the timely interaction during eLearning, extra time and responsibility required, children's eyesight from screen time, and learning outcomes.
Dong et al. (2020)	Quantitative survey with 3,275 Chinese parents with young children enrolled in early childhood education programs	Parents generally believed that eLearning does not offer a positive learning atmosphere and social interactions to engage young children, causes harm to eyes and independent thinking, and demands time and professional knowledge from parents.
Flynn et al. (2021)	An online survey with 2,733 parents and 1,189 students from primary and second-level schools in Ireland	Parents expressed high stress from supporting their children's learning at home during the COVID-19 pandemic.
Fontenelle-Tereshchuk (2021)	A case study with 10 parents of elementary school children in Canada	Parents believed that eLearning does not foster independent learning; is not suitable for young children; demands too much burden; and is shallow, lacking explicit expectations and appropriate assessment.
Günbaş & Gözükcük (2020)	A case study with 148 parents of students at different elementary schools in Turkey	The majority of parents preferred in-person lessons for their children and reported challenges of eLearning, including lack of technical knowledge and internet access and distanced their children from teachers and peers.
Harjule et al. (2021)	An observational statistical study using snowball sampling with 754 responses from parents of different age-group children in India	Most parents preferred in-person lessons and were concerned about increased screen time. Most parents believed that long-term online learning would reduce their children's social skills.
Henderson et al. (2021)	A public-opinion survey with a nationally representative sample of 1,249 parents with children in K-12 in the USA	Participants reported mixed-feelings toward online learning. They were satisfied with the virtual instructions and activities provided by schools and teachers. However, they believed their children learned less as they would in face-to-face settings.
Kolak et al. (2021)	An online questionnaire with over 10,545 parents of students from Grade 1 to Grade 4 in the Republic of Croatia	Parents were mostly satisfied with their children's eLearning. They were pleased with how teachers managed instruction and feedback. However, parents also reported stress and exhaustion in assisting their children's schoolwork.
Lau & Lee (2021)	An online survey with 6,702 parents of kindergarten students and primary school students in Hong Kong	Parents were happy when given the option of eLearning for their children but wanted more interactive online lessons. They were concerned about increased screen time.
Mantovani et al. (2021)	A quantitative study with 3,443 parents with children aged from 1 to 5 years and from 6 to 10 years living in northern Italy	Participants displayed confidence in coping with the COVID-19 emergency, and there were unexpected improvements such as parent/child and sibling relationships. However, parents were also concerned about excessive use of digital technologies and increased television viewing.
Nusser (2021)	An online survey with 1,452 parents of children from kindergarten to eighth grade in Germany	Most parents reported difficulties in motivating their child to learn at home. Parents were unsatisfied with the support they received from schools and teachers.

Table 1 continued

Researcher(s)	Research Design	Findings on Parental Perspectives
Pastori et al. (2021)	A national survey with 6,905 parents of 9,802 primary and secondary school children in Italy	“Frustration” was the most cited emotion experienced by mothers. However, participants also recognized some strengths and positive implications of eLearning.
Pozas et al. (2021)	Qualitative online interviews with seven parents of primary school students from Mexico and Germany	Mexican and German parents felt challenged to organize home-schooling and motivate their children.
Ribeiro et al. (2021)	An online survey with 21,333 parents with children from elementary school to secondary education in Portugal	eLearning demanded a significant amount of time from parents, especially parents of primary school children.
Soltero-González et al. (2021)	Interviews with 20 parents of pre-schoolers in a metropolitan area in the United States	A majority of the parents felt stressed managing the demands of eLearning and found keeping their children interested in eLearning difficult.
Sonnenschein et al. (2021)	An online survey with 361 parents with children younger than 18 years old in the United States	Supporting children’s online learning in ways such as monitoring, teaching, and technology assistance increased parental stress.
Sonnenschein et al. (2021)	An online survey with 126 parents of preschoolers in the United States	Parents displayed a lack of confidence in fostering their children’s mathematics skills, and most parents wanted to receive more information from their children’s teachers.
Çakın & Akyavuz (2021)	Interviews with 20 parents with children studying at a primary school in Turkey	Parents considered eLearning insufficient as their children became bored during the process, did not receive adequate teacher support, and experienced decreased teacher presence in eLearning. Parents were also concerned about social problems developing due to increased screen time.

INITIAL RESULTS

From the 21 published studies, three themes emerged related to parental attitudes toward eLearning for young learners. First, studies indicated parents reported feeling stress from supporting their children’s eLearning (Dong et al., 2020; Flynn et al., 2021; Fontenelle-Tereshchuk, 2021; Harjule et al., 2021; Pastori et al., 2021; Pozas et al., 2021; Ribeiro et al., 2021; Soltero-Gonzalez & Gillanders, 2021; Sonnenschein & Stites, 2021; Sonnenschein et al., 2021). One reason for this stress was the extra time required for eLearning and homework (Cui et al., 2021; Lau & Lee, 2021; Pastori et al., 2021; Ribeiro et al., 2021; Stites et al., 2021). Furthermore, lack of training in eLearning and inadequate professional knowledge of school subjects also contributed to parental anxiety (Lau & Lee, 2021; Pastori et al., 2021; Sonnenschein et al., 2021). Finally, life disruption and financial tension caused by the worldwide pandemic created parental anxiety (Abuhammad, 2020; Friedman et al., 2021).

Second, parents expressed negative beliefs toward eLearning due to perceived disadvantages of eLearning, inadequate professional knowledge of content and technology, young learners’ lack of self-regulation, and inadequate support from schools and teachers (Abuhammad, 2021; Çakın & Akyavuz, 2021; Cui et al., 2021; Dong et al., 2020; Fontenelle-Tereshchuk, 2021; Günba & Gözükcük, 2020; Nusser, 2021; Pastori et al., 2021; Sonnenschein et al., 2021; Yayci & Kendirci, 2021). Parents reported that eLearning did not foster independent learning and demanded too much time from working parents (Dong et al., 2020; Fontenelle-Tereshchuk, 2021; Ribeiro et al., 2021). Also, parents hoped to return to in-person learning for their children to achieve better learning outcomes and the development of social skills (Günba & Gözükcük, 2020; Harjule et al., 2021; Henderson et al., 2021; Mantovani et al., 2021; Çakın & Akyavuz, 2021). Parents’ negative beliefs toward eLearning also came from concerns related to increased screen time creating vision problems (Cui et al., 2021; Dong et al., 2020; Harjule et al., 2021; Lau & Lee, 2021; Mantovani et al., 2021).

Third, parents also indicated positive feelings toward eLearning for young learners (Ahhabi, 2021; Cui et al., 2021; Henderson et al., 2021; Kolak et al., 2021; Lau & Lee, 2021; Mantovani et al., 2021). Parents were pleased eLearning offered an opportunity for their children to learn at home (Cui et al., 2021; Henderson et al., 2021; Lau & Lee, 2021),

and they were satisfied that eLearning helped prevent the spread of COVID-19 (Ahbabi, 2021). Also, parents gained confidence in coping with the difficulties caused by the COVID-19 pandemic due to their experiences supporting eLearning (Ahbabi, 2021; Mantovani et al., 2021) and were pleased with teachers' instruction and feedback (Kolak et al., 2021). Although young learners experienced challenges, their parents believed that parent-child and/or sibling relationships improved as a result of eLearning (Mantovani et al., 2021). Specifically, in one study, 40.8% of families reported an improved parent-child relationship; and 32.8% of them indicated an improvement in siblings' relationships (Mantovani et al., 2021).

IMPLICATIONS

Teaching and learning through a global pandemic have significantly changed the PK-12 educational system. Although the rapid shift to embrace eLearning as a path through a turbulent time forced learners, educators, and parents to quickly acclimate to new educational realities and resulted in negative feelings, the potential of eLearning as a supplementary tool to traditional learning efforts was simultaneously realized. However, for the full benefits of implementing eLearning to support face-to-face efforts, several considerations must be made when intentionally engaging parents and guardians in the learning process. The results captured in this chapter offer insight into parental perspectives regarding supporting their children with eLearning during the COVID-19 pandemic, which in turn offers direction as to how preservice teachers can be prepared to intentionally facilitate parental partnerships.

Training Preservice Teachers to Facilitate Parental Partnerships

When designing eLearning experiences, PK-12 educators must be mindful of learners' needs and determine the level of parental support required to achieve an effective outcome. When supporting young learners during eLearning, parents are a primary source of support for children (Gayatri, 2020; Rice et al., 2021), serving as digital classroom managers and tutors (Rice et al., 2021). To sustain children's education at home, findings from this analysis revealed that parents expected to receive support and ongoing, authentic, caring, flexible communication from schools and teachers (Bates et al., 2021; Lau & Lee, 2021; Soltero-Gonzalez & Gillanders, 2021). While the initial results of this study indicate that eLearning was difficult for parents of young learners, understanding the negative feelings offers insight into how educators can design with parental support in mind and therefore determine how best to prepare preservice teachers to facilitate these partnerships.

Preservice teachers should be given opportunities to explore existing frameworks that engage parents and apply these while designing eLearning. For instance, Ali et al. (2021) proposed an eLearning approach for young learners during the COVID-19 pandemic that included crafting projects with guidance from parents and teachers. Additionally, although constructed prior to the COVID-19 pandemic and not explicitly addressing eLearning, Epstein's (1995) six types of involvement provides a comprehensive framework for home-school partnerships, with type 1 focused on parental involvement in the establishment of home environments to support children's learning. Giving preservice teachers opportunities to create plans that intentionally engage parents in the eLearning process can be worthwhile, especially if they are prompted to incorporate frameworks, other research, and parental input to inform the strategies being detailed in the plan.

Offering Diverse Design Experiences for Preservice Teachers

Creating effective eLearning training for preservice educators is a complex problem with many potential viable solutions. However, providing preservice teachers with opportunities to intentionally practice design, to understand design as a complex process involving multiple stakeholders, and experiencing different design approaches is essential in developing effective skills (Jordan, 2016). For instance, the results of this review indicate that parents felt stressed for a variety of purposes while supporting their child during eLearning, and empathy towards parents could be a useful consideration in improving design outcomes.

Designers "often do not think empathically toward learners or are limited in how they act (or can act) upon empathic insights while creating their designs" (Matthews et al., 2017, p. 486). Therefore, helping preservice teachers to empathize

with parents while designing eLearning can be a useful strategy for reaching more successful outcomes. Additionally, how solutions are developed matters to stakeholders. Utilizing eventual users in a codesign process, therefore, could offer innovative ways to create advocates of the design (Cavignaux-Bros & Cristol, 2020), better envision the potential use cases of a design (Björgvinsson et al., 2012), and improve the design's overall quality (Könings et al., 2014). Recent research of a codesign experience revealed that participant educators felt they had made significant contributions to the development of a solution by sharing their unique perspective with eLearning through the global pandemic (Farmer, 2022). Offering preservice teachers opportunities to codesign with parents can simultaneously help develop design skills while creating a more viable end product.

Preparing Preservice Teachers to Support Children's Social and Emotional Development

Many parents in the research reviewed in this analysis expressed negative views towards eLearning for a variety of reasons, including the appropriateness of instruction to maintain learners' attention and self-regulation. Preparing preservice teachers to design appropriate instruction for young learners is important. Borup and Archambault (2019) suggest several strategies for designing courses for young learners, including creating personalized learning with online technologies. For example, online courses should use dynamic games, simulations, and adaptive-learning software to tailor individualized learning. Furthermore, Borup et al. (2020) described a framework called Academic Communities of Engagement to enhance student engagement through the consideration of relationships. Prompting preservice teachers to create eLearning experiences based on frameworks like this can help them consider the potential appropriateness of activities. At the same time, by using a specific framework, preservice teachers can more effectively articulate specific design choices, which will help them communicate with parents regarding the specific design choices being made.

Identifying eLearning Competencies Focused on Parental Involvement

The results of this review suggest that preservice teachers, especially aspiring elementary teachers, should be trained to intentionally consider and involve parents as a part of the eLearning design process. To help guide preservice teacher development, professional organizations should consider the creation of specific standards geared towards the inclusion of parents and guardians into the design process. For instance, while both the International Society of Technology in Education and National Standards for Quality Online Teaching have standards offering insight for collaborating with stakeholders or the types of behaviors appropriate for interacting with parents during the learning process. These could be further strengthened by considering the way parents and their involvement can be considered during the design process before an experience is implemented. In turn, these standards can be used to develop competencies. Competency-based education is considered a useful approach for facilitating professional skills (Zhang & West, 2020), and "competency frameworks have been adopted to strengthen professional excellence, promote quality teaching, and contribute to improving outcomes for students" (O'Flaherty & Beal, 2018, p. 462). By creating a competency-based approach to facilitate eLearning (among other technology integration) skills in preservice teachers, preservice teachers share ownership in their learning (Parish & Sadara, 2020), as they are responsible for setting progress and selecting a representation of their understanding.

CONCLUSION

To be competent in contemporary classrooms, educators face increasing demands, and the ability to effectively use eLearning is one of them. eLearning offers new ways of solving old problems and enhancing traditional learning experiences. However, many parents experienced extreme stress while supporting young learners during eLearning, and as a key partner in the eLearning process, this reality can impact the overall success of eLearning implementations. The key is to intentionally develop parental partnerships and prepare preservice teachers to develop these partnerships and design for them as a part of the eLearning process. Offering preservice teachers diverse design experiences and articulating specific competencies related to the development of parental relationships can be useful in preparing them to successfully implement eLearning in their careers.

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5 Minutes On K-12 Online Learning With... A Re-boot for Educational Leaders

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In March and April 2020, a series of interviews with veteran classroom and online teachers, independent evaluators, online school leaders, change agents, government officials, university faculty, and/or researchers were posted to the Virtual School Meanderings blog. Entitled “5 Minutes On K-12 Online Learning With...” the series was designed to provide advice to teachers on what to do to provide some form of continuity of learning or to parents on how to structure their child’s learning at home during the emergency remote learning that occurred in the Spring of 2020. Following this first series, in an effort to help school leaders plan for a disrupted school year that was inevitable, interviews were conducted with additional veteran school leaders, university researchers, and independent evaluators. The goal of this second series of “5 Minutes On K-12 Online Learning With...” was to ask them for guidance on (1) how to finish out the current school year and what impact that may have on how they open the coming school year, and (2) what to do to ensure that when the system has to shut down again due to local flare ups or a second wave, the toggle from in person learning to remote learning would be done in a more seamless way. Unfortunately, as most school and district leaders failed to adequately prepare for what has been two disrupted school years, this second series of “5 Minutes On K-12 Online Learning With...” likely had little impact on school leaders.

HISTORICAL REVIEW

In mid-March 2020, much of the media was focused on providing advice on the K-12 pandemic pedagogy that was occurring. What was largely absent was the voices of individuals who had years of experience in the field of K-12 distance and online learning. At the same time, the Virtual School Meanderings blog (see <https://virtualschooling.wordpress.com/>) had been active since 2005, and throughout that 15 year history it had hosted a podcast that included both audio and video segments. The confluence of these events (i.e., a pandemic-induced focus on K-12 distance and online learning, a lack of advice from veterans in the field, and an established medium) led to the creation of the “5 Minutes On K-12 Online Learning With...” series that featured short interviews ranging from 6-18 minutes with veteran classroom and online teachers, independent evaluators, online school leaders, change agents, government officials, university faculty, and/or researchers.

In total, 27 individuals in the field of K-12 distance and online learning were interviewed over a six-week period. Each individual was asked three questions with no follow-ups.

1. Tell me about yourself.
2. There are teachers all around the world who now finding themselves having to use online tools and curriculum for the first time. Do you have any advice for them?
3. We also have parents whose children are learning at home for the first time. Do you have any guidance for them on how to support their child’s learning?

The collection of interviews was posted to the blog in an unedited fashion at noon each weekday from 24 March to 30 April 2020 (see Barbour, 2020a for the complete discussion of this first series). Since the collection was first posted it has received approximately 1200 views.

PROCESS

As this project was designed to create a resource that could be used for teacher professional development, there was no formal data collection. However, following six weeks of blog entries and 27 guests, most teachers and parents were at the stage where they had four to eight weeks (some even more) of experience with emergency remote learning (Hodges et al., 2020). Additional advice to teachers on what to do to provide some form of continuity of learning or to parents on how to structure their child's learning at home was no longer an immediate need. Most teachers and parents had figured it out – at least to the extent that they would be able to do. As such, it was time to transition the “5 Minutes On K-12 Online Learning With...” series to look more to the future.

One model to better understand the K-12 education response to the pandemic was proposed by Barbour et al. (2020).

Multiple Phases of Education Response to COVID-19

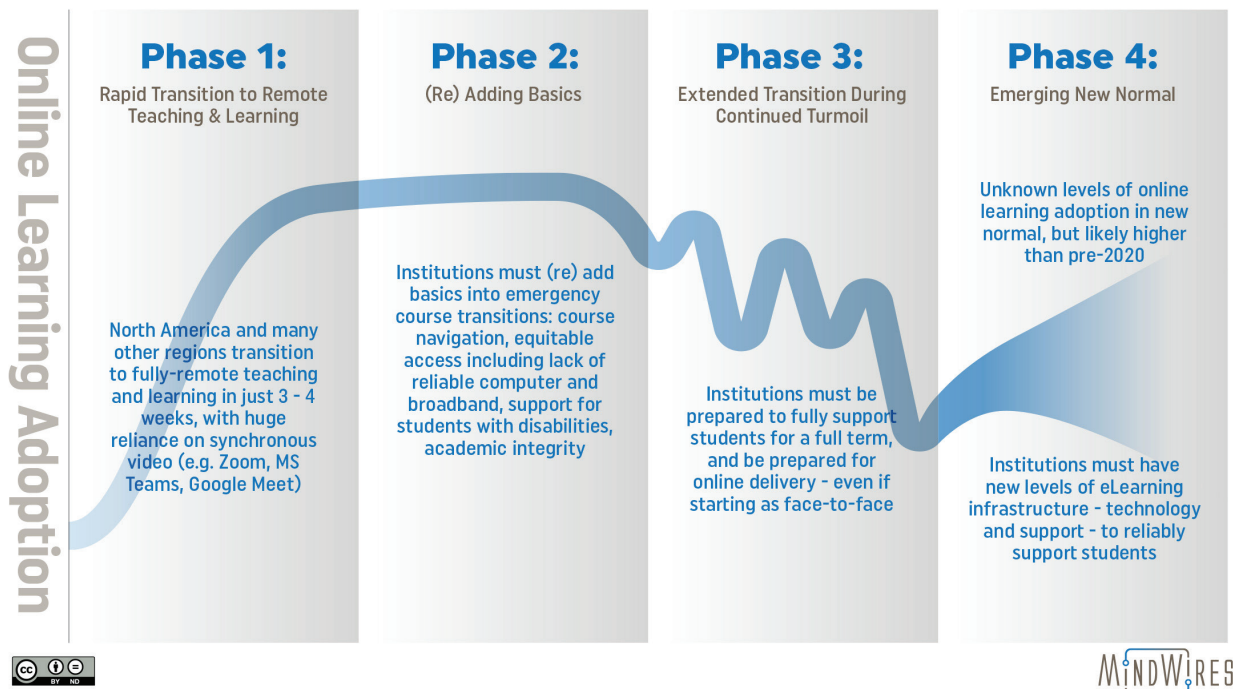


Figure 1. The Four Phases of Remote and Online Learning Due to the Pandemic.

Phase 1: Rapid Transition to Remote Teaching and Learning – Institutions making an all hands on deck movement to remote delivery, often relying on synchronous video, with massive changes in just four weeks.

Phase 2: (Re)adding the Basics – Institutions must (re) add basics into emergency course transitions: course navigation, equitable access including reliable computer and broadband, support for students with disabilities, and academic integrity.

Phase 3: Extended Transition During Continued Turmoil – Institutions must be prepared to support students for a full term, and be prepared for online delivery – even if starting as face-to-face.

Phase 4: Emerging New Normal – This phase would see unknown levels of online learning adoption, likely higher than pre-COVID-19 days, but institutions would have new levels of technology and support to reliably support students. (p. 3)

The first series of “5 Minutes On K-12 Online Learning With...” blog entries were focused on providing advice for teachers and parents as they began Phase 1 and, to a lesser extent, transitioned into Phase 2.

However, as the 2019-20 school year was drawing to a close, many educational leaders began to consider the next school year. Phase 3 is described by many as a ‘toggle term’ or ‘toggle year,’ where a school is able to switch from in person learning to remote learning as “states of lockdown and openness, depending on their sense of epidemiological

data and practical feasibility” persist (Alexander, 2020, para. 32). Inherent in the toggle phase is the need to ensure that the appropriate planning and preparation is in place to ensure that the quality of the learning experience is the same regardless of which modality the teacher is forced to use. As the first series of “5 Minutes On K-12 Online Learning With...” was coming to its natural conclusion with approximately four to eight weeks left in the 2019-20 school year, it was a logical transition to focus the next round of interviews on the two things that educational leaders needed to be deal with: (1) how to finish out the current school year and what impact that may have on how they open the coming school year, and (2) what to do to ensure that when the system has to shut down again due to local flare ups or a second wave, the toggle from in person learning to remote learning would be done in a more seamless way.

The desire to equip educational leaders with advise on how to address the transition to Phase 3 was the focus on the second series of “5 Minutes On K-12 Online Learning With...” interviews. Once again personal contacts were leveraged to arrange interviews with primarily veteran school leaders, university researchers, and independent evaluators (although many of those individuals had at various times in their careers also been classroom and online teachers). The specific questions that were asked during this second series included:

1. Tell me about yourself.
2. What advice would you give to school leaders in terms of accommodating the disruption that has happened during the 2019-20 school year with respect to finishing up this school year and/or beginning the next school year?
3. What advice would you give to school leaders on how to prepare for the likely scenario of a local flare up or second wave shutting down their system again at some point during the 2020-21 school year?

Once again, the collection of 30 interviews was posted to the blog in an unedited fashion at noon each weekday from 04 May to 12 June, 2020.

RESULTS

Similar to the first series (and unlike most of the other chapters in this volume), there was no formal data collection. While the first series was posted from 24 March to 30 April 2020 and had collectively received approximately 1200 views by May 2022, this second series of “5 Minutes On K-12 Online Learning With...” interviews has only received approximately 650 views. Further, while there was no formal thematic analysis of the advice that this group provided to educational leaders, on an informal basis it can be suggested that the guidance did coalesce around several general areas. First, many of the interviewees stressed the need for school leaders to survey parents to develop an inventory of the device and bandwidth capacity and needs of their students. Second, many of these school leaders, researchers, and evaluators spoke about the need for schools and districts to adopt complete suites of tools (such as a learning management system [LMS]) and to standardized the types of tools that they were going to support and provide professional learning. For example, there was no need for some teachers to use *VoiceThreads*, others use *FlipGrid*, and even more use the LMS’s discussion forum to conduct asynchronous discussion threads using video (i.e., three different tools to accomplish the same pedagogical task).

Speaking of professional learning, almost all of those interviewed referenced the need for teacher professional development as a third general theme. Additionally, this professional developed should not just on how to use the various tools that were being adopted by schools and districts according to the interviewees, but also how to teach using those tools and how to help students and their parents troubleshoot those tools. In fact, many of those interviewed suggested ending the 2019-20 school year early for students or delaying the start of the 2020-21 school year to allow the appropriate time for this professional learning to occur, as well as time for the teachers to begin their own planning and preparations after having received that professional development. Finally, many of the interviewees spoke about the need for school leaders to build partnerships and collaborations within their own schools and districts, as well as with other schools and districts as a fourth general theme. For example, it was seen as a waste of resources for a district to have 10 high school mathematics teachers, all of whom were independently developing their own online content and online activities for the same Algebra I course. As such, school leaders should seek ways to streamline these processes

IMPLICATIONS

This project was designed to create a resource that could be used by school leaders in their own planning and preparations for what was likely going to be another disrupted school year due to the pandemic. However, this second series of “5 Minutes On K-12 Online Learning With...” interviews was only viewed half as much as the first series. Both series received fewer than 2000 views or roughly the same number of teachers and school leaders in a single large, urban school district. After three disrupted school years, there has been little evidence that many, if any, school years have truly achieved Alexander’s (2020) notion of a toggle term with any fidelity (Barbour, 2022). Given these realities, it may be easy to suggest that the potential impact on school leaders had less than the impact that the first series had on teachers and parents, and that both series may have only had minimal impact overall. But another way to look at it was that these two series have the potential to be have a significant impact on the field of K-12 distance and online learning in three areas.

First, German (2020) described isolated incidents of the use of correspondence education materials in Los Angeles during the Spanish flu pandemic, New Zealand during the polio epidemic, and – most recently – Nebraska during COVID-19. He then asked the valid question given that “distance learning has been part of American culture for 100 years, why can’t we get it right?” Over the past decade, online learning has frequently been suggested as a way to provide instruction during short-term school closures such as snow days (Haugen, 2015; Hua et al., 2017; Milman, 2014; Morones, 2014; Swetlik et al., 2015) or for longer term continuity of learning following natural disasters such as wildfires, hurricanes, earthquakes, and the polar vortex (Baytiyeh, 2018; Mackey et al., 2012; Rush et al., 2016; Samson, 2020; Schwartz et al., 2020; Watkins, 2005). In fact, a decade ago scholars highlighted how jurisdictions like Bolivia, Hong Kong, and Singapore used online learning as a way to continue learning during that pandemic-induced school closures during SARS and H1N1 (Alpert, 2011; Barbour, 2010; Barbour et al., 2011; Latchem & Jung, 2009). Given all of this literature – much of it published by advocacy-oriented organizations or in more popular publications – for more than a decade calling on school leaders to plan and prepare for the use of distance and online learning to provide continuity of learning, why weren’t school leaders more prepared? It has been suggested that one of the reasons why the field of K-12 distance and online learning has not impacted policy is a lack of historical perspective (Barbour, 2020b; Molnar et al., 2021), or put another way a lack of learning lessons from the past. The two “5 Minutes On K-12 Online Learning With...” series, particularly this second one focused on school leaders,

Second, it has been well documented that teacher education has not included a focus on the design, delivery, and support of K-12 distance and online learning in either their pre-service teacher preparation (An et al., 2021; Archambault et al., 2016; Davis & Roblyer, 2005; Kennedy & Archambault, 2012) or in-service teacher professional development (Dawley et al., 2010; Rice & Dawley, 2007; Rice et al., 2008). Given the problems and gaps in teacher preparation highlighted by the pandemic, Hodges et al. (in press) argued there was a need for additional content focused on K-12 distance and online learning as one of six objectives to better position teacher education for the next disruption. These two series of “5 Minutes On K-12 Online Learning With...” interviews provide an extensive collection of expert advice that can be used as a resource in both initial teacher preparation and on-going teacher professional development programs.

Finally, even though these videos were not used by those in the field to the extent that was desired, both series of the “5 Minutes On K-12 Online Learning With...” interviews could be used as the basis for future research. These interviews consisted of experts from various professional backgrounds and a number of different countries. Each of them provided advice based on their knowledge of existing research and their extensive experience in the field. In essence, these interviews represent a trove of qualitative data that could be thematic analyzed in a variety of ways. While this kind of analysis was beyond the author’s ability for this volume, it is somewhat shortsighted to write that there was no data collected – as was suggested earlier.

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Community and Collaboration

Creating Local Course Communities to Engage Culturally and Linguistically Diverse Teachers in Global MOOCs

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Massive Open Online Courses (MOOCs) can provide a scalable approach to continuing teacher professional development. This case study shows the positive influence of bMOOCs to participants' English as a foreign language (EFL) teacher professional learning experience when local course communities ("MOOC camps") were created and engaged culturally and linguistically diverse (CLD) teachers throughout their concurrent participation in a global MOOC. Virtual semi-structured interviews (45-60 minutes each) with MOOC camp facilitators from three different countries (Brazil, Vietnam, Peru), using a protocol designed from the Academic Communities of Engagement (ACE) framework (Borup et al., 2020), which focuses on three dimensions of engagement required for academic success: affective, behavioral, and cognitive. The preliminary analysis of the six facilitator interviews revealed the importance of MOOC camps to create local course communities that connect global MOOC content to EFL teachers' culture, context, and language.

HISTORICAL REVIEW

The COVID-19 pandemic created a global need for teacher professional development (PD). Barbour et al. (2020) explained that in the initial phase of the pandemic, out of necessity teachers took the approach of putting "everything on Zoom and worry about details later" (p. 3). Similarly, teacher educators commonly attempted to prepare teachers to meet the demands of emergency remote teaching by offering just-in-time PD webinars (Leonardo & Cha, 2021; Poce et al., 2021; Toquero & Talidong, 2020).

Webinars for Teacher Professional Development

Beginning in March 2020 we partnered with National Geographic Learning (NGL) and the Office of English Language Programs (OELP) in the U.S. Department of State's Bureau of Educational and Cultural Affairs to offer free webinars to teachers of English throughout the world. The attendance at the webinars was surprising and a reflection of the high demand for global PD opportunities and the pre-established online networks fostered by both NGL and OELP. For instance, the two offerings of the OELP webinar had a combined view total of over 94,000. Similarly, the three NGL webinars were each offered three times at varying times of day and each of the three webinars had an average attendance of 3,053 ($SD=197.76$). NGL webinar participants who completed an evaluation survey overwhelmingly agreed or strongly agreed that the webinars addressed the challenges that they were facing and changed how they taught online. The survey research results have been published in the edited book, *Teaching, Technology, and Teacher Education During the COVID-19: Stories from the Field* (Shin & Borup, 2020) and the AERA Open's special issue, *Education in the Time of Pandemic* (Shin et al., 2022). While the webinars proved helpful, we also found that they were limited in important ways.

First, offering the webinars multiple times a day to accommodate different time zones was time consuming and unsustainable considering the other demands on our time. Second, the synchronous nature and size of the webinars did not allow participants to discuss and apply their learning during the webinar.

MOOCs as Scalable Teacher Professional Development

Barbour et al. (2020) explained that following the initial phase of online learning adoption, K-12 teachers began to take a more systematic approach to teaching remotely by (re)adding important instructional basics to more fully support their students online long term. Similarly, colleges of education began offering entire courses online to offer continued support to teachers during the pandemic. However, the cost of tuition is prohibitive for many teachers--especially international teachers. As a result, many teachers enrolled in Massive Open Online Courses (MOOCs) for free PD opportunities causing MOOC enrollments to surge during the pandemic (Alamri, 2022; Impey & Formanek, 2021; Purkayastha & Sinha, 2021).

For teacher educators, MOOCs can provide a scalable approach to PD that can extend several weeks. However, MOOCs have long failed to live up to their promise due to high attrition rates (Reich & Ruipérez-Valiente, 2019). Additionally, MOOCs offered to teachers throughout the world may not be able to address the unique teaching contexts that vary widely across countries.

Blended MOOCs (bMOOCs) for Teacher Professional Development

Now that K-12 teachers are developing new ways of blending in-person and online learning, those offering MOOCs should also consider the same to improve learning outcomes. Traditionally, MOOCs have been offered as either extended MOOCs (xMOOCs) that focus on access to learning materials and activities or connectivist MOOCs (cMOOCs) that emphasize learner-learner interactions around the learning materials. More recently MOOCs have been blended with in-person learning opportunities. Often these blended MOOCs (bMOOCs) combine the open online course with closed university in-person courses (Mabuan, 2019; Yousef et al., 2015). However, some bMOOCs are truly open by combining the open online course with open in-person “camps.” In this chapter, we will share our preliminary research findings on how MOOC camp attendance in different countries associated with a MOOC designed for English as a foreign language (EFL) teachers in global contexts has benefited participating teachers and share implications for those looking to design and facilitate a bMOOC.

PROCESS AND METHODS

While facilitating the MOOC *Teaching English to Young Learners* (TEYL) in 2019, we learned that some of the MOOC participants were participating in local MOOC camps. Intrigued by this model of support, we conducted interviews at three MOOC camps in three countries: Brazil, Peru, and Vietnam. The MOOC camps in Brazil and Vietnam were conducted in partnership with the Regional English Language Offices and local U.S. embassies, who work in collaboration with the U.S. Department of State's Office of English Language Programs in the Bureau of Educational and Cultural Affairs. The MOOC camp in Peru was organized and facilitated independently. While all of the interviews were completed in the first half of 2020, the pandemic shifted our attention and efforts to facilitating and researching PD webinars for teachers and we did not return to analyzing the survey and interview data collected from MOOC camp participants until mid 2021. However, we found that the research was even more important considering the surge in MOOC enrollments during the pandemic and the new possibilities that some MOOC camps would be re-opening in some parts of the world.

In total, we conducted 19 virtual 45–60-minute interviews: five participants and two facilitators from Brazil, six participants and three facilitators from Vietnam, and two participants and one facilitator from Peru. For this chapter, we focused on our preliminary analysis of the six facilitator interviews by answering the question: How did MOOC camp attendance support EFL teachers' learner engagement?

Academic Communities of Engagement (ACE) Framework

The interview protocol design was guided by the Academic Communities of Engagement (ACE) framework (Borup et al., 2020). The ACE framework focuses on three dimensions of engagement required for academic success: affective, behavioral, and cognitive. The ACE framework also maintains that a learner's ability to independently engage affectively, behaviorally, and cognitively is limited and frequently insufficient for academic success. As a result, these learners require support from other actors to increase their engagement to the levels required for academic success. Specifically, the ACE framework groups support actors into two communities. First, the learner's personal community is composed of actors who are invested in the learner's success due to relationships that they developed with the learner prior to the course (i.e., friends and family). Second, the learner's course community is comprised of actors who are officially affiliated with the course and have developed relationships with the learner as a result of their course participation (see Figure 1).

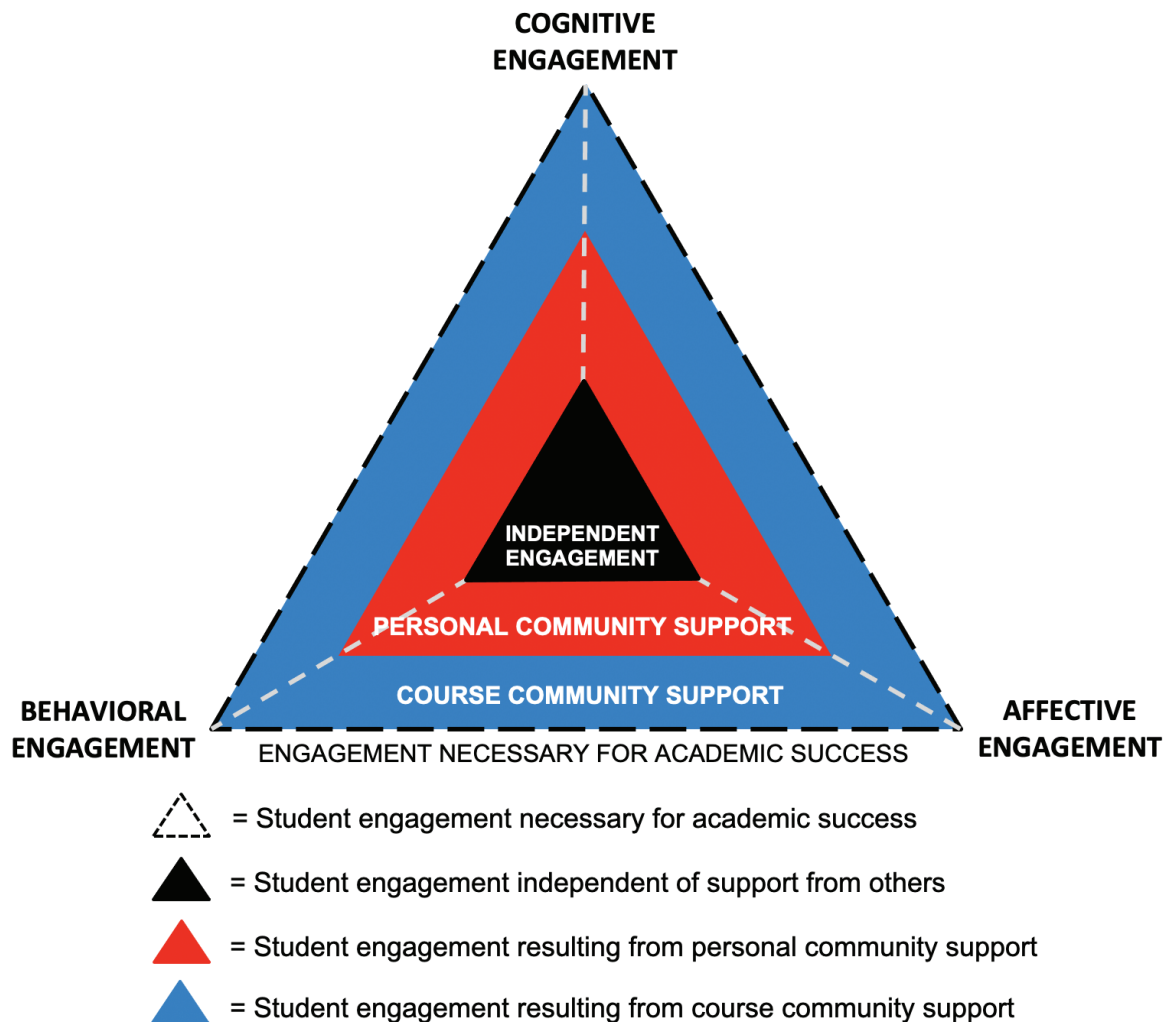


Figure 1. The ACE Framework.

Note: © Jered Borup CC BY, adapted from a figure created by Borup et al., (2020).

The interviews focused on support learners received from the course community and specifically on the support learners received from the online course community in the MOOC and the local, in-person community in the MOOC camps.

PRELIMINARY RESULTS

The interview analysis is ongoing, but the preliminary results highlight the importance of the local culture, context, and language to support engagement of diverse participants in a global MOOC. While answering the question about how MOOC camp attendance supported EFL teachers' learner engagement in three different countries, it became evident that the local culture, context, and language enabled and amplified the facilitators' efforts to directly impact participants' engagement. Specifically, we found three main findings that MOOC camps created safe spaces for engagement, supported application of content to local contexts, and provided language support.

Created Safe Spaces for Engagement for Culturally Diverse Learners

As members of the local community, facilitators used their cultural understanding to adapt the MOOC camp activities to participants' preferences. For instance, one facilitator in Brazil shared, "I think that the idea of the camp is the interaction. I don't know about you in the States, but in Brazil we like very much to interact, to be close to each other." Similarly, a facilitator in Vietnam explained that Vietnamese teachers often "are not comfortable enough when they have to communicate with other people in different countries," making the MOOC camp discussions and community especially valuable. The facilitator in Peru explained that the teachers he worked with "really wanted to have somebody to hear them, to listen to them."

Supported Application of MOOC Content to Diverse Local Contexts

Facilitators also supported MOOC camp participants to apply their learning within the local context. For instance, one facilitator in Vietnam stressed that the large classes—commonly "more than 50 students"—could be "very noisy" and required teachers to adapt the teaching and management strategies shared in the MOOC. The discussions in the MOOC camp allowed participants to share strategies and ideas for applying their learning in the MOOC to "fix their problems in their school." The facilitator added that "we look for the rule, what they have done in the MOOC, and then we figure out...[what] we should touch on [in the MOOC camp]." A facilitator in Brazil similarly shared that MOOC camps allowed participants to "get together, work together" to "see the situation" from within their local context so that they could better address the common challenges that they had to overcome within their classrooms.

Provided Language Support for Linguistically Diverse Learners

The MOOC camp became a space where participants enjoyed practicing speaking English but the facilitators also used their native language strategically to meet participants where they were and help them to better understand and apply the MOOC content in their classrooms. While the MOOC reading materials were written at the B1 level of the Common European Framework of Reference for Language (CEFR), the facilitators also recognized that some participants' reading comprehension was lower than others. As a result, at times they took the opportunity to discuss the readings in the participants' native language.

IMPLICATIONS

After providing webinars for just-in-time PD, we experienced the value of quick and responsive support for teachers around the world during the pandemic (see Shin & Borup, 2020; Shin et al., 2022). However, teachers need longer, more sustained opportunities for PD (Desimone, 2009), and MOOCs can provide an openly and freely accessible option. Teachers also need PD facilitated by an expert who understands them and their teaching context (Shin & Kim, 2021), which for a global MOOC means engagement in the local context. Based on our preliminary analysis of how MOOC camp attendance can support EFL teachers' learner engagement, we developed a vision for online teacher PD that is global and scalable which includes the utilization of MOOCs in conjunction with MOOC camps to provide culturally, linguistically, and contextually relevant and responsive spaces for engagement. MOOC camps can provide a local course community that engages learners in the application of the global course content to their context.

Benefits of MOOC Camps as Local Course Communities

Global MOOCs offered in one language, specifically a language used internationally like English, can be offered to culturally and linguistically diverse (CLD) teachers throughout the world with more robust content than individual webinars. Even if global MOOCs can be offered in multiple languages, they cannot be offered in *all* languages. Therefore, a more equitable solution for access of global MOOCs could be to offer them in an international language like English with materials developed at the CEFR B1 to increase accessibility for varying proficiency levels. Then MOOC camps can provide linguistic support to increase comprehension of global MOOC content in English and provide space to scaffold learner understanding of the content.

ACE Framework for Culturally and Linguistically Diverse (CLD) Learners

As our study shows, shared language, culture, and context are very influential in creating supportive spaces for global MOOCs offered in limited or only one language, in this case English. As a tool for research, the ACE framework can be helpful to understand and visualize a culturally, contextually, and linguistically responsive MOOC experience using MOOC camps (see Figure 2).

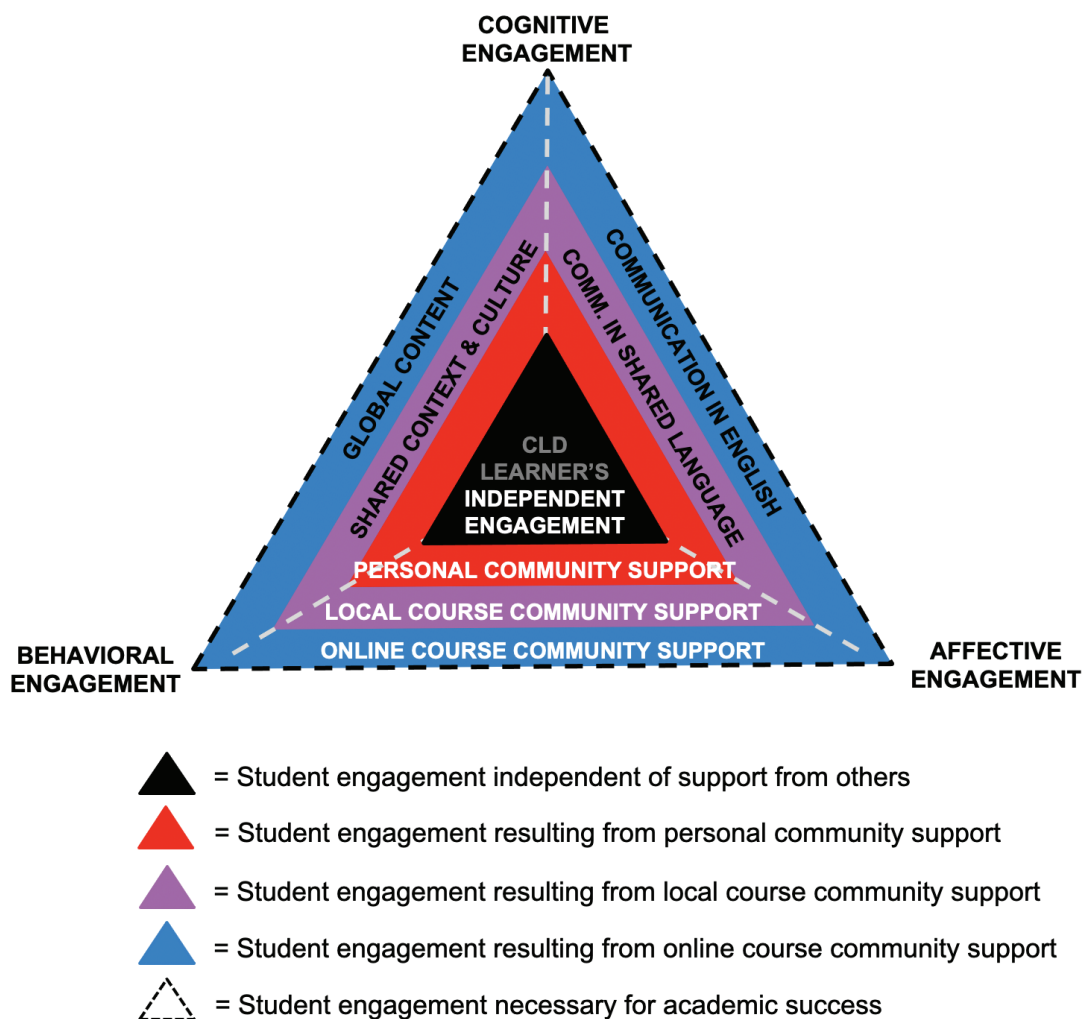


Figure 2. The ACE Framework for Culturally and Linguistically Diverse (CLD) Learners.

Note: © Jered Borup & Joan Kang Shin CC BY, adapted from a figure created by Borup et al., (2020).

Here we have reimagined the ACE framework for CLD learners to illustrate what they need for engagement in global online courses. We have differentiated between the online course community (blue), which is the MOOC, and the local course community (purple), which is the MOOC camp. Use of the ACE framework reimagined for CLD learners can help conceptualize how to utilize MOOCs globally for teacher PD. Understanding the importance of the local course community to support teachers' engagement in an online course environment, we can add a new layer onto the ACE framework. This highlights how MOOC camps can provide a local course community for students that can help make global MOOC content more culturally and contextually relevant for diverse learners who are geographically dispersed. For global MOOCs offered in one language, CLD learners can rely on the local course community to support comprehension of MOOC content through communication in a shared language. Based on this framework, we can see that more research into culturally and linguistically responsive supports for diverse participants would be useful to promote engagement necessary for academic success in MOOCs and bMOOCs.

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Sustaining A Self-Initiated Professional Learning Community: A Story of Six Teacher Educators' Experiences

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During the COVID-19 pandemic, universities were forced to adapt their course delivery methods, such as hybrid, blended, and multi-modal formats, to meet student needs. Instructors with limited training, time, resources, and online teaching experience were clearly challenged by this emergency transfer. To overcome this challenge, six teacher educators formed a self-initiated professional learning community (SIPLC) to support each other during the emergency transition to online instruction in spring 2020. This SIPLC was able to sustain itself long after the emergency transition stage. This chapter presents how the six teacher educators continued to support each other in facing new challenges such as those posed by anti-Asian racism and xenophobia. A framework for sustaining SIPLCs is presented and discussed in the chapter.

Keywords: remote teaching, professional learning, teacher educators, professional learning community

HISTORICAL REVIEW

The COVID-19 pandemic changed the landscape of higher education instruction, forcing universities to move their courses into different modalities such as hybrid, blended, and multi-modal formats (Keiper et al., 2020). This emergency transition was undoubtedly challenging for instructors with limited training, time, resources, and online teaching experience (Karma et al., 2021). To overcome this challenge, six teacher educators at a Mid-Atlantic university formed a self-initiated professional learning community (SIPLC), hoping it would provide mutual collaboration, emotional support, and professional growth to achieve what they could not accomplish on their own (DuFour & Eaker, 1998).

The six teacher educators conducted a collaborative self-study that examined themselves, their actions, and their ideas (Pinnegar & Hamilton, 2009). They developed a framework (See Figure 1) for forming a SIPLC (Song et al., 2020).

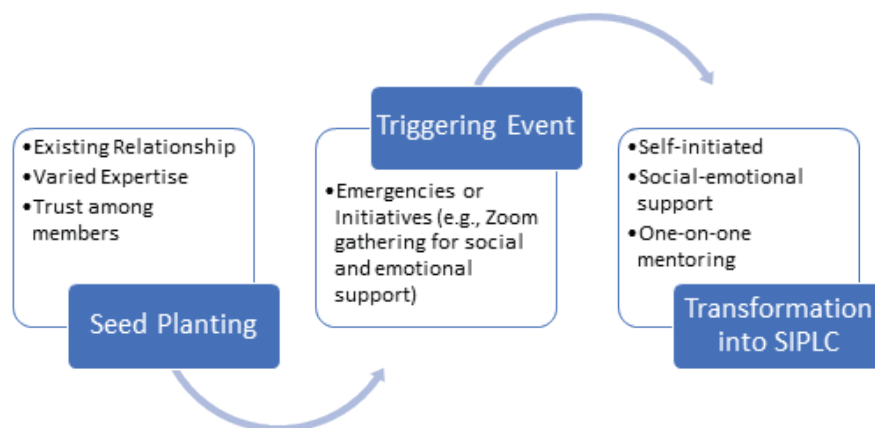


Figure 1. The Formation of the SIPLC.

There are three phases in the formation of the SIPLC: the seed planting stage, the triggering event stage, and the transformation stage to SIPLC. The existing close relationship among the six teacher educators prior to the pandemic helped build trust among them, which serves as the potting soil for the seed planting of the SIPLC. The pandemic, serving as the contextual force, demands all members of the social group respond to the external challenges. When a member of this social group initiated a Zoom gathering for social and emotional support, the conversations moved from sharing personal reactions towards asking for ideas on how to teach online during the pandemic as three of the members have expertise in online instruction. This Zoom gathering triggered the transformation of the informal social group into a professional learning community where they collaboratively and individually shared and reflected on their experiences of transitioning to online instruction.

Two years later, the SIPLC remains active. In fact, with more triggering events such as the increasing number of anti-Asian attacks, the bond among the six teacher educators has grown even stronger as they used the SIPLC space to collaboratively face and tackle the issue of anti-Asian racism both personally and professionally.

THE PROCESS

Through a collaborative self-study, the six teacher educators aimed to answer this research question: What are the factors influencing the sustainability of their SIPLC in the past two years? The reflections on their own actions and experiences and the focus on improving professional development make it a good fit for a self-study research methodology (LaBoskey, 2004; Pinnegar & Hamilton, 2009). The data sources include postings and discussions in a social app group (WeChat), the in-person and virtual meetings, individual and collaborative reflections through shared logging and manuscript preparation. Thematic data analysis (Saldaña, 2016) was conducted to identify factors influencing the sustainability of the SIPLC.

Like the formation of the SIPLC, a triggering event provoked deep discussions among the six teacher educators, which in turn helped strengthen the bond among them. This time, the surge in anti-Asian attacks partly brought by the pandemic (Perliger, 2022) served as the triggering event. Perliger and Anastasio (2022) reported that anti-Asian violence increased by about 1,111% in 2020-2021 compared with the five-year average before the pandemic. This drastic increase in anti-Asian attacks added a layer of challenge to teacher educators as they were already scrambling to find strategies to address diversity, equity, and inclusion (DEI) in their curriculum. As Asian teacher educators, the six teacher educators felt obligated to address anti-Asian racism and bring it to the attention of a broader audience.

They started with sharing news of anti-Asian attacks, stories of brave and kind Asian acts, webinars on Asian American history, critical conversations with students in their classes, and other community involvement in the support of

Asian-Americans within their WeChat group. The sharing process created a space for them to provide social and emotional support to each other. It also became a collective brainstorming process, which led to an effort to request institutional support for the Asian American community. As a result, one of the SIPLC members invited a guest speaker to discuss the pandemic impact on Asian American families' experiences with racial discrimination. This session was open to the entire university community to raise awareness of anti-Asian racism.

In addition to the WeChat discussions related to anti-Asian racism, the six teacher educators reflected on other factors contributing to the sustainability of their SIPLC. They found that their SIPLC experiences mirror the five dimensions of Hord's (1997) framework on PLCs: supportive and shared leadership, shared values and vision, collective learning and application of learning, supportive conditions, and shared personal practice. All six teacher educators constructed an equal and respectful working culture in the community where each member's contributions were valued and respected, be it a topic for discussion or a possible action plan. As aforementioned, one member initiated the formation of the SIPLC two years ago. Another member started the conversation on the topic of anti-Asian racism. All six members shared common values on the topics of online teaching and anti-Asian racism. They have learned together about different topics and applied their learning in their classroom instruction and in their daily lives accordingly. Their collegial relationship and the convenient use of social media every day provide the supporting conditions for their learning in the SIPLC.

RESULTS

The SIPLC among the six teacher educators has witnessed knowledge brokerage (KB) since its formation. KB refers to the sharing and discussion of knowledge developed among members in a PLC including self-initiated PLCs. The knowledge is then exchanged and communicated with colleagues who are not members of the PLC but work in the same organization (Farley-Ripple et al., 2017; Malin et al., 2018; van den Boom-Mullenburg et al., 2022). KB helps to promote organizational learning through engaging all members of the larger organization (Argyris & Schon, 1996). The discussions on anti-Asian racism among the six teacher educators in their SIPLC resulted in the college's invitation of a guest speaker to present this topic to all faculty and staff at their institution. This is a form of KB where the six teacher educators share the knowledge of anti-Asian racism that they developed in their SIPLC with colleagues outside of the SIPLC.

The experiences of the six teacher educators provide further evidence for the framework of forming a SIPLC (Song et al., 2020). The established relationship and trust among them, and their varied experiences offer the necessary foundation to sustain this SIPLC. A triggering event, like the anti-Asian attacks in this round, provides the necessary nutrients and catalysts for the members to continue their personal and professional bonding. The active participation and contributions from all members enable the sustainability of SIPLC.



Figure 2. Factors to Influence the Sustainability of SIPLCs.

We propose a framework for sustaining a SIPLC over time (see Figure 2), which is built upon Hord's (1997) original framework of five dimensions for PLCs. We modified Hord's framework based on the six teacher educators' experiences in their SIPLC. Specifically, the six teacher educators' similar cultural and professional backgrounds, as well as personal interests, seemed to help establish and maintain the bond among them over the past two years. This may be different from the formal PLCs where members mostly share their professional interests. Convenient communication is a key to the success in sustaining the SIPLC. The six teacher educators use an app for personal sharing as well as discussions on topics related to their professional learning. Instant notifications on their phones have allowed them to respond to each other's messages almost in real-time. For a community to grow and sustain, sharing knowledge and experiences is essential. The varied experiences and expertise among the members played an important role in mutual mentoring (Landay, 1998; Liang, 2019) and shared leadership roles.

IMPLICATIONS

While the U.S. is edging out of the full-blown pandemic phase, the impact of the pandemic, however, is long lasting. Issues such as diversity, equity, and inclusion become more critical than ever before and need to be addressed in schools and higher education (Barnett, 2020). As schools consider PLCs as one strategy to address these issues organically and sustainably in school contexts (Valenzuela, 2021), the findings from this study contribute to the existing research on faculty's experiences with DEI (Bernacchio et al., 2007) by providing further insights on how to establish and maintain PLCs. The six teacher educators' experiences in their SIPLC show the importance and value in developing PLCs among teacher educators with diverse needs and foci. The collaborative efforts of the six teacher educators to promote Asian American Pacific Islander (AAPI) culture at their institution may provide inspiration and examples for other teacher educators addressing DEI issues. It is crucial for educators and administrators to explore how to best exemplify the mission and vision of an institution while addressing and advocating DEI in and beyond the campus communities.

SIPLC promotes conversations on a variety of topics that address existent as well as long-lasting important issues in teacher education, such as online instruction and racism. The constant and meaningful exchange of relevant information, resources, and experiences among the six teacher educators helps sustain their SIPLC. It helps motivate them to participate and engage actively in the SIPLC. All members of the community benefit from the educational and social values generated in the SIPLC. Their success in sustaining their SIPLC over time provides an example for other teacher educators to follow as they work to form PLCs that benefit all members. Research has shown that just-in-time support plays an essential role in professional development (Glazer et al., 2005). For a PLC to succeed and sustain and for the members in a PLC to voluntarily participate and engage in the community, it is critical that communications among members of the community are frequent, meaningful, and relevant.

Our emotional, social, and psychological well-being is such a critical aspect that affects our thoughts, feelings, and behaviors. Mental health problems can lead to many serious issues, ranging from depression to anxiety disorders, to committing suicide. A pre-pandemic study conducted in 2019 shows that of the 300,000 students at some 300 higher education institutions, almost 40% reported experiencing a significant mental health problem (National Academies of Science, Engineering, & Medicine, 2021). Many studies have reported higher mental health and suicide risks since the pandemic (Oh et al., 2021). This suggests that mental health is a critical issue that needs to be addressed at universities. The six teacher educators offered support to and gained support from each other within their SIPLC space, both personally and professionally. Their experiences demonstrate that the PLC has a positive impact on mental health and well-being. As the world is transitioning from pandemic to epidemic, university faculty, school teachers, and students of all levels will need to make new adjustments to their personal and academic lives. Teacher educators not only need to support each other socially and emotionally, but they also need to model this type of support for their students (preservice and in-service teachers) so that their students will then be able to help support their own students in the K-12 settings (Song et al., 2020).

PLCs can help sustain teacher professional development as teachers could benefit from the various teaching and learning approaches shared in the PLCs and develop positive thinking skills (Meesuk et al., 2021). Once established, a PLC may help promote organizational learning through KB (Farley-Ripple et al., 2017) as experienced by the six teacher educators. Instead of forming large PLCs that involve a large number of people, teacher educator programs (or any programs) may consider encouraging the formation of small group SIPLCs on a voluntary basis among teacher educators who share similar learning and professional development goals (e.g., SIPLC) and collectively identify and address

emerging needs. As more SIPLCs are established, the teacher education program may offer opportunities for sharing and exchange among different PLCs to facilitate the KB for organizational learning (Argyris & Schon, 1996).

The COVID-19 pandemic has brought fundamental changes to higher education settings in policies and practices. What remains unchanged is the need, the constant need, for professional development. Working and learning collaboratively in a PLC benefits all members of the community. It is worth exploring different ways to form and sustain successful PLCs.

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Do Virtual Worklabs Still Work?

Utilizing Digital Accountability and Micro Goals in Teacher Education

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This chapter revisits proposed suggestions and implications of utilizing virtual worklabs to complete coursework when the COVID-19 pandemic impacted the education system in 2020. Using reflexivity and ongoing data collection, this chapter evaluates how worklabs build upon accountability and goal setting (e.g., structure, attendance, macro and micro goals). Reviewing strategies and tools from that period of time forward brings a deeper understanding to what is still relevant in learning today (e.g., flexibility in settings, collaboration, choice) and how reflecting on these processes during the last two years continues to evolve and provide implications for teacher educators, professional development, and K-12 classroom learning environments.

Keywords: accountability, collaboration, micro goals, reflexivity, virtual worklabs

INTRODUCTION

Two years ago, the authors imagined a greater need to elevate the use of digital spaces for work sessions, community, and accountability in higher education and teacher preparation (Boutelier et al., 2020). It has morphed into endless options, fatigue, and continued chaos--and so today, we navigate through an intentional hybrid space, always flipping, and ultimately, always wondering what mode of learning will be or should be. This chapter sought to discover if virtual worklabs still work in higher education. This is a reflexive response about how community and accountability through virtual worklabs have bridged learning environments beyond initial stay-at-home orders.

HISTORICAL REVIEW

In 2020, the authors suggested that digital communal spaces held promise for ongoing PLCs (Professional Learning Communities) at all levels of education. This practice was a shift from in-person or hybrid (historically asynchronous digital options and in-person) learning spaces pre-pandemic. The authors defined virtual worklabs as a digital, synchronous space for working on individual goals, assignments, or research; this practice included inservice (i.e., teachers of record in PK-12) and preservice (i.e., teacher candidates) educators in addition to teacher educators. Examining these virtual spaces increased understanding of moving from in-person settings for design, reflection, and most importantly, relationship building to transfer across learning environments (Boutelier et al., 2020; Gee, 2018; Ito et al., 2020; Leeman & Altman, 2020; Stockleben et al., 2017).

With the onset of the COVID-19 pandemic, teacher education programs moved to virtual platforms to continue educating. This necessary shift created new opportunities along with challenges. Benefits of virtual platform use during the

pandemic included building community among participants, flexibility in attendance, and PLCs—connections they may not otherwise have made—while supporting each others’ goal setting, accountability, and technology support (e.g., platform tools, technology shortcuts) (Boutelier et al., 2020; Stockleben et al., 2017). Challenges included navigating unfamiliar technology, motivation to attend, and a space in which participation without interruption would be possible.

Utilizing virtual platforms for education has continued, not only because COVID-19 mitigations continue to factor into education today, but also as there are advantages in the flexibility it provides for both educators and participants. Reflexivity and participant feedback provide opportunities to examine and refine practices to address challenges as noted above, allowing for improvements as virtual worklabs remain a relevant option for education.

METHODS

The authors used reflexivity to understand what continued to work in the digital workspaces (i.e., for K-12, professional development, research, higher ed.). Answering this question with researchers involved as participants helped further strengthen the understanding of how worklabs and accountability are effective in digital settings. Reflexivity drew upon personal reflection to understand an inquiry process (e.g., do these virtual worklabs still work?) and allowed for a professional connection of the outcomes to make sense of initial discovery (Boutelier, 2022; Finlay, 2002; Siewert, 2021). In retrospect, the same process was repeated to further analyze success. It is valuable for educators to use these methods to understand an insider view of how our “selves” also act as an instrument and as a participant in the inquiry process (Ellis & Bochner, 2000; Yoon & Uliassi, 2022). This cyclical process of feedback and reflection in education practices—through digital and personal means—is an ongoing process of growth for educators to benefit learners and selves (Bannink & van der Zwaard, 2020; Boutelier et al., 2021; Grysko et al., 2020).

The survey data overlapped in responses from graduate students who participated in these virtual worklabs over the last 3 years ($N=70$), including the fall of 2019, to reflect on transitions of practice since before the pandemic to fully consider what we learned. Survey participants included inservice (K-12) graduate education students working on their master’s thesis research. Participants completed a total of 8 graduate credits for their thesis sequence (average length equals four semesters) through these worklabs. The macro goal of the virtual worklabs was for graduate students to complete their thesis research (e.g., ready for publication) while working on individual steps—ultimately finishing on time with effective accountability from others and self.

RESULTS

Initial findings were reaffirmed through the authors’ iterative reflexivity and reflective student feedback survey data (see Boutelier et al., 2020). The results presented below emerged as we sought to answer the question: do virtual worklabs still work in higher education? Key findings and transitions from this cyclical process are organized in Table 1. During the last two years, modifications to the worklabs included: more defined timelines, micro goals for each working session, variations in accountability (e.g., small groups, student-led working sessions without the advisor), and modified breakout sessions (e.g., data visualization, literature review peer groups). Elements that were unsustainable or unnecessary included tech tips (e.g., many educators have caught up with basic time saving digital practices), exit slips, and faculty-involved accountability groups. Through ongoing reflexivity some practices remain, while others continue to morph based on learners’ needs as discussed below.

Table 1
Results, Transitions, and Sustaining Virtual Worklabs

Fall 2019 <i>Pre-COVID for comparison</i> N=18	Spring 2020 <i>First COVID semester</i> (see Boutelier et al., 2020)	Spring 2020- Spring 2022 <i>Insight from feedback for sustained growth</i> N=70	Spring 2022 <i>Sustained, ongoing imple- mentations</i>
<ul style="list-style-type: none"> • Worklabs: On-campus/in-person • Peer editing in person • 1:1 in the same room (limits quiet space to edit self/peers) • 89% favorable; 6% neutral of worklab structure (not setting modality) • 80% interest in accountability groups during non-semester/structured meeting time 	<ul style="list-style-type: none"> • Worklabs: virtual, synchronous based on stay-at-home orders • Implemented accountability groups with students, faculty, and external participants • Group goals • Pre-recorded screencasts • Tips for tech use • Exit slips • Breakout sessions (choice) • 1:1 & mentor breakouts 	<ul style="list-style-type: none"> • Optional sessions • Live, collaborative notes • Feedback sheet • Quiet, focused time • Favorable key topic presentations (e.g., data visualization) • 64% wanted accountability groups in Fall 2020 • 90.9% benefited from peer feedback in Fall 2021 • increased neutrality in Fall 2021 with full return to school (41%) 	<ul style="list-style-type: none"> • Required, 3-hour virtual worklabs every 2-3 weeks in the semester • Organized processes • Collaborative sheet with micro goals, sign-up for feedback, 1:1 sessions, accountability groups • Set time during worklabs to meet with accountability groups • 94% favorable of virtual worklab format as of Spring 2022

Learner Feedback

Synchronous digital working sessions were needed and successful while holding graduate students accountable (Boutelier et al., 2020; Stockleben et al., 2017). Much of the qualitative data provided evidence of this, with positive feedback for virtual worklabs (e.g., direct participant quotes: “motivated and enjoy hearing from others and their process;” “there was structure and someone to ask questions;” “allowing me to focus and be in the right mindset to work”)-refer to Table 1 for further results leading to sustained practices. Results around self-assessment and timely completions were at a rate near 90% to enhanced motivation was a strong outcome of worklabs because of holding oneself and peers accountable (Knowles, 1984; Stoll et al., 2006).

Negative tones arose in three single instances (i.e., three out of 70) where the learners noted they were often unsuccessful due to attendance or external contexts. It should be noted that students were in the final stages (e.g., copy editor, content reader sign-off) and were not required to attend virtual sessions which sporadically led to a lag in completion. In reflecting upon some of the in-person sessions, inservice teachers tended to prefer virtual sessions so they weren’t rushing from their school site to campus—many would join from their classrooms (Knowles, 1984). Additionally, some learners requested the need for individual/quiet time which seemed more accessible in a digital space than when face-to-face on campus.

Facilitator Reflections

The facilitator considered flexibility when modifying the student-centered design as an iterative response to the participants’ needs/results of transitions through the previous two years of the pandemic. The minimal negative experiences from both ends (facilitator and learner) resulted in the need for consistency in one mode (i.e., virtual only and not hyflex or in person). This made it easier to flow from large group, micro goal settings to one-on-one meetings, or to accountability breakout sessions while also providing feedback synchronously on written drafts (Leeman & Altman, 2018). As noted in Table 1, consistent accountability and organized processes were imperative to success.

Through ongoing reflection over the last two years, the facilitator identified the benefit of integrating a collaborative Google Sheet during each session (and in between) to create a tab for micro goals (e.g., finish draft of chapter 4; synthe-

size literature to support a subtopic) for each 3 hour session; a tab to sign up for one-on-one meetings with facilitator-student or student-student; a tab for feedback requests; and a tab for accountability groupings. Contributions from these results identified the imperative need in teacher education to create digital settings to promote social, relational, digital connections (Gee, 2018; Ito et al., 2020). It is important to model this environment and facilitate goal setting and attainment through collaborative digital mentorship to transfer into any digital learning environments.

Participants developed self-efficacy with virtual learning platforms and tech tools for enhancing educational opportunities by accomplishing micro goals and holding others accountable. Online worklabs have sustained the test of time and are still utilized because they meet participants' needs, investments, emotions, and accountability (Leeman & Altman, 2018). Virtual worklab structures transfer over to PLCs (and independently guided PD) and provide the time and space to set micro goals, strengthen one's pedagogical practice, and gain confidence with digital facilitating that prove invaluable (e.g., virtual learning platforms, productivity apps, gamification, digital libraries) (ISTE, 2022). Worklabs and PLCs provide a convenient, common time and space to collaborate and accomplish shared goals (Gee, 2018; Ito et al., 2020). They are a powerful way to ensure participants have opportunities to build relationships and make meaningful connections with content taught in communities of support (Stoll et al., 2006).

IMPLICATIONS

Outcomes identify the need for sustained, organized, virtual synchronous worklabs to support adult learners. Virtual worklabs and the added benefits (i.e., accountability and micro goals) have continued to be effective for educational purposes in both digital learning and a return to in-person instruction. The reflexivity of these experiences provides implications for K-12 settings, PLCs, Professional Development (PD), and teacher education. As educators move forward in this new era, our reflective retrospective confirms a need for sustained virtual practices and organized synchronous sessions.

Sustained Virtual Practices

The transition to virtual learning throughout the pandemic has put a spotlight on the ongoing need for PD around digital competencies so educators can continue to integrate technology and deepen student learning experiences. Knowles (1984) asserts that growth is most likely to take place if the learner participates in the planning and evaluation of their growth, can identify the relevance to current practice, and engages in problem-based learning which is why it is imperative teachers continue to gain certainty in their ability to utilize new technology as it is developed. Future policy and funding for educator preparation programs should include funding for digital implementation, mentoring, and transformation. These aspects are essential for teacher educators and K-12 coaches to consider for their adult learners.

For many, the necessary shift provided a learning opportunity where teachers realized technology was not something to fear or a waste of time; rather, technology could simultaneously strengthen a lesson while also modeling how students can guide themselves to compete in a global society. This newfound confidence trickled down to teacher lesson planning, increased courage for inservice educators to tackle the digital design for online teaching, and provided them with the knowledge and tools to incorporate it more readily into their practice.

Organized Synchronous Learning Environments

The results also lead to implications for organized synchronous learning environments to include norms, timelines, micro goal setting and accountability grouping. Similar to worklabs as a graduate student, these lessons provided opportunities to evaluate students' competence with tech skills, develop accountability, and ensured completion of work needed for modern technology application (ISTE, 2022). The use of accountability partners was implemented in the K-12 setting by one author during reading and writing instruction. A similar model was utilized during writing workshops with accountability partners monitoring each other's micro writing goals for the day while providing both encouragement and feedback through digital means. Another author replicated the worklab setting to create opportunities for elementary students to become literate in tech tools, individual goal setting, and accountability.

Virtual worklabs in the K-20 classroom are tenable because they provide opportunities for emotional needs to be met when regular socialization is a challenge, which are equally as important as academic content when seeking to educate

the whole student. This structured, synchronized environment continues to provide opportunities for students to collaborate, achieve goals, and work simultaneously to hold peers accountable (e.g., homework, group projects). Future research around digital socialization and its effectiveness should be continued in all educational settings.

Flexible Conclusions

Technology has varying options for supporting preservice and inservice educators to enhance options for learning, connecting, and collaborating worldwide. Hybrid courses that utilize both virtual and in-person attendance have become common practice. One author suggests a new form, *tribrid*, seems to have emerged. This might be described as three elements for instructional design for a single course: 1. traditional in-person learning environments, 2. asynchronous online design, and 3. online design synchronously during face-to-face sessions (i.e., *hyflex*). Such options provide participants with flexibility for virtual weeks as attendance is possible from any location. For teacher educators, hybrid or *tribrid* options facilitate pivots to virtual modes as necessity arises (e.g., illness, weather) without canceling classes—which although provides flexibility, can be time-consuming to plan. New and existing platforms continue to elevate access (i.e., Kumospace, Zoom, Google Meets, Microsoft Teams) to best provide options for synchronous groupings and engaging activities. Continuing to utilize technology, even while in-person, can benefit participants by offering collaborative choice, one-on-one sessions, and small groups with or without a facilitator.

As we battle digital fatigue, ongoing modified modal changes, and teacher burnout, the need to be flexible in our learning environments continues. Educators can use accountability groups with varied tech to encourage participation in PLCs, micro goal setting, and choice. Realizing the benefits of synchronous and asynchronous working sessions can increase community motivation, thus leading to more successful learners at all levels. Virtual worklabs have proven to help accomplish micro and macro goals (e.g., personal PD choice, connections with PLC's, completing research projects) and allow for ongoing reflexivity of goals for learners, educators, and facilitators.

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Weekly Teacher Encouragement: One Text Message at a Time

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The Oxford Dictionary (2022) defines encouragement as the “act of giving someone support, confidence, or hope.” The use of encouragement in the classroom is nothing new, and the positive implications for encouraging students are known. However, there is a question of how teachers are receiving the much-needed support, confidence and hope post-pandemic. The impact of using safe texting platforms to provide more frequent encouragement for teachers at various stages of their educational careers has not been investigated. This study examines the extent in which teachers receive encouraging words, as well as the effects (if any) of encouraging text messages on in-service alumni and pre-service teachers. A purposive sample of 31 participants from the mid-Atlantic region were surveyed. Results suggest weekly encouraging messages positively impacted both in-service and pre-service teachers, while also aiding in relationship building. Participants indicated messages were timely, supportive, motivating, and impacted their overall mindset each week.

Keywords: Encouragement, Texting, Motivation

HISTORICAL REVIEW

In 2020, the pandemic has greatly impacted the field of education; this prompted educators to be more innovative and consider new approaches to accessibility, support, and connection. Because technology is a beneficial tool in the field of education (Paulus & Scherff, 2008) and texting is the preferred method of communication for most college-aged students, faculty can use safe texting during remote, blended, or traditional learning within any academic department as a mechanism to increase communication for creating announcements, checking in, and providing encouragement (Carr, 2020).

Two years later, the stress level and depression symptoms of educators is higher than it has ever been in the history of education causing nearly half the teacher workforce to consider leaving the field entirely (Gomez, 2022; Will, 2021). Teacher shortages have always been a concern in the United States, however the National Education Association (NEA) (2022) states, there is “an unprecedented staff crisis across every job category” in schools nationwide which is dangerously impacting student learning (para. 2). Administration and school leaders are also overwhelmed; focused on their day-to-day tasks and they may not be able to encourage or support their teachers. School districts are creatively identifying ways to battle the crisis by increasing teacher salary, improving professional development, and creating learning communities (Frahm & Cianca, 2021; National Education Association [NEA], 2020; Paulus & Scherff, 2008). These attempts scratch the surface of the foundational issues in education, but most in-service teachers at the core desire support, respect, hope, cooperation, and patience from colleagues, administrators, students, and families (Frahm & Cianca, 2021; Hoskin, 2022).

Currently, a heightened stress level exists within both experienced and novice teachers. Even prior to the pandemic, research has unequivocally pointed to the difficulties of both first year and pre-service teachers who often report feeling unsupported (Paulus & Scherff, 2008). New teachers should be provided with social and emotional support that facilitate “their self-confidence, self-esteem, self-reliance, and ways to handle stress” (Paulus & Scherff, 2008, p. 114). Frahm & Cianca (2021) have found the structural support, affirmation, and encouragement provided by school leaders can help to

increase the retention of new teachers. Thus, providing encouragement to in-service and pre-service teachers can result in motivation, confidence, and hope, as well as much needed social and emotional support.

PROCESS/METHODS

This research seeks to examine the impact, if any, of a weekly encouraging text message on both in-service and pre-service teachers. The following research questions were addressed:

1. To what extent do pre-service and in-service teachers receive encouraging words?
2. What impact, if any, did a weekly encouraging text message have on in-service and pre-service teachers?

Purposive sampling was used to recruit participants from a population of 67 individuals who joined an optional group on a safe texting platform from 2019-2022 (i.e., Remind) designed to provide them with announcements, encouragement, check-ins, and peer-to-peer communication opportunities during and after their teacher preparation program at an independent liberal arts college. Both pre-service teachers enrolled in courses and in-service teachers recently graduated (i.e., alumni) were included in the population. All participants were actively receiving text messages on Monday mornings that included encouraging teaching quotes along with a brief message from a faculty member (see Figure 1).

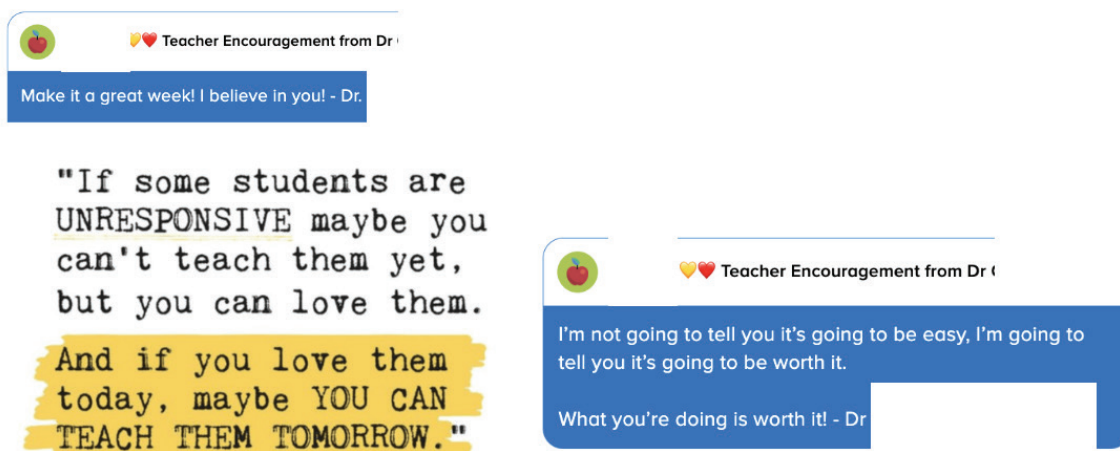


Figure 1. Example Text Messages.

Given Carr's (2020) results indicating how helpful weekly text messages were found to be during remote learning, the audience was expanded to include pre-service teachers in the fall of 2020. Additionally, given that "faculty can effectively communicate, support and connect with pre-service teachers and in-service alumni through safe texting platforms" (Carr, 2020, p. 239), and positive implications are outlined in the literature when teachers receive encouraging words, it follows that *encouragement* was the focus of the text messages administered through a safe texting platform. Upon receiving Institutional Review Board (IRB) approval, a text message was sent to all potential participants using the Remind platform. A sample of 31 participants was recorded, including 9 pre-service teachers and 22 in-service alumni who worked in the field less than 1 year (19.4%), 1-2 years (6.5%), or more than 2 years (45.2%).

The survey sent via text message included a combination of Likert scale items and open-ended questions. For research question one, descriptive statistics were conducted using a Likert scale item related to how stressful participants found their role as a teacher, as well as the frequency they received encouraging words from their school district, building administrator, or mentor. For the second research question, descriptive statistics were conducted using a Likert scale item related to how encouraging participants found the weekly texts as well as a yes/no item indicating if participants felt more connected to the person sending the weekly text. The open responses related to the overall impact participants felt from the texts were analyzed using in vivo coding, involving the use of short phrases or words from the participant's own language as codes (Saldaña, 2013).

RESULTS

Participants were asked the frequency they received encouraging words from their school districts, building administrators, or mentors. Figure 2 outlines that 'weekly' encouragement is the predominant frequency in which both in-service and pre-service teachers receive words of encouragement, with pre-service teachers receiving words of encouragement more often than in-service teachers. Despite the majority of participants indicating a high level of stress in their role as a teacher (see Figure 3), over 50% of in-service teachers indicated receiving words of encouragement on less than a weekly basis. It follows that words of encouragement could be provided more often to in-service educators to provide more frequent support in their stressful roles.

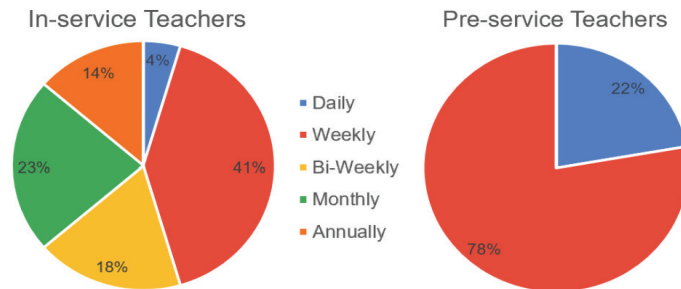


Figure 2. Frequency Encouraging Words are Received.

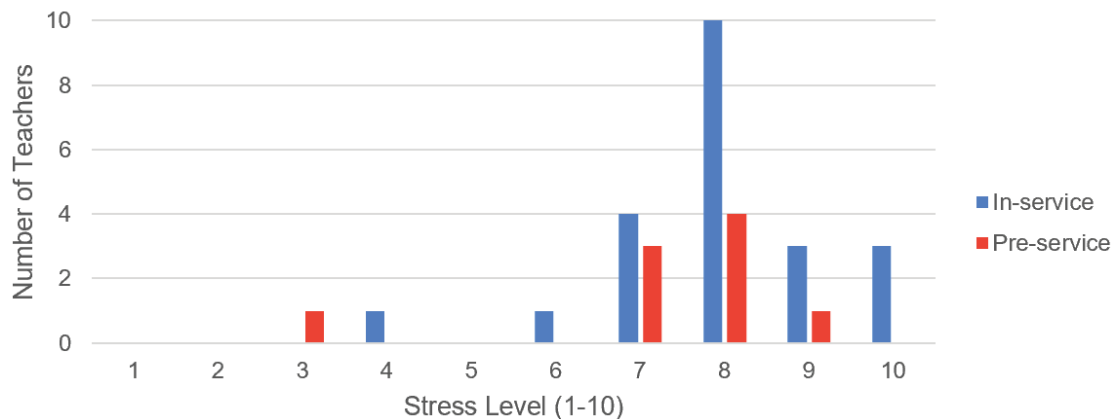


Figure 3. Extent Teacher Role is Stressful.

When it came to assessing the extent to which participants found the weekly text messages encouraging, the majority of participants indicated feeling a high level of encouragement (see Figure 4), with just under half of the participants (48.4%) indicating a 9 or 10 on a 10-point scale. Additionally, all but one in-service teacher indicated they felt more connected to the person sending the weekly text, while exactly two-thirds of pre-service teachers indicated they felt more connected. Results suggest frequent (i.e., weekly) communication focused on encouragement and aides in relationship building.

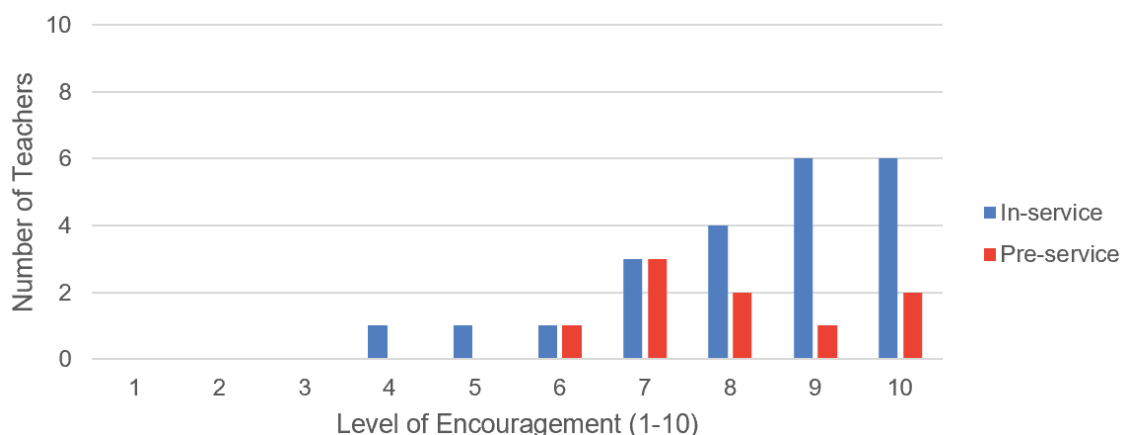


Figure 4. Extent Weekly Text Messages were Encouraging.

Several themes were identified from participants' qualitative responses related to the overall impact they felt from the weekly text messages. Results suggest weekly encouraging messages positively impacted both in-service and pre-service teachers. All participants expressed appreciation for the opportunity to receive the text messages while they sought to navigate new teaching and learning experiences daily. Additionally, they spoke of how the texts impacted their mindset, with pre-service teachers indicating they were reminded of their purpose and in-service teachers stating the texts provided a moment of reflection and a reminder they are "in the right place." Comments from pre-service teachers also focused on how the text messages served as a "fresh" and "positive" start to the week. Comments from in-service teachers focused on how timely the texts were, often coming "at a time when they are needed most," as well as how supportive the texts were, with one participant indicating it was nice to know "someone is looking out for me while I'm busy looking out for 22 kids!" As outlined in Figure 4, there were two in-service teachers who indicated low levels of encouragement related to the text messages; comments indicated that the text messages were still appreciated and enjoyed.

IMPLICATIONS

Although at different stages in their careers, both in-service and pre-service teachers require support as they continuously work towards becoming effective educators. In-service teachers actively encourage their students by providing support, confidence, and hope. Likewise, pre-service teachers are taught that encouragement yields positive implications in the classroom. However, the question remains, who is encouraging and pouring support, confidence, and hope into teachers? The results of this study provide direct implications for both in-service and pre-service teacher education that includes providing teachers with relevant, and much needed, encouragement.

With in-service teachers facing elevated stress levels and historic rates of burnout during and after the pandemic, it follows that the need for support is at an all-time high (Gomez, 2022; Will, 2022). Although sending a weekly encouraging text message may not change the landscape of the teaching profession, nor keep teachers in the field, the results of this study indicate weekly text messages focused on encouragement may provide an avenue for support, help boost teachers' confidence during times of stress, and foster hope that education is both meaningful and purposeful. School administrators are encouraged to set up text messaging groups using a free safe texting platform (e.g., Remind, Bloomz, etc.). These platforms are recommended because they provide an innovative and preferred approach to staying connected, are cost effective, are device agnostic, and do not require district approval. In-service teachers can be added to the group as part of their on-boarding process at the school, and can begin receiving encouragement from administration immediately, adding another critical layer to support in the field. Text messages could also be modified to include schoolwide announcements, or communications to specific grade level teachers.

As education faculty work to ensure pre-service teachers are prepared to enter post-pandemic classrooms, there is a lot more shifting than the addition of multimodal pedagogy. Faculty can utilize a free safe texting platform to model best teaching practices, including how to provide students with 21st century encouragement. Additionally, as K-12 students who have been through educational turmoil and trauma related to the pandemic move on to college and look to become

teachers themselves, weekly text messages can aid them in their transition and handle the stress of college, as well as help them to stay motivated to reach their educational and professional goals. Faculty can have pre-service teachers sign up at the start of their program or a specific course. Much like messages in the field to in-service teachers, pre-service teacher messages could also be modified to include a quick tip, instructional strategy, or resources applicable for participants.

In an effort to provide encouragement to current and future teachers, it is suggested that communications directed towards support, confidence, and hope be implemented more frequently, with the possibility of utilizing a safe texting platform as the vehicle for these communications. As indicated in the results, frequent encouraging text messages have the potential to strengthen both in-service and pre-service teachers' purpose in the field of education, enhance their ability to support their students with the knowledge that they are supported, and can handle the inevitable difficult situations that come from working with K-12 students. With teachers across the country continuing to navigate the changing educational landscape moving from remote learning back to in-person instruction, it is vital for the social-emotional needs of both in-service and pre-service teachers to remain at the forefront of our attention. Although this seems like a monumental task, it may be as easy as one text message at a time.

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Pre-service Teacher Education Methods and Pedagogy

How Immersive Should Virtual Field Experiences Be? A Comparison of Single and Multi-Perspective 360 Video

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We examined preservice teachers (PSTs) immersive experiences comparing single and multi-perspective 360 videos together with two variables of pedagogical content knowledge (PCK) and perceptual load. The purpose of this research was to analyze how teacher virtual field experiences can be enhanced and to investigate whether using multi-perspective 360 increases PSTs' duration of focus for their field of view (FOV). Data were collected from early childhood (PreKindergarten-3) education majors and was analyzed using a quantitative approach with multiple regression analysis. The preliminary results indicate that the multi-perspective field experiences led to a higher perceptual capacity in PSTs noticing and are similar to face-to-face assignments. Overall, results indicate that the duration of focus doesn't warrant PSTs being better at noticing. While PCK was found to have a negative effect on focus, the multi-perspective videos were found to reinforce longer duration focus. Finally, a useable interface that is currently in Beta has been shown to facilitate teacher viewing in multi-perspective 360 and gives feedback on where teachers tend to focus.

HISTORICAL REVIEW

Field experiences with students in K-12 classrooms are an essential component of preservice teachers' (PSTs) professional development. Such experiences are also tied to assignments in PSTs' methods courses to help align theory learned in a college classroom with practice engaged in a K-12 classroom. Beginning in March 2020, face-to-face field experiences ceased due to the COVID-19 Pandemic, and this pressed us to adapt PST's field-based assignments to a virtual field experience (Zolfaghari et al., 2020). Specifically, we used multi-perspective 360 video to engage PSTs in observing students' mathematical reasoning in previously recorded elementary mathematics lessons. Single-perspective 360 video records a classroom omnidirectionally (a spherical video) that allows the viewer to look in any direction from a fixed location, whereas multi-perspective provides this affordance with multiple vantage points in a classroom (see Figure 1).

Our use of multi-perspective 360 video to create an asynchronous field experience was based on lessons from research. First, scholars had found that single-perspective 360 video supported PSTs' professional development more than standard video (Kosko et al., 2021a; Walshe & Driver, 2019). Particularly, 360 video has a higher degree of perceptual capacity, or "a medium's capacity for aspects of the scenario to be perceivable" (Kosko et al., 2021a, p. 286). This perceptual capacity allows PSTs the potential to observe more children in a recorded classroom, which, in turn, increases PSTs' focus on children's mathematical reasoning (Kosko et al., 2021a). In spring 2020, we piloted multi-perspective 360 videos as a virtual field experience. Although these video-based experiences "were created to supplement, not replace face-to-face field experiences...we found PSTs engaged in authentic observation when assessing students" (Zolfaghari et al., 2020, pp. 318–319).

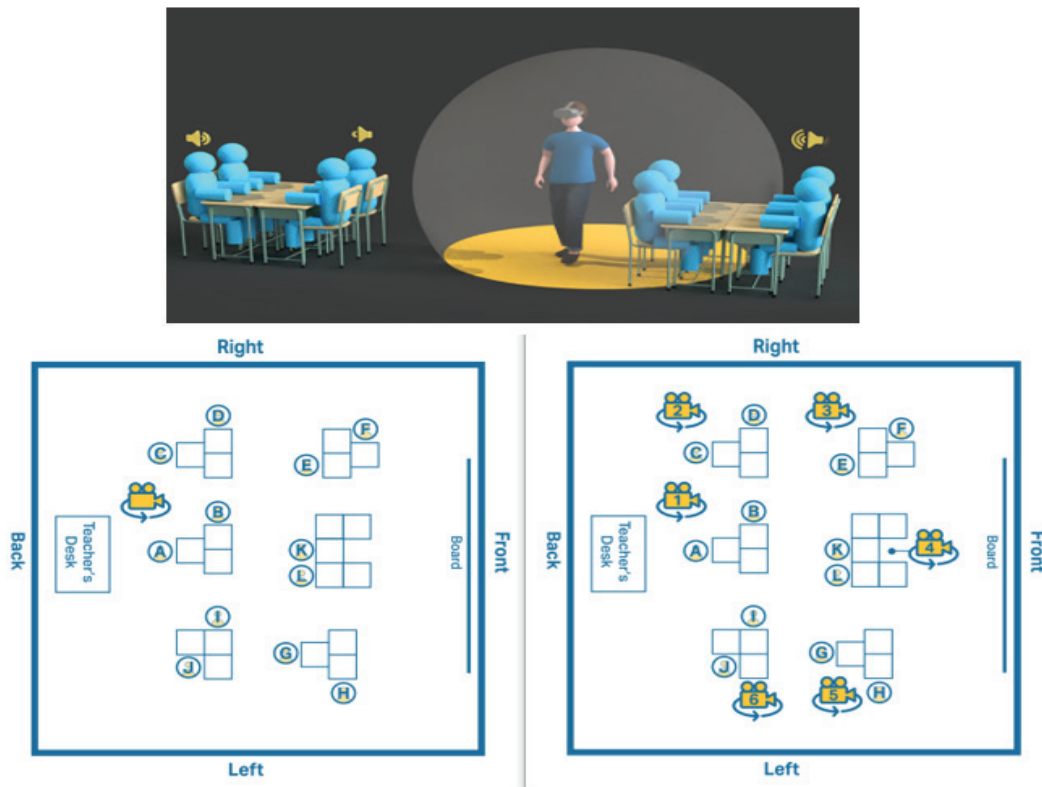


Figure 1. On the top view: Illustration of a teacher with a VR headset immersed in a single perspective recorded 360 video. On the bottom View: Illustration of single perspective classroom map (left) and multi perspective classroom map (right).

Since the events of spring 2020, we and others have continued studying 360 video while circumstances continuously evolved with the changing world. At our institution, face-to-face field experiences returned slowly. In the following academic year, only our seniors received field placements, with many having a placement where they taught students online. Face-to-face placements began returning in fall 2021. As we continued to integrate both single and multi-perspective 360 videos, we learned that “merely providing 360 videos allows for more student actions to be observed by PSTs. However, PSTs may not necessarily take up such observations” (Kosko et al., 2021b, p. 245). Many PSTs need to be scaffolded in how to attend to students, what to look for, and why specific student actions matter (Buchbinder et al., 2021; Weston & Amador, 2021). In attempting to measure the effects of such scaffolding, we developed pedagogical content knowledge (PCK) measures like the PCK-Fraction assessment that examines teachers’ knowledge of students’ reasoning (Zolfaghari et al., 2021a). We also sought a means of assessing teachers’ physical ability to identify things visually; a construct described by Eayrs and Lavie (2018) as *perceptual load*. Rather, when teachers watch 360 video, they turn the camera perspective to look at different locations. Although an affordance, some teachers overuse it to the degree they attempt to see everything in general rather than anything in particular. This has led to findings that longer durations of focus (i.e., looking in the same place for longer periods) are associated with more sophisticated professional noticing (Heisler & Kosko, 2021; Kosko et al., 2022; Zolfaghari et al., 2021b). In this chapter, we sought to examine whether the duration PSTs tended to focus was different in single and multi-perspective 360 videos and whether accompanying factors such as their PCK and perceptual load affected such tendencies.

METHODS AND PROCEDURE

Data were collected from 42 PSTs majoring in early childhood education (preK-3) at a Midwest U.S. university in fall 2020. The participants primarily identified as white (97.6%) and female (95.1%). Participants were at varying points in their professional education, with 26.2% not having taken any of the three mathematics pedagogy courses in the program, 26.2% having taken the first course, 4.7% having taken the third, and 42.9% having taken all three courses. Participating PSTs completed the PCK-Fractions assessment (Zolfaghari et al., 2021), which was estimated with a Rasch model ($\bar{\theta} = 3.483$, $SD = 2.199$, $Range = -4.57$ to 6.41). PSTs were also assessed on their perceptual load (Eayrs & Lavie, 2018), which was also estimated with a Rasch model ($\bar{\theta} = 0.564$, $SD = .906$, $Range = -1.16$ to 3.04). Rasch modeling transforms ordinal data (i.e., 0 = incorrect, 1 = correct) into continuous data using logarithmic transformation; thereby providing a more specified statistic for analysis (Bond et al., 2021). Following these measures, PSTs viewed a 360 video of a fifth-grade class reviewing fraction addition with like denominators.

Participants either viewed a single-perspective or multi-perspective version of the scenario using the Praxi platform for viewing 360 videos (Miller et al., 2020) and a map of the recorded classroom for reference. Multi-perspective participants' maps included the different camera perspectives such that they were able to click on the location in the classroom they wanted to view the video (see Figure 2). Single-perspective participants viewed the video from Camera 4 and were not provided information regarding the other camera locations. Participants in both conditions watched the 360 video before describing, in writing, what they noticed regarding students' mathematical thinking.

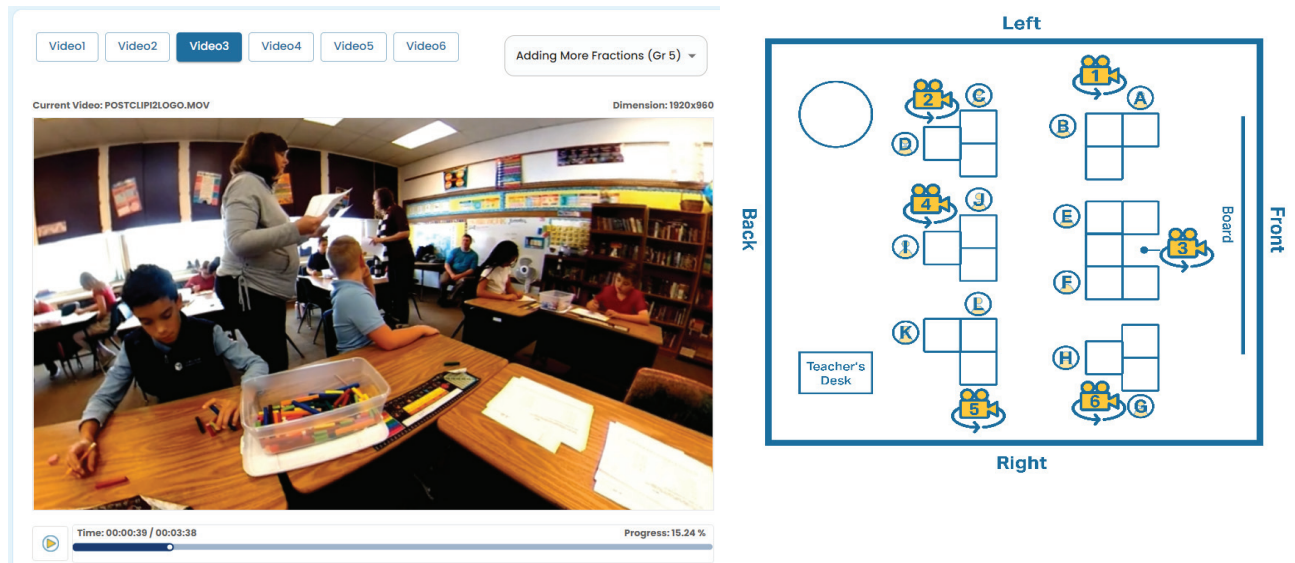


Figure 2. Screenshot of Praxi Viewing Interface (Left) with A Map Of The Recorded Classroom Scenario (Right). For The Multi-Perspective 360 Video Version. The Single Perspective Included Only Camera 4 as an Option.

Participants' viewing sessions were recorded with the Praxi system and reassembled for analysis (i.e., Praxi produced video files of what and where participants looked). This allowed us to calculate the number of times participants changed their field of view (FOV) and for how long they maintained their FOV. We used multiple regression to examine the effect of being placed in the multi-perspective condition, accounting for participants' PCK and duration of focus for their FOV. This is represented in the equation below:

$$\text{FocusDuration} = B_0 + B_1 \cdot (d_MultiPerspective) + B_2 \cdot (PCK\text{-}Fractions) + B_3 \cdot (Perceptual\ Load) + e$$

RESULTS

Results indicate the regression model accounts for 20.6% of the variance in the duration of FOV focus and is statistically significant ($F(df=3) = 3.285, p = .031$). Being placed in the multi-perspective condition had a positive and statistically significant effect on focus duration ($B_1 = 10.406, p = .031$). However, PCK-Fractions had a negative and statistically significant effect ($B_2 = -7.390, p = .007$) and perceptual load had a positive but not statistically significant effect ($B_3 = 1.495, p = .163$). The results shown in Table 1 suggest that when accounting for participants' assessed PCK and perceptual capacity, viewing a multi-perspective 360 video increased the duration of focus by about 10.4 seconds over viewing a single-perspective 360 video. Although having a higher PCK score had a negative effect on the duration of focus, the size of the coefficient suggests a participant needed a score of about 1.41 or higher to overcome the potential benefit if placed in the multi-perspective condition; which only 16.7% of the sample achieved. Descriptive statistics do suggest multi-perspective participants had a higher average duration ($M = 17.18$) than single-perspective participants ($M = 11.81$). However, multi-perspective participants also had higher PCK scores ($M = .858$) than their single-perspective peers ($M = .343$). We suspect there is a more complicated interplay between professional knowledge and perception than is possible to be modeled with these data. However, the trends observed here suggest both the potential for multi-perspective 360 video and areas for further study.

Table 1
Results from the Multiple Regression Analysis

	<i>B</i>	<i>SE</i>	β	<i>t</i>	<i>p</i>
Intercept, B_0	8.610	4.725		1.822	.076
Multi-Perspective, B_1	10.406	4.632	.353	2.247	.031
PCK, B_2	-7.390	2.610	-.454	-2.831	.007
Subitizing, B_3	1.495	1.049	.223	1.424	.163

IMPLICATIONS

Following an abrupt cessation of face-to-face field experiences in spring 2020, we incorporated multi-perspective 360 video as a means of engaging PSTs in attending to children's reasoning in a realistic context (Zolfaghari et al., 2020). An implicit assumption, and one our 2020 results supported, was that a more immersive representation would lead to the potential for more specificity of focus on children's actions. In this chapter, we sought to examine whether this assumption was justified with empirical data. Results support early findings from Zolfaghari et al. (2020) and expand upon them. First, PSTs viewing the multi-perspective 360 video had an average duration of focus of 10.406 seconds longer than their peers viewing the single-perspective 360 video. While statistically significant, the magnitude of this effect size is large, suggesting a more focused viewing pattern with less variance (i.e., less 'looking all around'). Results here suggest that multi-perspective 360 videos may provide a means of scaffolding more focused attending. So, there is a general increase in focused behavior despite more aspects of a classroom being perceivable. We contend this happens because once a teacher finds the particular locations they wish to focus, they do not feel a need to constantly move about. Rather, if their attending is purposeful, their focus is less varied, and most teachers (novice or expert) have a purpose in how they look around.

Earlier in this chapter, we noted scholarship supporting the need to scaffold PSTs' engagement with 360 video (Buchbinder et al., 2021; Kosko et al., 2021b; Weston & Amador, 2021). To scaffold engagement in the technology, Kosko et al. (2021b) suggest using standard video and single-perspective video before introducing multi-perspective. Yet, even with this scaffolded engagement, there is a need for decomposing practice, generally (Grossman et al., 2009). Over the course of the pandemic, we created a tool to support PSTs' and teacher educators' viewing of multi-perspective 360 videos. Praxi is a web-based platform that allows for viewing single and multi-perspective 360 videos and provides users with summary viewing reports (see Figure 3) for how much of a 360 video they viewed, from which camera perspective, and from which direction they viewed (Miller et al., 2020). Those interested in testing both the viewer and the summary report can do so as a guest at the Beta version of the platform (<https://praxi.guans.cs.kent.edu/>). By discussing directional

views with PSTs, a teacher educator can initiate discussions about events at locations and times in the recorded scenario, and prompt PSTs to describe children's actions at those locations. In our experience, teachers will tend to focus on events at specific locations and times, but this often results in multiple groups focusing on different locations in the classroom. Such situations provide rich opportunities for pedagogical discussions surrounding different students' reasoning, choices for attending to certain students over others, and so forth.

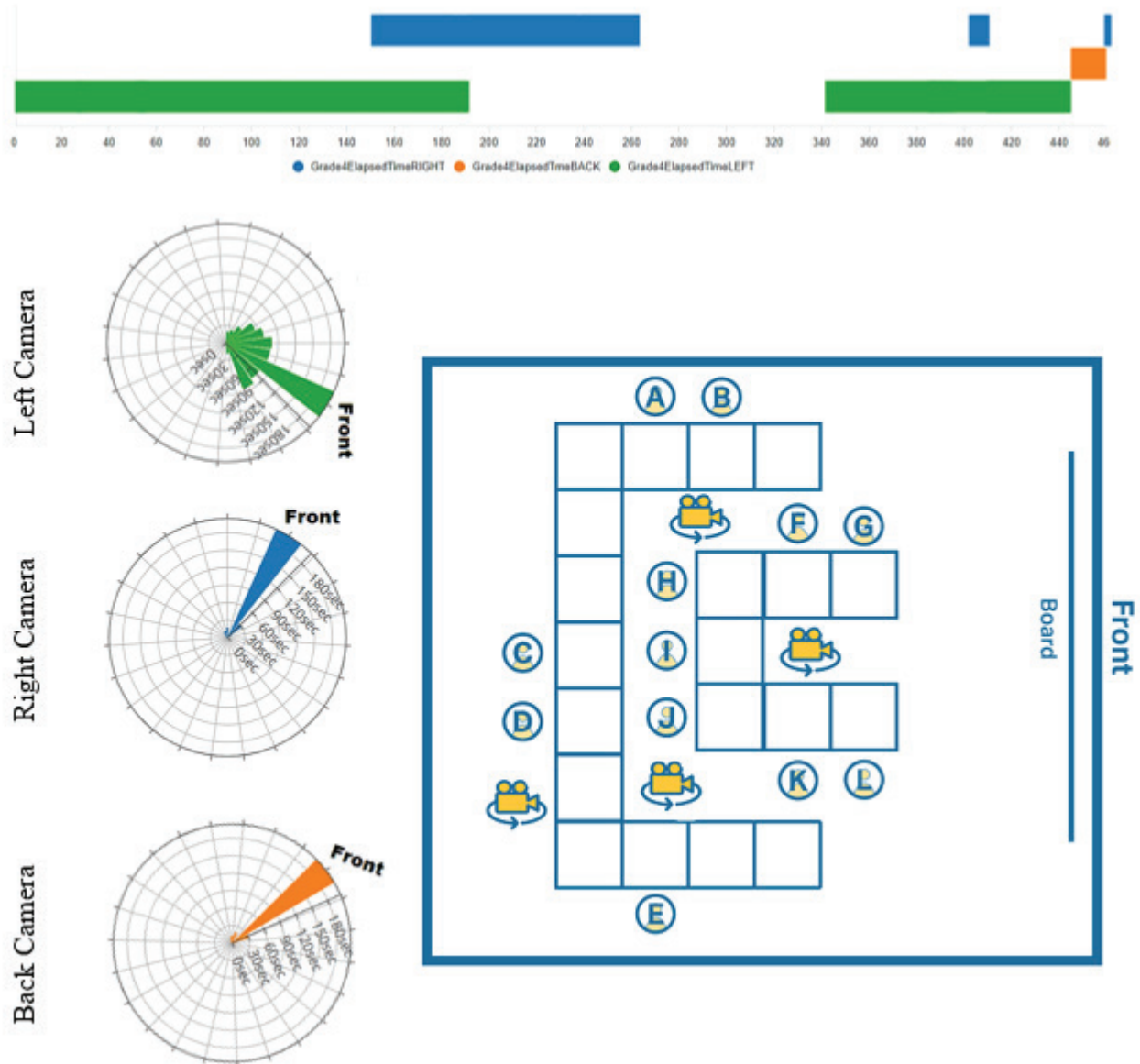


Figure 3. Example Summary Report for One PST's Viewing in Praxi.

This chapter presented additional results that we believe warrant further study. First, we found higher PCK scores had a negative statistical effect on PSTs' average duration of focus. The literature on the relationship between professional knowledge and noticing is complex; suggesting at times either no or a negative relationship (Jong et al., 2021; Yang et al., 2021) or a positive association (Simpson & Haltiwanger, 2017; Voutsina et al., in press). Thus, this is an area in need of further study to better understand the nuances in how professional knowledge affects how and where one looks. Additionally, the varying professional experiences PSTs engage across coursework and field experiences is also worth further study. Results presented here also point towards the potential for studying perceptual load in more detail. We

used an adapted version of Eayrs and Lavie's (2018) subitizing assessment to assess PSTs' ability to deal with perceptual load. However, the effect in our regression equation was not statistically significant. Rather, the majority of our sample had scores above 0.0, which is considered 'average' on a Rasch scale. This suggests a heavy skew and may indicate that those entering into the teaching profession have a higher ability to deal with perceptual load. Regardless, future study is warranted to better understand this construct. Lastly, our study focused on viewing 360 video on a flatscreen display. It is possible that PSTs would have benefited more from viewing with a dedicated VR headset, as found by Kosko et al. (2021b). Evaluation of the benefits of using dedicated VR headsets versus access to 360 video on a standard screen is a pragmatic and important topic for future research.

At the height of the COVID-19 pandemic, amidst a lack of face-to-face field experiences, Zolfaghari et al. (2020) suggested multi-perspective 360 video can help "fill part of the gap" (p. 319) when no such face-to-face field placements are available. Two years later, we believe multi-perspective 360 fills a gap even when such placements are in use. Results presented in this chapter, and in prior work on the topic (Kosko et al., 2021b; Zolfaghari et al., 2020) support the continued use of multi-perspective 360 videos to support PSTs in their professional development.

ACKNOWLEDGEMENTS

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Beyond COVID: Extending Teacher Candidates' Digital Practice via Virtual Teaching, Coaching, and Supervision

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School closures and changing instructional arrangements resulting from the coronavirus pandemic created widespread challenges for teacher preparation programs. One significant barrier was access to clinical placements for teacher candidates and college supervisors with schools closed or restricting access to non-employees. Supporting teacher candidates to develop and refine pedagogical skills with no access to classrooms and schools became a significant challenge during the first two years of the pandemic. This chapter provides an update on a teacher preparation program strategy developed to keep teacher candidates engaged in lesson planning and implementation during the period of widespread US school closures (Keefe, 2020) and details how it was extended and further developed when access to schools remained challenging. Self-study of teacher education practices (S-STEP) guided an examination of program practices and priorities and helped determine necessary shifts to respond to pandemic challenges/barriers. Technology served as a centerpiece for updates to coursework and clinical supervision models. Implications for teacher preparation programs' use of technology to prepare teacher candidates are discussed.

By the end of March 2020, over 4200 US higher education institutions had shuttered their doors following the global coronavirus outbreak, affecting approximately 26 million students in the US (Alexander, 2020; Entangled Solutions, 2020). While all universities began an abrupt shift to virtual instruction and grappled with how to support students to complete coursework, a secondary complexity emerged for teacher education programs given parallel PK-22 school closures, since teacher candidates are often placed/working in school clinical placements during their preparation programs. Continuing to support teacher candidates to develop and refine pedagogical skills with no access to classrooms and schools became a significant challenge and presented a critical issue, given the strong research evidence base on the importance of clinical practice in teacher preparation (AACTE, 2018; Burn & Mutton, 2015; Cochran-Smith & Reagan, 2021; NCATE, 2010).

In this chapter, we provide an update on a teacher preparation program strategy developed to keep teacher candidates engaged in lesson planning and implementation during the period of widespread US school closures (Keefe, 2020). This strategy was first detailed as part of JTATE's special issue in May 2020 focused on supporting pre- and in-service teachers during the school "shutdown" and quarantine period of the pandemic. While the original strategy was developed as a workaround to keep teacher candidates engaged in clinical practice during the quarantine/school closures period of the pandemic, there were immediate positive results that signaled promise for inclusion in future teacher education practice. In the next section, an overview of the original strategy is provided, followed by an explanation of how it was extended and further developed to support teacher candidates during continued school closures.

HISTORICAL REVIEW

Supporting teacher candidates to develop and refine pedagogical skills without access to classrooms and schools became a significant challenge in the Spring of 2020 during widespread closures. It was essential to keep teacher candi-

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dates who were enrolled in or nearing their final clinical experiences *engaged* in teaching practice vs. *theorizing* teaching despite their lack of access to schools. To address this, a coaching model of virtual practice, reflection, and feedback cycles was developed (Keefe, 2020), extending Darling-Hammond's (2010) model, and was used to support teacher candidates' developing skills with instructional routines via the design and implementation of synchronous and asynchronous virtual lessons. Participants in this model were graduate teacher candidates enrolled in varying stages of their clinical experience.

During the spring semester of 2020 following the pivot to fully online classes, shifts were made to individual classes for candidates who were dually enrolled in pre-clinical and clinical experiences. Teacher candidates instead attended a weekly synchronous class focused on planning, instructional routines, technology skills, and accessibility, and developed universally designed lessons aligned to content curriculum with an identified age/grade range. Lessons were approximately 30 minutes long, delivered synchronously and/or recorded within the college's learning management system. Immediately following the conclusion of the lesson, teacher candidates completed a digital self-assessment form that encompassed both internal program commitments and external regulatory expectations. Faculty reviewed the lesson design and instructional plan, observed teacher candidates' practice virtually, and completed a mirror assessment form digitally. The goal was to support teacher candidates' application of theoretical knowledge to their practice, fluency of content curriculum, and digital and technological competencies (Keefe, 2020; Mishra & Koehler, 2006).

Faculty and teacher candidates met weekly via video conference for a 1:1 feedback and coaching session, involving comparison of feedback/reflection, shared analysis of the recorded lesson, and in-vivo feedback focused opportunities to improve pedagogical skill, content fluency, and technology skills. At the conclusion of the coaching session, the teacher candidate and faculty collaborated on clear, well-developed, highly specific goals that guided the teacher candidate's planning and instructional practice for the following week.

While it was immediately clear during the Spring semester of 2020 that aspects of teacher education programs (i.e., course design/delivery, teaching, and supervision) would require a digital pivot to technology-centered practice, at first, undertaking these shifts was daunting to even consider. However, early evidence, including teacher candidate feedback, informal surveys, and faculty observations suggested that the strategies we were developing, such as the model described above, held promise for future program practice.

However, as schools reopened using varying models - fully in person, fully online, hybrid, and other combinations that included episodic remote instruction (Keefe et al., in preparation) - requiring candidates to teach in a variety of formats and rapidly changing instructional environments-- new barriers to supporting, developing, and supervising teacher candidates' instruction emerged. School access became a central issue and in some cases was limited to gainfully employed personnel, which meant some teacher candidates were restricted from in-person teaching and would participate in clinical experiences virtually. This would require additional program support for teaching online - a set of candidate skills not fully developed prior to this point. It also meant that supervisors would need access to districts' digital platforms to observe virtually, which presented some additional challenges given schools' privacy concerns in relatively unknown territory. When teacher candidates were welcomed into school in person, similar barriers existed. Finding ways for college supervisors to observe teacher candidates either in-person or using districts' virtual platforms prompted the same health and privacy concerns. Finally, in instances when the supervision of candidates who were teaching in-person was strictly virtual, visual and audio limitations could pose challenges to comprehensively evaluating candidates' instruction. This meant that, to access teacher candidates' classrooms, observe, and provide high quality feedback that would be relevant in *both* face-to-face and virtual environments, our model needed to include deeper, more comprehensive, and more flexible supports than our traditional model and the original pandemic strategy, which was designed for what we originally viewed as short-term school closures.

To accomplish this, we focused on three areas. First, we engaged in a self-study of our pre-pandemic practices, early pandemic strategies, and program priorities to determine what remained relevant and what needed to shift in response to the new challenges/barriers. Next, we made explicit changes to classes to reflect new priorities. Finally, we extended the clinical supervision model to reflect these priorities via a more extensive coaching and observation protocol, including a shared rubric for candidate self-assessment and faculty feedback. We elaborate on these three areas in the next section.

PROCESS/METHODS

In this section, we describe how the original strategy was extended and further developed employing self-study of teacher education practices (S-STEP). Self-study in teacher education is a validated and widely used approach in the field

of teacher education and explicitly focuses on one's own practice "with the purpose of improving it, making explicit and validating their professional expertise and, at the same time, contributing to the knowledge base of teacher education" (Vanassche & Kelchtermans, 2015, p. 508).

Given our relative lack of experience preparing graduate teacher candidates for *virtual* teaching, we re-evaluated the ways we had been "teaching about teaching" (Korthagen & Kessels, 1999) to determine what aligned to preparing candidates for virtual and hybrid teaching. Self-study was helpful in this regard, given that it calls for "reconceptualization of the very process of teacher education itself" (Dinkelman, 1999, p. 3). The first step was to examine our pre-pandemic practices, early pandemic strategies, and program priorities to determine their fitness for the lingering challenges and new barriers we described above. We also interrogated internal accountability commitments to ensure alignment to program mission and philosophy, and crosswalked external accountability responsibilities (accreditors' requirements). This process resulted in new and reinforced program priorities in response to the pandemic, which included safety, care, and connection; inclusive instruction and supports; flexibility; explicit technology instruction; and universal design for learning centered lesson planning and implementation.

The next step was to incorporate and model these priorities across graduate classes. We began by incorporating explicit instruction of virtual teaching into coursework to improve teacher candidates' digital competency. Dedicated time was allotted for explicit instruction of specific software and applications for connecting with students, student engagement, and delivery of content. Explicitly taught technology was then modeled by the faculty within the context of their own instruction in graduate coursework. In turn, there was an explicit expectation that teacher candidates would use modeled strategies in their own developed lessons and clinical practice during observation. This provided an opportunity for teacher candidates to continue to expand their repertoire of technological approaches to content, continue to improve their virtual teaching, and finally develop the adaptive expertise to pivot between in-person, virtual, and hybrid environments. In the same way as faculty modeled explicit instruction of technology, we emphasized connection, care, and safety at the beginning of classes, coaching sessions, and observations by dedicating time to a wellness "check-in" with teacher candidates, which was also an expectation for their lessons and in their own practice. Finally, to help maintain high internal consistency across multiple instructional environments and arrangements, we taught candidates to develop cross-cutting, universally designed, content-focused lessons to ensure that, like the original strategy, academics and access remained central.

Our next step was to develop a flexible supervision protocol for in-person, virtual, or hybrid teaching which emphasized the priorities described above. This model leveraged the original strategy, extended the foci of coursework, and was expanded to include two required observations in one focused content area, mathematics. By focusing on only one content area, we hoped to strengthen teacher candidates' content knowledge -- specifically, their mathematical knowledge for teaching (Marin & Keefe, in press) as they developed new technology skills for virtual and hybrid teaching. A rubric which encompassed identified internal priorities and attended to external accountability commitments was provided to teacher candidates in advance. Mirroring the original self-assessment form, the rubric offered a clear structure for observations and was used by both teacher candidates and faculty for reflection and assessment. During implementation of the lesson, the rubric was used to structure and standardize faculty observations and organize feedback after the lesson, when the teacher candidate's self-assessment was compared to the faculty assessment of the lesson and used as a centerpiece for goal setting. At the conclusion of the coaching cycle, actionable next steps and key elements for future work were identified.

FINDINGS/RESULTS

Self-study was a helpful and efficient process for our work and is an approach that may be useful for teacher educators when significant program changes are required in short order. While our focus was to develop a proactive approach to pandemic challenges, self-study provided opportunity for close examination of our practices, helped us to determine our program priorities, and make necessary program shifts to better support teacher candidates during the pandemic. Three interesting findings emerged from this work.

First, the need to rapidly improve candidates' digital competence for virtual teaching prompted us to develop highly connected theoretical and pedagogical experiences. This made clear how the right innovations and approaches help even the most novice teacher candidates to develop skilled practice. Making these connections explicit and visible to teacher candidates resulted in their deeper understanding of program priorities, which were integrated into their lessons and evident during observations. This validates previous researchers' arguments about the importance of clinical experience for

preprofessional teachers (Ball & Forzani, 2009; Grossman, 2018; Grossman et al., 2009; Lampert & Graziani, 2009).

Second, focusing on one content area – in this case, mathematics – established how to deepen candidates’ content knowledge in ways we had not previously observed. The focused opportunity to employ strategies from coursework and in clinical practice over a set of planned observations provided clear evidence for deepening candidates’ mathematical knowledge for teaching. This suggests that candidates’ content knowledge can be more fully developed through highly visible connections between coursework and clinical practice. Importantly, technology as a vehicle for instruction contributed to deeper content knowledge, greater curricular flexibility, and deeper understanding, all of which provides a foundation for pedagogical content knowledge (Shulman, 1986) and technological pedagogical content knowledge (Mishra & Koehler, 2006) both of which “enable teachers to make ideas accessible to others” (Darling-Hammond, 1998).

Third, our revised practices highlighted the importance of observation protocols given the variance in instructional arrangements (in-person, hybrid, and fully online). Part of our protocol, the shared rubric, helped teacher candidates to self-evaluate more accurately, make adjustments using their own self-assessment and a mirror faculty assessment, and incorporate targeted feedback from coaching cycles into future practice with fidelity. This evidence of improvement aligns with the small body of academic literature focused on virtual supervision and coaching as a robust process (Darling-Hammond, 2010; Keefe, 2020; Liu et al., 2018; Rock et al., 2012). The shared rubric also helped faculty to identify a small subset of teacher candidates who needed extended support and were assigned a faculty coach or supervisor to provide coaching for 3-4 additional virtual practice, reflection, and feedback cycles to target skills. Anecdotal feedback from this subset of teacher candidates was very positive and signaled that their confidence, skill, and feelings of preparedness improved with this process.

IMPLICATIONS: TECHNOLOGY’S PLACE IN TEACHER EDUCATION

Despite the challenges brought on by the COVID-19 pandemic, our experience shifting core tasks in our teacher preparation program resulted in new practices and outcomes which we believe will significantly improve our work and teacher candidates’ experiences in their preparation programs in the future. Like many of our colleagues across the US, we were largely unprepared for this work; however, our confidence grew based on feedback from teacher candidates and the early results we observed, and we became increasingly engaged in refining, extending, and developing our internal program practices to match changing circumstances as schools began to reopen.

As we undertook this work, and moved through many different phases of the pandemic, we learned some enduring lessons. The first, and most surprising to us, is that we can provide rigorous, effective instruction in virtual environments – a significant shift from our pre-pandemic beliefs. Teacher education scholars have long argued that this was possible (Carney, 2019; Garrison et al., 2010; Stapleton et al., 2017; Wake et al., 2017; Weiss et al., 2020); but in many ways, the pandemic prompted a new legitimacy for online teacher education. There are, however, additional implications. Teacher educators and teacher education scholars will have to grapple with how teacher candidates who are prepared online --whether by circumstance or choice --will translate these skills to physical classrooms. Additionally, as a field we have not yet fully established competencies for “good” virtual instruction in PK-22 classrooms and will need to examine whether/how they differ from traditional instruction.

While the pandemic necessitated the short-term use of technology, it also heightened technology use and confidence in all teacher preparation programs and signaled an urgent need for a curricular placeholder for technology training in teacher education. Our model is one example of how technology can be successfully leveraged to help address the long-perceived gap between theory and practice (Cochran-Smith & Keefe, 2022; Reid, 2011; Zeichner, 2012). Teacher education scholars have called for highly effective, resourced, and scalable models of teacher preparation that require students to connect theory and practice through a combination of coursework and extensive field experiences (Darling-Hammond, 2010; Zeichner, 1993); we believe technology has a lasting place in this equation.

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Virtual STEM+C: Helping our Residents Navigate their First Year of Teaching

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4+1 TEACH provides an opportunity for preservice teachers to complete a Bachelor's and Master's degree along with teacher certification within 5 years. 4+1 TEACH Residents complete an internship in lieu of student teaching. The program was funded by the Department of Education with one of the priorities of the program is to promote computational thinking education through evidence-based professional development. During the summer, our program provides an intensive week-long training in Computational Thinking Instructional Strategies and STEM+C professional development. The following week, Residents teach using these skills to K-12 students. Due to the Pandemic, the Residents were trained using a hybrid model and taught K-12 students using an online platform. Though initially challenging, this transition was beneficial for the educational community by providing a promising alternative for our pre-service teachers to earn field experience, and gain online teaching skills, while also providing academic enrichment for K-12 students. Using purposeful sampling, Residents were surveyed on the impact of participating in this project on their first year of teaching. We also share the challenges they faced as they transitioned into the classroom at such a pivotal time in education.

Keywords: STEM+C, professional development, online learning, pre-service teachers, K-12 students, teacher preparation, academic enrichment, pandemic, novice teachers

HISTORICAL REVIEW

The 4+1 TEACH program gives preservice teachers an opportunity to complete a Bachelor's and Master's degree along with teacher certification within 5 years. This program was funded by the Department of Education with one of the priorities being computational thinking. During the summers, the program provides training in Computational Thinking Instructional Strategies and STEM+C for the teacher candidates (Residents). The following week, the Residents teach using the skills in a STEM+C Camp to K-12 students. Due to the Pandemic and many education programs moving to remote learning, the Residents were taught using a hybrid model and the STEM+C Camp moved to a virtual environment. This opportunity provided a critical experience for our Residents in working with K-12 students, especially since their field experience was shortened due to the Pandemic. There is no argument that field experience is critical to developing effective teachers (Darling-Hammond, 2006, 2014) and unfortunately many teacher preparation programs were left with very few options. We viewed this as a possible valuable opportunity for our Residents to gain additional experience before they start their first year of teaching. In addition, the Virtual STEM+C Camp provided academic enrichment for K-12 students during a time when the loss of academic gains was exacerbated due to the Pandemic (Coyne et al., 2020).

The Virtual STEM+C Camp was set up in 10 teams that were led by Program Leaders. Program Leaders were faculty and former STEM+C Residents. Each Program Leader led a team of six Residents. Each Resident was assigned three campers. The camp entailed five online modules focusing on Computational Thinking (CT) Principles for the Residents

and four CT online modules for the K-12 students as shown in Tables 1 and 2 using Blackboard. As shown in Table 1, in the first week the Residents were provided STEM+C and Computational professional development as well as instruction in teaching these skills effectively to K-12 students. In the second week, as shown in Table 2, the Residents used these skills to teach K-12 students in a Virtual STEM+C Camp. This project was unique in the fact that it was online providing academic instruction for K-12 students. As shared, we have done this project in the past, but had not yet in a virtual platform. This project in prior years had been a great experience for our Residents to get additional teaching experience in the summer prior to starting the first year of teaching. But this project would be even more advantageous to our Residents due to the fact that their field experience was shortened due to the Pandemic. We were anxious to see what impact this project would have on the Residents' first year of teaching.

Table 1
Module Overview for Residents

Days	Modules for Residents	Module Components Overview
1	Introductions & Computational Thinking Overview	<ul style="list-style-type: none"> • Overarching question related to module
2	Abstraction Module	<ul style="list-style-type: none"> • Introductory videos of each topic
3	Decomposition Module	<ul style="list-style-type: none"> • Readings (text, articles)
4	Pattern Recognition Module	<ul style="list-style-type: none"> • Development of a teaching product (Screencastify video of Resident walking through hands-on activity for K-12 participants to be used in Campers' modules). • Zoom Grade Level Team Meetings (with Program Leader and Residents)
5	Algorithmic Designs Module	

Source: Based on Coyne et al, (2020).

Table 2
Module Overview for K-12 Students for Virtual STEM+C Camp

Days	Modules for Residents	Module Components Overview
1	Introductions & Computational Thinking Overview	<ul style="list-style-type: none"> • Introductory videos of each topic that geared toward their grade level
2	Learning About Abstractions	<ul style="list-style-type: none"> • Top selected product video selected from each team (Screencastify video of Resident walking through hands-on activity for K-12 Campers) • Optional activities that were created at the program level by Program Leaders • Residents checked in with camper via Zoom call • Self-Reflection Rubric for K-12 Students • Residents available to answer camper questions and guide campers through the various CT activities. • Program leaders available via office hours through the K-12 Summer Camp week to answer questions and offer support to the 4+1 Residents as they mentored K-12 students
3	Exploring Decomposition	
4	Fun with Algorithmic Designs	

Source: Based on Coyne et al, (2020).

First-Year of Teaching

Like many teachers across the globe, our residents were in a unique situation that they started their first year during the 2020-2021 school year, a time in which many school districts were transitioning back to in-person instruction from virtual instruction. Some of our Residents started their first year as online teachers, some were hybrid teaching online and in-person simultaneously, while some started entirely in person. Our residents were faced with many multifaceted challenges. We wanted to assess if the Virtual STEM+C camp was beneficial to the Residents in their first year of teaching. In addition, we wanted to assess what barriers they faced, specifically due to the Pandemic in this critical transition time in education as many schools were transitioning back to in-person instruction.

Employing purposeful sampling (Palinkas et al., 2015; Patton, 1990), ten Residents were given the survey and participated in this study. They were chosen because of their high participation in the STEM+C camp. As shown in Table 3, five participants taught at the elementary level ranging from grades kindergarten through fifth grade, and five taught at the intermediate level ranging from grades 6-8.

Table 3
Participants' Demographics (All Names are Pseudonyms)

Participant	Gender	Race	Teaching Level	Content
Amanda	F	W	Middle	SS/ELAR
Cindy	F	H	Elementary	SC
Hank	M	AA	Middle	ELAR
Jessica	F	W	Elementary	SC
Patricia	F	W	Middle	SS/ELAR
Kate	F	W	Middle	Math
Tracy	F	W	Elementary	SC
Sarah	F	W	Middle	ELAR
Brooke	F	H	Elementary	SC
Wendy	F	W	Elementary	SC

(F=Female, M=Male, AA=African American, H=Hispanic, W=White, SS=Social Studies, ELAR=English, Language Arts; SC=Self-Contained)

Survey

Participants were asked the following questions in their second year of teaching: a) How did the Computational Thinking training, STEM+C professional development, and the K-12 Virtual STEM+C Camp prepare you in teaching?; and b) What barriers did you face as a first-year teacher? To gain an understanding of the Residents' reasoning, responses were thematically coded (Glaser & Strauss, 1967). By employing surveys, we can better understand Residents' experiences during their first year of teaching after participating in this project.

RESULTS

Several themes emerged as shared in the following sections. We have also included a summarized table of the themes below (See Table 4).

Table 4
Summary of Themes

Themes	Explanation
Virtual Teaching Experience	Through the STEM+C Camp, Residents were provided an opportunity to increase skills and experience in working with students virtually.
Barriers Faced During First Year of Teaching due to Pandemic	Residents were faced with many barriers due to the Pandemic during their first year of teaching including increased gaps in K-12 student learning and an increase in workload.
Emotional Impact on Teachers	Emotional toll on Residents as they complete their first year of teaching
Importance of Mentorship	Residents share the importance of mentorship during their first year of teaching including their full-release mentor.

Providing Virtual Teaching Experience for Residents

One of the themes that emerged was how this project, specifically in working with K-12 students at the Virtual STEM+C Camp provided them an opportunity to gain additional online teaching experience indicated by 90% of the participants. For example, some of our Residents felt like it was useful in increasing their skills in using online platforms for teaching because even though many schools were transitioning to in-person traditional schooling, some of the Residents were responsible for providing online teaching to their K-12 students who were absent or whose parents requested online learning as an option. The experience also helped them identify areas for improvement in working with K-12 students.

One main area that our Residents struggled with during the Virtual K-12 STEM+C Camp included student engagement. Teaching virtual requires teachers to employ a new pedagogical approach that many do not necessarily have the knowledge and skills to effectively teach K-12 students (Dowton et al., 2022). Even with new teachers that might have had more exposure to technology, teaching online was a paradigm shift. Unfortunately, there has been limited teacher preparation in this area requiring additional time to conceptualize what virtual teaching looks like for K-12 students. But this experience did provide them an opportunity to gain experience and be more effective in this area as well as learn more about classroom technologies.

Fortunately, the Residents were able to utilize what they shared during this experience in their role as a teacher. One Resident, Amanda shared, “The strategies were great, but what helped me the most was learning to work with an LMS (Learning Management Software). This proved beneficial since online education was a necessity”. Residents shared that this experience helped them conceptualize teaching differently. Another Resident, Tracy shared her experience, “It forced me to think harder when planning online assignments, differentiation, and variety”. Unfortunately, as we learned through the Pandemic, many teachers lacked the knowledge and technical skills needed to effectively teach online. This experience provided them an opportunity to hone their skills in increasing student engagement, formative assessments, and communication through an online environment.

Barriers Faced During First Year of Teaching Due to COVID-19 Pandemic

Another theme that emerged was the barriers the Residents faced during their first year of teaching which was unique in the fact that this was during the transition year from completely online to hybrid and or completely face-to-face K-12 instruction. Of the themes that emerged, the two most common were working with struggling K-12 students’ academic levels and personal emotional stress. Eighty percent indicated stress in working with struggling students in an effort to get them caught up and 60% indicated personal emotional stress as a barrier.

Students on average lost significant strides in their learning with some estimates reporting they ended the school year of 2020-2021 five months behind in math and approximately four months in reading, with underserved students having even greater gaps in their learning (Dorn et al., 2020). Students were significantly behind academically when the new school year started which was also the Residents' first year as a teacher. This was very stressful for the Residents as they balanced their role as first-year teachers and tried to help students catch up academically.

Another disconcerting factor that schools across the nation were facing was the increase of students' absences, many due to COVID-19 quarantining protocols. If students were to make up the work online, many Residents shared that it was very inconsistent and the students would as a result fall further behind. One participant, Kate shared, "Students being absent for 2 weeks and then trying to get them caught up when they returned. They also rarely completed assignments posted online to access for a variety of reasons, so they came back and were lost in class". With this interruption in students' learning and school routine, Residents struggled in maintaining an environment that was conducive to learning.

Another theme that emerged was the social and emotional impact this year had on the Residents and their K-12 students. There is no argument that the Pandemic impacted individuals emotionally in a variety of ways. Many teachers across the globe experienced burnout due to the emotional toll of the Pandemic (Zieher et al., 2021). Naturally, many factors lead to burnout including climate, administrators, and transition from pre-service to the teacher of record (Voss & Kunter, 2020; Perrone et al., 2019) during a regular school year but were magnified during the Pandemic. One of the factors that affected teachers was being unclear regarding their job responsibilities (Chan et al., 2021) including ensuring students wore their masks, keeping the classroom clean, and online teaching among other responsibilities. One resident, Brooke shared her experience regarding the added stress of the Pandemic and her work responsibilities. "As a first-year teacher, teaching is stressful, but it is compounded with now the added workload, due to in-class and online teaching, high absence rate, more duties (cleaning, demanding students to wear masks, more school procedures)". Also, teachers are not sure what is expected of them in their role leading to burnout (Chan et al., 2021). Teacher burnout seemed to strike novice teachers even greater. In their study, Sanchez-Pujalte et al. (2021) found that more experienced teachers had lower levels of burnout in comparison to less experienced teachers such as novice teachers during the Pandemic.

Mentorship

In addition, 90% of the Residents shared how mentorship was key in helping them survive their first year of teaching. Like many first-year teachers, our Residents also had site-based mentors but like many mentors, they either have their own classrooms or because of the high rate of absences from school staff due to COVID-19 quarantining protocols, they would be pulled to teach or provide online instruction. But our program is unique in the fact that our Residents have full-release mentors who are retired administrators and instructional coaches who mentor and provide continuous support to our Residents. Many of the participants shared how the full-release mentors were critical. One Resident, Wendy shared, "My mentor was an amazing resource in my first year, especially during a time when there were many unknowns. She helped me navigate the many challenges novice teachers face, especially during this time of COVID".

There is no debate that high-quality mentoring is imperative to teacher retention during the induction years. With the Pandemic, novice teachers across the globe were negatively affected in being provided an opportunity for effective mentoring with site-based mentors being emotionally impacted themselves as well in balancing new job duties, higher absenteeism among staff due to COVID-19 protocols, and some were pulled to teach uncovered classes. Unfortunately, many of these novice teachers were impacted during their preservice years due to the closing of schools, thus not providing opportunities to gain valuable field experience warranting even additional support from school districts.

IMPLICATIONS AND MOVING FORWARD

As shared, the purpose of this study was to examine the impact the STEM+C project had on the Residents in the first year of teaching, especially during such a unique time in education with the Pandemic. In addition, we also wanted to identify barriers the Residents faced during their first year of teaching. The data from the participants has helped us in adapting our planning for our Residents in the area of providing additional professional development on online teaching, academic support for struggling students, and socio-emotional care.

Our Residents shared how the virtual STEM+C provided additional practice for online teaching. But many teachers and districts across the globe scrambled to adapt their teaching to a virtual platform with little preparation and experi-

ence. Though our project did provide additional practice for Residents, the Pandemic demonstrated a need for teacher preparation programs to courses for teachers to incorporate effective online teaching practices. Many teacher education programs feature one to two technology classes but fail to adequately prepare teachers to effectively teach online warranting the need to add a more robust technology curriculum in their programs. In addition, many during the Pandemic teachers felt there was little support at the district level demonstrating a need for additional training, and a stronger support system to help teachers teach effectively online (Nikolopoulou & Kousloglou, 2022).

Another area that was brought to our attention from this survey was the additional professional development needed for our Residents in supporting academically struggling K-12 students. Learning was disrupted globally for K-12 students resulting in the loss of academic gains and causing students to be significantly behind. Teachers were faced with the daunting task of helping their students fill in the gaps in their learning. One feature of our program is providing regular professional development. Because of the Pandemic, we have adapted our sessions to meet the needs of the Residents including providing additional support for struggling students. Some school districts have used this opportunity to employ innovative practices such as streaming expert teachers and modeling effective teaching practices for novice teachers (Darling-Hammond & Hyler, 2020).

In addition, we discovered that there was a deep emotional impact on our Residents. The first year for teachers can be emotionally daunting as they assess their role, balance their life, and simply survive. But the Pandemic magnified the effect and toll it had on teachers, specifically novice teachers. Many of our Residents struggled with understanding the requirements of their additional responsibilities such as the mask mandates, keeping their classroom clean, and providing online support that is traditionally outside the scope of their traditional teacher. Because of this, we have ensured that our full-release mentors continue to do regular check-ins with the Residents. We also have plans in providing additional professional development in Social-Emotional Learning for both K-12 students and teachers.

Lastly, as shared, the full-release mentors have been a critical component of their induction years. Our program is unique in the fact that we provide full-release mentors that have vast experience with novice teachers and have provided support for our Residents. We highly recommend that teacher preparation programs and school districts invest time and energy in a well-established induction program that features mentorship. In reflection, our mentoring program was the key feature in helping our Residents navigate their first year of teaching by providing support, guidance, and coaching.

Implications for Teacher Education Programs

In summary, there are several implications for teacher education programs. Teacher education programs need to incorporate more technology classes that help teacher candidates effectively teach students online. Though the majority of schools across the globe are back to in-person instruction, many school districts are still providing online options for students. The majority of technology classes that are taken by preservice teachers provide tools to use in the classroom but fail to effectively prepare them to teach fully online, especially in the areas of how to engage, assess, provide feedback and communicate online. Another implication for teacher education programs is to ensure teacher candidates know how to help struggling learners. As shared, many of our teacher candidates were faced with helping students who were significantly academically behind and they were faced with the daunting task of helping them get back to grade level. Our program has provided additional professional development and we have had faculty conversations to ensure this is included in our curriculum. Another implication for teacher education programs is to ensure there is a strong mentoring program. Our mentors work with our Residents in their first two years of teaching and have a vast amount of experience working with novice teachers. In addition, we have ensured that our mentor-to-resident ratio is kept small. Also, the Residents reported an emotional impact they had as first-year teachers. This information was shared with our mentors because they must continue doing check-ins and provide guidance on how to minimize stressful situations.

As shared, the purpose of this study was to determine the impact the Virtual STEM+C Camp had on our Residents as well as determine what barriers they faced as first-year teachers. This provided our program with valuable insight into how our Residents were doing on how we can continue to improve. Moving forward, we will continue the Computation Thinking Training, STEM+C professional development, and the STEM+C Camp but it will be completely in-person. Although the Virtual STEM+C Camp was successful in some regards, we felt that it was more effective because of the hands-on learning that lends itself to STEM+C. Also, we found that not all the K-12 students had a parent, family member, or sibling to help them with the STEM+C Activities. With it being in-person, the Residents are available to provide assistance. This was truly a learning experience for the educational community. We continually adapt to meet the needs of our Residents and our Residents adapted and will continue to adapt to meet the needs of K-12 students.

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Student Choice and Mastery Learning Online: Unintended Consequences and Outcomes for COVID-19 Adjustments

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One way to create more student-centered courses is by having students choose assessments that allow them to leverage their strengths to demonstrate understanding. However, building such structures into the course design does not mean students will always prefer such an approach. Using an exploratory case research approach, this chapter examines how a shift in the design of an online mathematics methods course, allowing for greater student choice, impacted the way in which students engaged with the learning experiences. Findings indicate the anticipated benefits were actualized yet unexpected and unwanted outcomes were also uncovered that may not have benefited students' learning.

HISTORICAL REVIEW

Our original proposal centered on leveraging coding, during the rapid transition to emergency online teaching, as a means of supporting teacher candidates' understanding of the creative, flexible, and logical thinking needed for learning mathematics and computational thinking. Specifically, we proposed a four phase approach to learning about coding to support teacher candidates' pedagogical understanding and instructional capacity for using coding in their future classrooms. Two of these phases required independent opportunities to explore coding through a variety of different applications, websites, and other learning experiences. However, given the sheer number of possible tools, platforms, and opportunities available to explore coding, it was decided that teacher candidates would choose from a limited, but high quality, set of options to select and demonstrate mastery of the intended outcomes for the course. At that point, the focus of the exploratory case shifted from coding during the pandemic to an examination of the extent to which student choice in demonstrating mastery learning benefits learning within an online learning environment. In essence, there was a greater emphasis on mastery learning in the overall design of the course.

Mastery learning is grounded in the belief that students can demonstrate learning at different times, in different ways and not necessarily within the prescribed lesson planning and implementation cycle (Guskey, 2010). To the research/instructional team, this was viewed as a critical part of the new course design especially given the rapid shift to emergency online teaching. While one student may have a substantial preliminary understanding of content, and may thus take less time to meet the related learning objectives, others may need substantial feedback and more tailored interactions to arrive at the same understanding (van Geel et al., 2019). Such opportunities are helpful for teacher candidates to learn the importance of mastery learning in their own classrooms.

Currently, the case is focused on better understanding student choice, as an aspect of mastery learning, as one means by which learning can be maximized (Rose & Meyer, 2002). As such, the research/instructional team is exploring the extent to which greater opportunities for teacher candidates to choose how to demonstrate understanding of concepts (Rosenthal, 2018) impact their learning. Given that student choice can also increase interest in the learning (Hanewicz et al., 2017) and motivation (Bennett & Ray, 2020), understanding how teacher candidates responded to a course that allows for greater autonomy and choice in demonstrating their learning of coding was central to this study.

PROCESS/METHODS

The primary intent with autonomous learning and student choice is to leverage strengths, competencies, and to enhance intrinsic motivation and engagement (Aguilar et al., 2015). As such, this exploratory case study is theoretically grounded in aspects of Gameful Learning (Holden et al., 2014), which includes authentic, active learning based on learner choice. Thus, the research question for this study centers on the extent to which student choice in demonstrating mastery learning benefits learning within an online learning environment.

This case study stems from our larger work in preparing teacher candidates to teach mathematics in an ever increasing digital and problem-based world and builds on the research/instructional teams' emerging work in understanding the efficacy of Gameful Learning (Holden et al., 2014). Data were collected using structured feedback forms given at the beginning and end of the semester. Responses were voluntary. Additional data were collected through emails, one on one conversations with students, and via instructor reflections. Data were analyzed independently by the two researchers to identify common themes and were discussed until an agreement was reached on the themes and their implications (Creswell, & Poth, 2017).

The participants consisted of 26 undergraduate students and two graduate students all enrolled in a synchronous mathematics methods course. There were 24 female students, one of whom was a graduate student, and two male students, one of whom was also a graduate student. Data collection consisted of student reflections, class observations, class discussions, semi-structured interviews, and other course artifacts (Creswell & Poth, 2017), such as questions or comments posted to online discussion forums, to appropriately describe students' perspectives on choosing their own assessments to demonstrate their learning.

RESULTS AND DISCUSSION

Findings indicate there were dichotomous and conflicting beliefs about choice among the students. Students seemed to both simultaneously like and dislike being able to choose which assignments to complete, resulting in some unintended and unwanted outcomes. Below is a representation of these perspectives organized by the major themes.

Perceived benefits of choice

Students repeatedly talked about and appreciated the flexibility and autonomy in choosing assignments and the sense of empowerment that came with it. Several made comments like "I also love that I get to choose what I am working on, it is based on my specific interests" or "I enjoy this mode of learning because it allows students to take ownership in what they are doing; they are able to challenge themselves in whatever ways they choose to." For some students, the autonomy to choose their own assignments was not something they had encountered previously. One student indicated "It was nice to not have everything chosen and given to me" and another believed this autonomy was "very beneficial" because they liked "to explore concepts and take their own time to do so." Others indicated they liked to "have a say in which assignments I have to complete." Autonomy, as an advantage to this structure of learning, was an anticipated benefit and has been found in other studies as well (Aguilar et al., 2015) and not necessarily surprising, though it was mentioned by the majority of the students.

Another benefit was the perceived growth in learning. Several students stated that because of the opportunity for choice, they were better able to understand the content. One student commented that having a choice was "fun because I felt like I was actually contributing to my learning instead of it just feeling like busy work" whereas another indicated that they "enjoy the opportunity to pick assignments that interested me, or that helped me to better understand a concept." Again, these kinds of responses were anticipated and further confirm previous studies (Bennett & Ray, 2020; Bridges et al., 2019) and are presented to better understand the juxtaposition between these perceived benefits and the perceived disadvantages with student choice.

Perceived disadvantages of choice

As with the perceived benefits, there were also emergent themes around the challenges of student choice such as understanding how to appropriately plan which assignments they wanted to do, allocating time to complete them, and feeling overwhelmed to the point where they felt debilitated by the choices. Each is discussed in further detail below.

One of the primary disadvantages several students had with respect to choice was struggling to plan appropriately for their learning. Many students reported they were falling behind, procrastinating, or otherwise feeling confused by the choices available to them. One student indicated that because they had choices in their assignments and in deciding when to do a given assignment, it did not help; “for learners that need guidance it gives them too much autonomy.” This suggests that too many choices at one time made it difficult to plan accordingly despite having set deadlines for when “choice assignments” needed to be submitted for evaluation.

Another disadvantage for students was the perceived lack of structure to the course despite a detailed outline and course schedule as to when assignments needed to be completed throughout the semester. “This can be very difficult for some students, because they may feel they are lacking the structure of a classroom, the lack of rigid instructions can take some getting used to.” Paired with difficulties in planning, the lack of structure further compounded the ability of many to complete work in an appropriate amount of time. Additionally, it seemed foreign for some to choose what they needed to do to demonstrate their understanding. “I have always had professors tell me what to do and when to have it done by. It was tricky to get to a point where I was able to do this without stressing out.” This student suggests that because of the freedom to choose assignments, their anxiety actually increased, which is an entirely unexpected and unwanted outcome.

Finally, many students felt overwhelmed by having options. The mere opportunity to make a choice about the ways in which they could demonstrate learning was debilitating and for some resulted in no choices being made. One student believed that “if someone does not know what to do they could get stuck and give up and that would cause problems.” For other students, they realized that having choices might actually have a “detrimental or have a negative effect on their learning because they have no motivation” simply because “It is a little overwhelming to consider creating so many assignments.” Again, the overwhelming feeling created by choice led to doubts, inaction, and panic all of which are the antithesis of safe and healthy learning environments.

IMPLICATIONS

This research examined the extent to which student choice in demonstrating mastery learning benefits learning within an online learning environment. For nearly all participants, the freedom to choose which assignments they wanted to complete to demonstrate their learning was perceived as a benefit. These findings are not unique and are well supported by the research literature (Schmidt et al., 2018). Furthermore, and given that choice is an underlying element to the larger construct of Gameful Learning, the data further supports choice as an important element for this instructional pedagogy and course design.

With that said, unintended consequences relating to choice lead to substantial issues that need to be appropriately addressed and considered. Healthy classroom environments nurture students in their academic growth as well as with their social-emotional growth (Schonert-Reichl, 2017). This means that learning constructs that do not benefit the student or that create unreasonable levels of stress and anxiety need to be examined by teacher education programs. Failing to do so, even unintentionally, may lead to other unintended outcomes such as an increase in teacher candidates disengaging from the program or dropping out of school because of increased stress. Doing so may further exacerbate the crisis in developing sufficient new teachers for an already critical teacher shortage. For the research team, and based on this initial data, changes to their subsequent and on-going courses were made so that not all choices were provided at the beginning of the course but were instead purposefully distributed across the course with fewer choice options at each assessment checkpoint. This was done to reduce the stress from choice.

While students are often intrinsically motivated to play and experiment with their learning (Holden et al., 2014), creating opportunities for teacher candidates to choose how they demonstrate mastery can be useful within the course design. For teacher education programs, especially in a post-COVID context, this also means understanding the ways in which adapted and modified systems of delivery unintentionally impact teacher candidates’ affective and cognitive well-being. Specifically, this study suggests there may be limitations and unanticipated consequences within online learning environments; acute attention to individual learners and their unique needs still matters.

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A Retrospect of Stability Under Pressure: Aligning Beliefs and Practices Reveals Opportunities

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A shift to emergency remote teaching due to COVID-19 created challenges and opportunities. Prior to the pandemic, the teacher educator examined within this document worked to align his beliefs and teaching practices. He sought to develop a face-to-face student-centered classroom based on constructivist-oriented teaching practices. Post-course surveys suggest that a student-centered environment was maintained during the shift to emergency remote teaching. However, a year of online instruction pushed this educator to teacher-centered, traditional teaching methods. The professor believed he taught from a constructivist-oriented perspective, but in retrospect, his teaching practices drifted back towards a conventional approach. A return to face-to-face teaching will allow all teacher educators an opportunity to re-evaluate their pedagogy. This chapter will discuss an exploratory sequential mixed-methods design research project that explores a teacher educator's online teaching, preservice teachers' perception of online course interactions, and suggestions for teacher educators who plan to support student-centered pedagogies.

Keywords: Teacher education, teaching practices, student-centered, videoconferencing, Zoom, professional development

HISTORICAL REVIEW

Research on teacher educators' professional development is a rising subject of study (Ping et al., 2018). Prior to the global COVID-19 pandemic, the teacher educator examined here sought to improve his teaching practices by shifting from a teacher-centered (Buttler, 2020b) to a more student-centered, constructivist-oriented approach (Brooks & Brooks, 2001). He sought to create a constructivist environment focusing on learner engagement and the classroom climate (Fraser, 2011). COVID-19's impact upended many teaching plans as teacher education courses abruptly shifted online (Assunção Flores & Gago, 2020).

As education moved online, the teacher educator reported on here sought to create a stable environment by providing the preservice teachers an opportunity to regain a sense of control of their educational environment (Buttler, 2020a). During the shift to emergency remote teaching (Buttler et al., 2021), he collected student input, providing preservice teachers a semblance of control over the design and management of the activities, assignments, and final assessment.

Personal, relevant, context-sensitive data informed the emergency transition online. The course delivery reflected the students' desires; thus, the shift online produced few obstacles and little self-reported anxiety. Confirmation of this qualitative analysis occurred via the university administration's post-course surveys.

With this apparent success, the professor planned to follow the same pattern when teaching a complete course online the following academic year. As Robert Burns' statement echoed, "The best-laid schemes o' mice an' men Gang aft a-gley" (1785, p. 154), the fall semester began.

What Went According to Plan?

As planned, the online semester began with data collection and a general student-professor meeting. The preservice teachers and teacher educator negotiated several management issues and pedagogical options, including choosing synchronous Zoom meetings and self-selected microteaching groups. As with the previous semester, students appeared comfortable with the results of the negotiations and stated that they understood why the professor chose to provide them with some control of their learning environment. The semester began with the professor explicitly modeling the education pedagogy. Specifically, he encouraged the preservice teachers to critique his actions, thereby assisting them “see into practice” (Loughran & Berry, 2005).

What Changed?

The course reported on here includes microteaching, a strategy combining reflective practice (Schön, 1983), and situated learning (Lave & Wenger, 1991). Microteaching is a “condensed lesson plan used to practise, rehearse and reflect on action...often delivered within a role-play context for real-time feedback and reflection” (Ledger & Fischetti, 2020, p. 37). The self-selected student groups conducted microteaching sessions via Zoom, a videoconferencing platform. The participants taught mini-lessons as they shared their screens and annotated a group whiteboard in what Zoom refers to as Breakout Rooms. Breakout Rooms allow instructors to divide participants into virtual rooms where they participate in separate group conversations before rejoining the primary virtual classroom. In this study, these rooms contained four students who planned and executed 10-minute lessons using teaching techniques examined previously in the semester. During the microteaching, the professor moved between the Breakout Rooms challenging and encouraging students as they developed their teaching practices.

The microteaching sessions worked well, as the students demonstrated growing teaching competencies as the weeks passed—nevertheless, the student groups showed a growing range of competencies and rigor. The solution initiated: reorganize the microteaching groups, placing weaker students with stronger peers. Thus, midway through the semester, the professor reorganized the Breakout Room groups. After announcing a change for the following week, the students immediately protested: “These are our friends” and “No, don’t change our groups!” The professor took away the agency given earlier in the semester, and the resulting anxiety was palatable. When the course began, the preservice teachers were given a semblance of control; reorganizing the groups eliminated that perception. The professor stepped back into well-worn patterns of traditional teaching practices.

PROCESS AND METHODOLOGY

The jolting misalignment between the teacher educator’s pedagogy and beliefs stimulated this research. The resulting research (Buttler & Scheurer, 2022) investigated preservice teachers’ perceptions and interactions within Zoom. In this chapter, an in-depth examination of the study promoted by reorganizing microteaching groups is impossible; nevertheless, the research project illuminated the professor’s misaligned practices and beliefs.

Soon after the reorganization of microteaching groups, the current project, an exploratory sequential mixed-methods design research project (Creswell, 2012; Creswell & Creswell, 2017; Harrison et al., 2020), commenced. The overarching focus of the research examined experiences within Zoom’s synchronous Breakout Rooms. The specific research questions:

1. What interactions do preservice teachers experience in Zoom’s Breakout Rooms?
2. What are preservice teachers’ perceptions of their interactions in Zoom’s Breakout Rooms.

A third question arose while investigating the first two questions:

3. How do the professor’s teaching practices and constructivist-oriented beliefs about teaching and learning align?

The exploratory sequential mixed-method design begins with qualitative data collection and analysis, followed by the creation of a quantitative instrument based on the qualitative findings. See Figure 1.

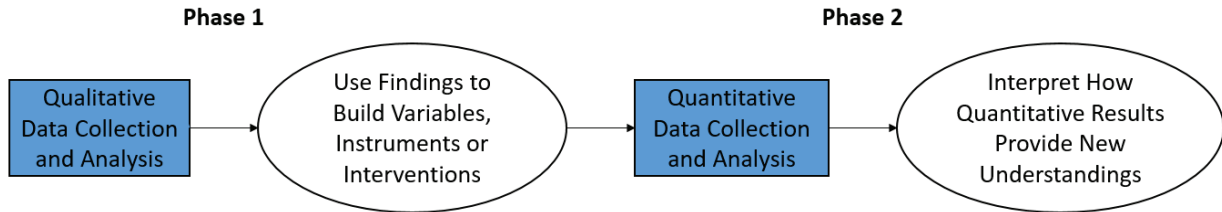


Figure 1. The Two Phases of Exploratory Sequential Mixed-Methods Design.

Note. Figure 1 consolidates Creswell’s (2012) and Harrison and Creswell’s (Harrison et al., 2020) descriptions.

Twenty-six Western Canadian preservice teachers within a third-year curriculum and instruction mathematics course participated in the study. This online teacher education course provided qualitative data; 26 virtual session recordings. Northrup’s (2009) categories of online learners’ preferences became the qualitative data analysis lens. Categorizing representative and meaningful student interactions formed the foundation for a 28-item closed-response Likert-like post-course questionnaire (see Buttler & Scheurer, 2022 for the questionnaire). Distributed via Survey Monkey®, the questionnaire sought to uncover preservice teachers’ perceptions of their online experience. Finally, IBM’s Statistical Package for the Social Sciences examined the data via cross-tabulation analysis.

RESULTS

The professor of this course reported that when he revoked the students’ agency, he felt as if he was “a living contradiction” (Whitehead, 2008, p. 8). As noted earlier, the preservice teachers noticed a shift in pedagogy, causing one student researcher (Maunder et al., 2013) and the professor to launch the current project. Although the third research question is the focus of this chapter, the first two questions provide background and context.

Video recordings gathered within Zoom Breakout Rooms revealed several types of interactions: Content engagement, peer collaboration, informal discussions, and requests for technical assistance. Questionnaire data revealed the pre-service teachers’ perceptions of these interactions. The participants reported feeling comfortable meeting and collaborating with peers in Breakout Rooms. In addition, all participants reported that time spent with peers in Breakout Rooms was valuable.

Cross-tabulation analysis via SPSS examined the correlation between the preservice teachers’ experience in Breakout Rooms and their online interactions with peers and professor. Table 1 reveals the combined Breakout Room questions correlated with the remaining 20 items.

Table 1
Breakout Room Responses Correlated with Other Questionnaire Items

Questionnaire Item	Q2	Q4	Q5	Q6	Q7	Q10	Q12	Q15	Q18	Q23
Pearson Correlation	.57	.58	.56	-.50	.60	.64	.64	.49	-.61	.54
Sig. (2-tailed)	.01	.01	.01	.03	.01	.01	.03	.03	.01	.02

Note. Only strong ($p < .05$) associations are listed. “Q” = question (e.g., Q2 = question two). See Buttler & Scheurer, 2022 for a granular examination of the data.

Table 1 demonstrates the preservice teachers’ perceptions of Breakout Rooms correlated positively and significantly with that the professor’s communication and technical management of course material (Q2, Q5, Q7, and Q10), the aca-

demographic goals achieved (Q4 and Q12), the social bonds fostered (Q15), and the students' preference for video and voice chat over text chat (Q23).

Items that negatively affected student perceptions of Breakout Rooms revolved around the students' belief that access to lessons, lectures, and materials was more manageable in a brick-and-mortar classroom than in an online environment (Q6 & Q7).

Significant to the third research question, the male participants reported that their experience online was impacted by a feeling that their contributions mattered (Pearson Correlation = 0.903 & two-tailed p -value = 0.036). This finding suggests that the professor's altered pedagogy negatively impacted the students' experience.

As planned, the student-centered, constructivist-oriented teaching practices were present as the semester began. The findings revealed that rearranging the self-selected microteaching groups affected the students' agency and their belief that they contributed to the learning process. The response to the microteaching issue did not align with the initial constructivist-oriented goal.

Although one teaching episode sparked the research behind this chapter, the incident is indicative of many choices revealed by the video recordings. Through this study, the professor learned that transitioning from face-to-face to online delivery encouraged him to fall back on traditional teaching methods. He taught about student-centered, constructivist-oriented pedagogies but modeled a traditional approach.

IMPLICATIONS

A Teacher Educator's teaching style significantly impacts preservice teacher development (González et al., 2018). Transitioning between different modes of educational delivery allows for reflection and refinement of teaching practices. Unfortunately for the professor examined in this study, the transition from face-to-face to online delivery resulted in a disconnection between his educational beliefs and teaching strategies. Nevertheless, the affordances provided by Zoom's Breakout Rooms met the broad constructivist-oriented goals. Additionally, the online space encouraged students to interact positively and collaboratively within a constructivist learning environment that facilitated "learners' conversations about what they were learning" (Jonassen, 1999, p. 229). Therefore, teacher education courses that move online can support constructivist-oriented, student-centered pedagogy.

Irrespective of the goals that teacher educators enter the new school year with, the following is recommended for teacher educators who want to model constructivist-oriented, student-centered practices:

1. Gather student input (in this case, a mixed-method model and Survey Monkey®) to identify student needs while giving them some control. Use tools available to the students.
2. Conduct meetings with the students (Possibly, starting on the first day of classes). Present the survey results and propose a course of action.
3. Model and explain your pedagogy. Return to this issue throughout the new semester and examine the purpose of providing options. Allow the preservice teacher to evaluate your pedagogy and the results. This process will allow them to envision how they may teach in the future.

Regardless of the teaching medium, the most successful educational experiences align teaching practices and student outcomes (D'Souza et al., 2021). A significant outcome of the teacher education course examined above includes the development of a constructivist-oriented teaching approach. Student learning was impacted as the professor demonstrated misaligned beliefs and pedagogy. Returning full-time to a face-to-face classroom presents another opportunity for this teacher educator to examine and refine his teaching practices.

Due to the impact of COVID-19, the manner in which students and teacher educators connect, teach, and learn has altered. As a result, the authors of this study encourage teacher educators to examine how their beliefs and practices align as they return to the classroom.

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Walking the Off- and On-line: Perceptions of Interaction and Development of Teaching and Learning Strategies

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After the rapid shift in environment from in-person to online classes in 2020, and the shift back to the in-person environment in 2022, the authors reflect on their existing teaching and learning strategies in pre-service teacher education. Moving forward, the authors aimed to find out students' and teachers' experiences of these changes and what lessons have been learnt. To find out about these experiences a student survey was conducted to further investigate the teachers' observations. Results from the survey suggested that students interacted with their teachers and peers differently in the two environments, and that different teaching and learning strategies were required in the two environments. Implications of the study are that forms of interaction from online environments may be useful in in-person environments, that learners may benefit from explicit teaching of strategies, and that there appears to be no one-size-fits-all solution; regardless of environment, teaching needs to include a wide variety of approaches.

HISTORICAL REVIEW

Teacher educators all over the world experienced an unexpected change from teaching in the physical classroom to teaching online during the Spring term of 2020. In the context of the present study, the authors needed to reflect on existing teaching practices and adapt them to a new teaching environment. Now, two years later, the shift of teaching environment means finding a way back to physical classrooms. Though all three of the authors have many years of teaching experience in physical classrooms, and some experience of teaching through the digital mode, the shift back to in-person teaching after the past two years of teaching in the digital format still caused feelings of apprehension and uncertainty. Somewhat ironically, these feelings mirror the feelings the authors had during the digital shift two years ago. While it may be tempting to return to pre-pandemic practices as if nothing had changed, it is the strong belief of the authors that there are opportunities to learn from the period of digital teaching, as it can benefit our in-person teaching practices in the future.

In Haslam et al. (2020), it was found that many activity types that work in the physical classroom could also work in the digital classroom, such as Think-Pair-Share. Readers of the 2020 chapter were encouraged to draw on these proven classroom methods in the digital environment. Recommendations were made for dealing with the shift in teaching by giving students more autonomy in terms of, for example, when and how to fulfil assignments and whether to participate in the class synchronously or asynchronously. Moreover, formative assessment strategies were recommended, since strategies such as walking around to monitor group work are not optimal in the digital classroom. In the practices of the authors, this adjustment in formative assessment strategies has taken the form of asking more questions to students during seminars and waiting longer after asking questions so that all students have time to think and prepare how they will answer before answering. The chat function in Zoom has also proven to be a helpful tool, as it seems that some students

are more willing to write questions directly to the teacher in chat rather than sharing them in an open Zoom discussion. As the transition back to the physical classroom is being made, it is the authors' aim to take the best of the digital teaching environment and apply it to in-person teaching.

Based on observations such as these, the authors were wondering about students' experiences of shifting between the physical and digital formats, including their willingness to participate both vocally and in writing and how their strategies and experiences for learning in physical environments and digital environments may differ. This prompted the authors to re-connect to the 2020 article, and to further investigate the most recent change of learning environment in the ongoing language education courses. The questions that guided the present study were:

1. What were students' perceptions of interaction in the on-line and off-line seminar rooms?
2. What teaching and learning strategies were mentioned by the students?

PROCESS/METHODS

In April and May of 2022, data were collected via a survey to teacher students who were enrolled in preservice teaching courses in English for young learners' language education taught by the authors during the Spring terms of 2020, 2021, and 2022. Notably, students in Spring 2020 experienced the change from in-person to digital format, students in Spring 2021 experienced their course in a completely digital format, and students in Spring 2022 had the first part of their courses in digital format and then moved to an in-person experience. Survey questions investigated students' willingness to participate vocally and/or in writing during the two class formats, their perceptions of the advantages and disadvantages of the two formats, and what strategies they developed for learning in the two formats. From a set of about 400 students invited to participate in the survey, 30 students responded. Many of the students were completing a practicum placement during this period, which may have contributed to the low response rate. In addition, some of the spring term 2020 students were in the process of finalizing the first part of their final degree project. Thus, they had other concerns on their minds, and potentially felt distanced from the ten-week language education course they studied parallel to an English proficiency course two years ago. This being said, it should be mentioned that our students in the primary school teacher education program study to teach the age group all school subjects on the curriculum and not only languages. With this relatively low response rate, these results cannot be taken to represent the entire population of students. Nevertheless, the responses we received provide much interesting information that we can use to inform developing teaching.

Students responded to a number of questions about their experiences during their digital courses. Since many of the students participating in this survey have Swedish as a native language, participants were encouraged to write their responses in either English or Swedish. In this way, participants could be freer in expressing their thoughts and feelings.

RESULTS

The survey included a number of qualitative questions about students' participation in the two environments. The survey questions focused specifically on interaction with teachers and peers and strategies for learning in the two environments. Answers among the 30 respondents ranged widely, with some students expressing strong preferences for in-person or digital learning.

Students' comments reflect that they interacted differently with their teacher and their peers in in-person and digital environments. Some students reported less willingness to interact in the digital environment, while others reported more. For example, one student wrote that the digital environment included, "Far less interaction. Fewer words are used. Made me less interested to discuss." On the other hand, another student reported, "I talked more during online [seminars]. People were quieter during digital teaching because then you can hide if you want to in a way you cannot in a classroom. I took the chance to speak as much as possible." More than one student reported that the digital environment also focused more on the subject matter and left less room for the social interaction that occurs among peers in the in-person classroom; this was experienced as both positive and negative by different students. Respondents also reported that they were less likely to ask individual questions to the teacher in digital environments.

Students indicated that participation in the digital environment required different strategies from in-person learning. For example, one student expressed that they needed "[t]o find answers on my own since the opportunity for interaction

is far less during digital classes” and another student wrote that they needed to “[l]isten carefully to teachers and other students (you cannot ask someone beside you for clarification as easily as in a normal classroom). Focus on listening and take [notes] on the most import[a]nt stuff only.” Another student also pointed out the importance of selective listening in the digital environment: “Strategies such as listening more closely when it’s really needed. Not to be in high alert all the time.” One student reported using “two screens, one for zoom and one for notes and looking things up.”

IMPLICATIONS

Willingness to communicate may be affected by the environment learners find themselves in. In a similar way to Airey’s (2011) observation that some lecturers feel more constrained and less fluent when teaching in a second language, students appear to find themselves less likely to communicate when learning in a “second environment.” Teachers should also consider language anxiety when teaching students in a second language in classroom settings (Lightbown & Spada, 2021; Shirvan, et al., 2019), and arguably even more so in online settings (Russell, 2020) as willingness to communicate is especially important for language teachers, as their own confidence in the language they teach can have a direct effect on their pupils (Enever, 2011). These online strategies are likely to be different to in-person strategies, such as practice recordings, extra rehearsal of individual speaking and activities aimed at addressing digital competence in relation to language anxiety (Russell, 2020).

Written interaction may be a beneficial form of in-person classroom contribution, and ways to integrate this into in-person teaching should be explored. Students reported using chat functions as a way of regularly contributing during online seminars, which matches our observations. One author took advantage of this by deliberately using the chat; the students were to respond to a question in the chat, and chat responses were subsequently used as the basis for breakout room discussions. Yarmand, et al. (2021) also found that 80% of students were comfortable contributing via chat, compared with only 45% via spoken communication. Returning to the classroom, it seems that teachers could try and capitalize on this willingness to contribute in writing. In an attempt to capture the thoughts and questions of students who are willing to participate in writing but not vocally, one of the authors has instituted a classroom practice where blocks of sticky notes are distributed around the class for students to use at any time, similar to the “Parking Lot” method (Mason, 2020). This method has the additional benefit of helping students with ADHD who are afraid of forgetting their questions; they can record their questions on sticky notes and address them with the teacher at an appropriate time (Storment, 2008). As stated in Haslam et al. (2020), students benefit from increased autonomy and having the flexibility to complete tasks how they see fit. The same may be said for how they participate in class, whether through written or spoken language.

Focusing more time on explicitly teaching, modelling and reflecting on teaching and learning strategies (TLS) may lead to more successful learning, particularly during shifts between environments. While we initially thought that in-person TLS appeared to work equally as well as online TLS (Haslam et al., 2020), the results from the student survey did not always support this. For example, in order to successfully complete group work online, TLS may be needed to scaffold students’ achievement. One such TLS could be to explore assigning roles as a method to scaffold breakout room discussions (Herrera-Pavo, 2021). This may also be beneficial to the students in their own future teaching, as providing roles for pupils during group work can be beneficial (Thurston et al., 2020). Therefore, in this case higher education teaching can be seen as a model for the students.

Additionally, TLS to decrease ‘Zoom fatigue’ may be beneficial, for example, to help reduce cognitive load (Bailenson, 2021). A simple example would be showing students how to turn off the ‘self-view’ mode, as constantly seeing a video of oneself leads to greater reported rates of self-focused attention (Bailenson, 2021). In the language education courses in focus of this study, during the ‘think’ stage of ‘think-pair-share’ or during other individual work, one author prompted students to turn off their cameras; this may have also led to reduced fatigue. Whilst students may have a wide variety of TLS for in-person learning, teachers need to assist students by helping them acquire new online strategies, even if the teachers are using familiar teaching techniques. This may become more significant in the future, if more teacher education moves to online modes.

Student perceptions and experiences seem to vary widely, and there appears to be no one-size-fits all solution; therefore, teaching should include a wide variety of approaches to support all learners. While we reflected that we had taken steps to increase learner autonomy, allowed space for peer interaction (e.g. use of breakout rooms) and attempted to employ silence as a tool (Haslam et al., 2020), the survey respondents did not always share perceptions of

how successfully this was done. Some students reported positively about their time spent on Zoom and some went so far as to state that they would prefer to have all teaching via Zoom. Other students reported negatively, stating that social interaction was less during online learning, and that breakout rooms did not feel meaningful. Teachers may consider offering social opportunities for learners on Zoom outside of class time, encouraging students to meet together in person when possible, or offering digital office hours (Russell, 2020). For students who feel that digital environments suit them well, providing digital equivalents of physical courses may help these learners to learn more comfortably. It appears that a learner community cannot be built in the seminar alone; other ways of interacting and socializing seem to be important in addition to seminar time.

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Impact of Covid-19 Pandemic on Pre-service Teacher's Practices and Readiness

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This follow-up paper reports on how the pandemic and the diverse delivery modes affected pre-service teachers' (PST) e-readiness and the teaching practices they have employed during the design and presentation of a STEM fair. The study participants are six pre-service teachers who participated in either an online STEM fair, a face-to-face fair or both modes in Spring 2021 and Fall 2021. Data include coded responses from a reflection questionnaire, STEM-designed materials, and presentations. The first finding of this study is that all PSTs improved their e-readiness during the pandemic, manifested by their perceived readiness and the ability to design and deliver STEM fair activities using new technological tools. Secondly, PSTs highlighted the importance of online community for interacting with classmates-technology-course instructors in real classroom settings as part of their teaching practices. Implications entail an imminent need to invest in teacher preparation programs, especially with new technologies, if we want the modernization of pedagogies to match the demands of our highly digitalized systems.

Keywords: Pre-service teachers; STEM fair; Teaching practices; e-readiness; COVID-19; Online education.

HISTORICAL REVIEW

The abrupt closure of schools and universities in March 2020 after the outbreak of the COVID-19 pandemic accelerated the digital transformation and created a new learning situation for everyone. Higher education institutions (HEIs) resorted to online learning as a remedy for universal lockdowns. The emergency transition to online teaching and learning (OTL) has brought the need for teachers to foster their digital skills (European Commission, 2020) and adopt new or existing ways of teaching (Damşa et al., 2021; Núñez-Canal et al., 2022). Faculty members from the Department of Education, emphasizing teacher preparation, had to improvise and make fast decisions when the pandemic started. Evagorou and Nisiforou (2020) described how a STEM fair was shifted online by reporting on students' readiness to adapt to online activities and interactions. After March 2020, the researchers continued engaging pre-service teachers with STEM fairs to provide authentic experiences to pre-service students, supporting them to explore relevant knowledge, challenge their skills, and provide them with the opportunities to work with students in smaller groups (i.e., Mbowane et al., 2017). By engaging pre-service teachers in designing and implementing interactive STEM activities, the teachers can improve the pedagogical skills that will assist them in the classroom (Berisha & Vula, 2021). This is supported by studies that exemplify the importance of teacher preparation programs emphasizing theoretical perspectives of education and supporting PSTs in designing and implementing activities in real settings (Smith & Guess-Newsome, 2004). The ongoing pandemic and school protocols between March 2020 and today forced us to adopt different forms of interactions with PSTs. For example, in Spring 2021, we were still teaching online and could design an online STEM fair because of limitations with visiting schools. In Fall 2021, we were able to have a STEM fair taking place in a primary school environment. This follow-up paper aims to present PSTs' voices on how the pandemic has impacted their pedagogical skills and technological e-readiness, as this is discussed within the context of two STEM courses. Specifically, the research questions guiding the study are: (a) What are pre-service teachers' views on the usefulness of STEM fairs in the different modes (online and face-to-face)?; (b) How the mode of the STEM fairs might have affected pre-service teachers' teaching practices and e-readiness?; and (c) What are pre-service teachers' views on how the pandemic has affected their preparation?

PROCESS/METHODS

The study participants were six pre-service teachers (PSTs) studying to become K-6 teachers who attended two STEM education-related courses during two consecutive academic semesters (Spring 2021 and Fall 2021) at the University of Nicosia, Cyprus. The six students were chosen from a total of 45 who participated in the two STEM fairs because they represent students who either participated only in one type of fair or in two different types of fairs during that time. The PSTs' profiles are presented in Table 1.

The course instructors (authors) engaged the PSTs in the STEM fair to provide an authentic learning experience (see Avraamidou & Evagorou, 2007 for details on STEM fairs for PSTs) and support PSTs in developing their pedagogical practices. Two STEM fairs were organized following different delivery modes: the first one run online and the second one with physical attendance at a school with the participation of students. Due to COVID-19 protocols, the Spring 2021 STEM fair was implemented online, whereas the Fall 2021 STEM fair was held in a primary school. Some PSTs participated in both fairs (see Table 1).

The development of the online fair involved four steps, and the process is outlined in an earlier paper that portrays the online STEM fair (Evagorou & Nisiforou, 2020). The PSTs designed an interactive activity to engage primary school students during the face-to-face STEM fair. Throughout the fair, the PSTs prepared working stations for groups of 2-3 students who visited each one of the stations and interacted with the activities and the materials.

The following data were collected to address the research questions of the follow-up study:

1. An online survey with 20 questions (open-ended and Likert scale) was designed to collect PSTs':
 - (a) views on their participation in the two modes of the STEM fair delivery,
 - (b) perceptions of their level of e-readiness, and
 - (c) views on how their preparation was affected by the pandemic. The responses were open-coded independently by the two authors.
2. PSTs' teaching materials (lesson plans, activities) and STEM fair presentations were collected to explore their teaching practices. The materials were open-coded, and the STEM fair presentation was coded using the same criteria.

Table 1
Profile of the Pre-Service Teacher Participants

Name	Mode of fair/ Semester	Teaching practices	Reported e-readiness ¹ before the pandemic	Reported e-readiness after the pandemic
Anastasia	Face-to-face Fall 2021	Interactive teaching, questions for students, an invitation to try the activity themselves, adapted activity to different students, and no use of technology.	Moderate	Competent
Stella	Face-to-face Fall 2021	Interactive teaching, questions for students, an invitation to try the activity themselves, adapted activity to different students, and no use of technology.	Moderate	Competent
Olga	Online Spring 2021	Interactive teaching, questions for students, shared experiences, and examples, utilizing a variety of content, appropriate use of digital technologies, creating digital content, using an online platform to facilitate teaching and learning, authentic online learning activities, and communication using technology.	Novice	Competent
Demetra	Online Spring 2021	Engaging PSTs in activity by asking questions, facilitating discussion between PSTs, sharing examples, incorporating digital technologies, creating digital content, and using an online platform to facilitate teaching and learning.	Moderate	Competent

¹ E-readiness level was rated on a 3-point Likert scale 1= Novice, 2= Moderate and 3 = Competent

Table 1 continued

Name	Mode of fair/ Semester	Teaching practices	Reported e-readiness ² before the pandemic	Reported e-readiness after the pandemic
Christina	Both Spring 2021 and Fall 2021	<u>Online</u> : Used various resources and digital tools, engaged PSTs by asking questions, shared examples, used digital technologies, created digital content, and used the online platform to facilitate teaching and learning. <u>Face-to-face</u> : Interactive teaching, questions for students, an invitation to try the experiment themselves, adapted activity to different students, no use of technology.	Moderate	Competent
Anna	Both Spring 2021 and Fall 2021	<u>Online</u> : Lack of digital literacy skills, low communication skills, inability to engage PSTs with questions, communication with PSTs limited. <u>Face-to-face</u> : Interactive teaching, questions for students, an invitation for students to try the activity themselves, did not adapt to individual students, no use of technology.	Novice	Moderate

RESULTS

(a) What are PSTs views on the usefulness of STEM fairs in the different modes (online and face2face)?

All PSTs who engaged in a face-to-face STEM fair with primary school students reported that their most critical aspect was interacting with students in the classroom. One PSTs said, “*Interacting with students and the excitement and interest the students showed during the fair was worth all the preparation*” (Anastasia). Furthermore, all students reported that they were more confident working with primary school students after the STEM fair, and for most of them, it was their first opportunity during their studies to do so. Christina said, “*During the fair, I felt more confident that I can work with students. It also helped me solve some of my questions and understand that each student has a different way of learning*”.

All PSTs who engaged in the online STEM fair with primary school students reported that interaction with their classmates and teachers was the most important aspect for them. They could resolve their questions through these interactions. For example, Olga said, “*Exchanging ideas about my activities with my classmates and the teachers was helpful for me*”. Furthermore, all PSTs talked about the role of technology in the online fair, which was not evident in the face-to-face fair. Specifically, they commented that the online STEM fair helped them discover new technological tools that can be used by the students or the teachers and increase interactivity in the classroom. Demetra, for example, stated, “*I learned about the existence of new technological tools that could make the class more interesting for the students and provide more interactivity. I used augmented reality activities to present planets to the class*”.

Overall, PSTs appreciated the opportunity to engage in an online STEM given the restrictions of the pandemic and understand the usefulness of the technological tools, but at the same time highlight the importance of interacting with students in schools.

(b) How the mode of the STEM fairs might have affected pre-service teachers’ teaching practices and e-readiness?

Based on the analysis of the PSTs’ reported e-readiness, all participants have improved, regardless of the mode of the STEM fair (see Table 1). Furthermore, the PSTs materials and activities analysis shows that those who engaged in online fairs were competent in using digital tools. Still, those in a face-to-face STEM fair did not use technological tools in their activities. As summarized in Table 1, there is no indication that the type of STEM fair affected PSTs’ teaching practices.

² E-readiness level was rated on a 3-point Likert scale 1 = Novice, 2 = Moderate and 3 = Competent

(c) Pre-service teachers' views on how the pandemic has affected their preparation?

In their reflections on how the pandemic affected their preparation, the PSTs highlighted the following points: (a) online learning can still be interactive, and various technological tools are available, and (b) face-to-face interaction with students is still very important for their preparation, (c) interaction with other PSTs in the classroom is essential, (d) interaction with their teachers in the classroom is significant. A representative response from the student who participated in the online STEM festival only *"I feel that two years were taken away from me. Two years without implementing interactive activities in a real environment with students. Yes, other solutions were available to continue our studies, but the activity is not the same if you do not interact with the students per se"* (Demetra). Students participating in the online and face-to-face STEM festival were more confident in integrating new technologies into their teaching practices. The students stated that the pandemic forced them to cultivate digital skills and adapt to the new normal.

CONCLUSIONS AND IMPLICATIONS

The first finding of this study is that all PSTs of our study were able to **improve their e-readiness during the pandemic**. This outcome is supported not solely by their perception of e-readiness but also by their ability (for those involved in online fairs) to design and deliver STEM fair activities using new technological tools. Pre-service teachers should be taught how to use technology so that they are equipped to apply the knowledge and skills acquired in their professional practice. This is also linked with previous research that declared the importance of instructors as role models in inspiring students to integrate technology effectively into their teaching practices (Irons, 2021; Tondeur et al., 2017; Uerz et al., 2018).

A second study finding draws on the **importance of working with students in actual classroom settings**, as reported by the PSTs. This finding is aligned with previous studies (i.e., Smith & Guess-Newsome, 2004) that have identified the need for PSTs to work with students to improve their practice. Since they need to transfer their knowledge to practice and experience classroom teaching conditions (Avraamidou & Evagorou, 2007). The originality of this finding is linked to the fact that PSTs compare similar experiences using a different mode of delivery, and we are not aware of any studies comparing online experiences with face-to-face experiences, especially during the pandemic.

A third finding is that PSTs **appreciate the online interaction and collaboration with other classmates and their course instructors**. It is noteworthy that online interaction with PSTs can enhance their sense of online community. In line with this result, several studies revealed the significance of online interaction and presence in student satisfaction, engagement, and learning (Cavinato et al., 2021; Croxton, 2014; Kyei-Blankson et al., 2019;).

A fourth finding was the **lack of pre-service teachers' knowledge and skills in applying their e-readiness skills to pedagogical practices**. Even though most teachers perceived readiness to teach online, they did not rely on using specific digital tools. Recent research shows that teachers are not adequately prepared to develop and teach practical online courses (Nisiforou et al., 2021).

The above findings appear valuable in several ways as a medium to resume pre-COVID education practices and are discussed in line with the current findings of the literature. One of the main limitations of the pandemic for teacher preparation programs is that COVID-19 protocols did not allow pre-service teachers to interact with students in schools. This evidence emerges the need to adopt new or existing ways of teaching (Damşa et al., 2021; Núñez-Canal et al., 2022).

In addition, the research tool of the study records PSTs' perceptions about their digital skills and does not objectively measure their fundamental digital skills and usage. A further study needs to explore the actual level of e-readiness by evaluating a range of factors that might impact their readiness to teach with technology (i.e., technical, pedagogical, and administrative readiness).

Given the findings above, higher education institutions can offer online teaching opportunities (e.g., via webinars) and workshop sessions covering technical and pedagogical support. Appreciating that PSTs need adequate time to explore and adjust to new teaching and learning approaches, instructors can act as inspiring role models to accelerate the digital transformation through authentic learning settings. In addition, teacher education experts should redesign the existing curricula to integrate innovative, pedagogical approaches, focusing on interactivity, authentic learning, and personalization to ensure continuous skills development. Consequently, effective professional development and teacher training programs must be tailored to the teachers' various needs and backgrounds (Darling-Hammond et al., 2017; Darling-Hammond & Hyler, 2020).

Ultimately, there is an imminent need to invest in teachers' professional development, especially in new technologies, if we want the modernization of pedagogies to match the demands of our highly digitalized systems (European Commission, 2020). This necessity can be supported through a series of actions related to teachers' digital skills development, technological and pedagogical support, synergies between teachers' community-society and industry, curriculum reform, investment in infrastructure, continuous monitoring, and evaluation of the quality of the implementation process.

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Using Lessons Learned from the COVID-19 Pandemic to Strengthen the Professional Development of PSTs

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Professional development (PD) can be used to foster and enhance pre-service teachers' development as an educator. This chapter describes how PedsAcademy® faculty used lessons learned from COVID-19 to change how University of Central Florida pre-service teachers engage in daily PD offered during their semester-long internship at Nemours Children's Hospital and reports on the effectiveness of these PDs. Combining synchronous and asynchronous learning opportunities, interns learn disease-specific conditions that impact student learning and technology tools to promote student engagement and critical-thinking. These embedded PDs align with internship goals and include reflection and feedback from faculty. A variety of data were collected to evaluate PD effectiveness and determine that interns benefitted from the PDs. Data sources included: module quiz data, summative reflections, anonymous end of semester survey responses, pre-posttest scores, and social media posts. While the quantitative findings showed no statistical significance in interns' content knowledge related to disease-specific PDs, the qualitative findings indicated interns developed a self-confidence for teaching chronically-ill children and increased their knowledge and experience using technology tools. The majority of interns also self-reported that the PDs were highly-effective or effective and they were highly likely or likely to use the PD content in their future classrooms. Implications for teacher preparation and teacher education are discussed, including the potential use of social media to demonstrate student learning and as a research tool.

Keywords: preservice teachers, professional development, reflection, technology, teacher candidates, STEAM and STEM learning, students with chronic illnesses, students with disabilities, social media

HISTORICAL REVIEW

What is PedsAcademy®?

Since 2018, over 100 pre-service teachers (PSTs) have interned at PedsAcademy®, a partnership between the University of Central of Florida and Nemours Children's Hospital (NCH). STEAM (Science Technology Engineering Arts Mathematics) focused, elementary, early childhood, secondary, and exceptional education majors can apply and complete a semester-long internship teaching children with chronic illnesses bedside or in the PedsAcademy® classroom. This collaborative clinical model uses a gradual release of responsibility, embedded professional development, on-going reflection, and feedback (Kelley et al., in press) to prepare PSTs to meet the needs of all children--regardless of illness or disability throughout their hospitalization (NCH, 2022), combining a teacher-residency model (Snow, 2015) with a professional development school (Hunzicker, 2018; Kelley & Grysko, in press; National Association for Professional Development Schools, 2021).

Impact of COVID-19 on PedsAcademy® Professional Developments

Professional development (PD) is at the heart of PedsAcademy®. PedsAcademy® interns receive technology and disease-specific PD. Prior to COVID-19 the Hospital School Teacher (HST), who supervises the interns at the hospital, facilitated PD an hour a day in the PedsAcademy® classroom. As follow-up, the HST and the university-based clinical coordinator could quickly determine from lesson plans and observations if interns were applying PD learnings. COVID-19 forced a shift to a remote internship model, therefore PD was offered virtually. The disease-specific PDs were delivered synchronously through Zoom and a digital “choice-board” approach (Flowerday & Shell, 2015) which was used for the technology PD (Grysko, et al., 2020). Interns were given “a menu of PD options to choose from, each focused on a different technology tool for enhancing student engagement and learning” (Grysko et al., 2020, p. 500). Our guiding question was to determine the effectiveness of virtual PedsAcademy® PD in terms of intern learning. Since PD follow-up within the internship was impossible, we relied on reflection and anonymous survey data to gauge interns’ learning.

The 3-R format of reaction, relevance, and responsibility was used to assist interns’ reflections on their PD experiences. To analyze the interns’ reflections, holistic coding, in vivo coding, and code mapping were used (Saldaña, 2016). Reflection analysis demonstrated interns gained “a deeper understanding of the instructional accommodations needed to support children with chronic and complex medical issues and the ways technology can be utilized to enhance students’ learning” (Grysko et al., 2020, p. 501). On the anonymous survey given to evaluate the PedsAcademy® internship experience, using a Likert Scale interns self-reported that the PDs were either effective or highly effective and that they would be likely or highly likely to implement the content in their future classrooms.

Lessons Learned from COVID-19

Our COVID-19 experience reinforced the idea that effective teacher preparation should include embedded PD and continuous reflection (American Association of Colleges for Teacher Education, 2018). Using a formal reflection format (e.g., 3-R) helped interns critically reflect on their PD learning and using Zoom with interactive features (e.g., chat and breakout rooms) encouraged collaboration and promoted engagement. Furthermore, an unexpected finding was that social media helped develop and nurture a professional learning community. During COVID-19, the GroupMe application used by faculty to support the PedsAcademy® internship experience, was spontaneously used by interns to post their own experiences and PD learnings.

PROCESS/METHODS: WHERE WE ARE TODAY

From COVID-19 we realized that PD can be effectively delivered virtually. Therefore, we continued some of the PD practices we employed during the height of the Pandemic as we returned to a face-to-face internship. PedsAcademy® interns still engage in an hour of PD each day, however it is now through online modules. Nine modules have been developed, as described in Table 1. The content of these modules reflects the technology tools interns have available in the PedsAcademy® classroom and the specific diseases/chronic conditions they will likely encounter at Nemours. While the choice board approach was successful during the Pandemic the content of the PD was not embedded in the internship and did not include any follow-up. Therefore, interns were not observed using the PD they engaged in. Recognizing that this is integral in determining the effectiveness of PD the choice board approach was abandoned since interns would be using the technology tools in their internship with patients. Some of the choice-board activities, however, have been included in modules and the content can be immediately applied with patients and used as a resource once PD is completed.

The modules include multimodal instruction via synchronous and asynchronous activities. Each technology module includes the benefits of the tool and video examples. When available a video of the technology tool used with a patient is included, along with suggestions for integrating the tool into academic content (e.g., mathematics and science), tips for implementation, additional resources to support the use of the tool (e.g., applications and links to lesson plans), and ways to immediately implement the tool with patients. As follow-up, the HST demonstrates how to use the technology when instructing chronically-ill students. Interns are then expected to use the technology with patients. For example, after participating in the robotics PD, interns conduct LEGO robotics projects with patients to provide educational enrichment and promote critical thinking and problem-solving skills.

Table 1
Professional Development at PedsAcademy®

Technology-Related PD	
Session Title	Purpose(s)
<i>Robotics: Wonder Workshop</i>	To teach interns how to utilize robots and computers to promote student engagement in hands-on knowledge application, problem solving, logic skills, algorithm creation and use. Specific tools taught include Dash, Dot, and Cue,
<i>Robotics: Ozobots and Sphero</i>	To teach interns how to employ Ozobots and Sphero to help engage students in higher-order thinking processes while learning about robotics and programming.
<i>Augmented/Virtual Reality: Merge Cube and Quiver</i>	To teach interns how to employ MERGECube and Quiver (augmented reality learning tools) to provide meaningful multi-sensory learning experiences.
<i>Robotics: LEGO WeDo 2.0</i>	To teach interns how LEGO WeDo 2.0 can be used to engage and motivate students' interest in learning science- and engineering-related subjects.
<i>3-D Printing</i>	To teach interns the variety of ways 3D printing can be used to develop students problem-solving skills and promote creativity.
<i>Robotics: Lego Mindstorms EV3</i>	To teach interns how to employ LEGO MINDSTORMS Education EV3 to deliver hands-on, engaging, cross-curricular STEM learning that helps develop creativity, critical thinking, collaboration, and communication.
Disease-Specific PD	
Session Title	Goal(s)
<i>Brain and Spinal Cord Injuries</i>	To inform interns about the types, causes, and effects of brain injuries as well as related implications for teaching and learning.
<i>Developmental Disabilities</i>	To inform interns about developmental disabilities, in their various forms, and relay evidence-based interventions that can support students with these disabilities in the hospital and educational settings.
<i>Childhood Cancer and Blood Diseases</i>	To provide resources and inform interns about childhood cancer as well as how to effectively address the educational needs of students with cancer.

Each disease-specific PD module includes a pre-recorded presentation by the HST, along with resources for teaching students with each disease/condition, ways to support learning in the classroom and at home, and suggestions for 504 and Individualized Education Plan goals. For example, students with traumatic brain injury (TBI) are eligible for exceptional student education services under the Individuals with Disabilities Education Act (IDEA, 2004). Therefore, interns learn different classroom accommodations and strategies that can be utilized to support students with TBI in the classroom. Interns are expected to use the information from the modules when planning lessons with patients.

Research Question and Data Collection

As we transitioned back to a face-to-face internship, our guiding question shifted slightly. We wanted to now determine the effectiveness of both synchronous and asynchronous PedsAcademy® PD in terms of the interns' teacher development utilizing a mixed-methods approach. A mixed-method research design integrates both quantitative and qualitative data to support and elaborate on findings (Onwuegbuzie & Mallette, 2011). To do this we revised previously used instruments and developed additional evaluation tools to determine the effectiveness of the PedsAcademy® PDs. Our previous guiding question relied primarily on qualitative data; therefore, we had hoped adding some quantitative measures would help us to elaborate on findings and implications for teacher preparation. For each PD module interns must complete a related quiz with a score of 80% or higher. Figure 1 includes a question from the Lego WeDo 2.0 module. To provide

more PD support, the GroupMe application is now intentionally used by faculty and interns, thus postings provide evidence of professional learning and teacher development. Other data sources used to determine how PD has enhanced interns' teacher development include a new summative reflection (Figure 2), a revised end of internship survey, and a new pre-posttest. Figure 3 is an example of a question from the pre-posttest. This pre-posttest was added in the spring of 2022 to provide another quantitative data source to evaluate interns' learning of the PD content over the semester.

Question 6	1 pts
<p>WeDo 2.0 gives students the opportunity to develop which of the following computational thinking skills using the engineering design process (select all that apply):</p>	
<input type="checkbox"/> Decomposition	
<input type="checkbox"/> Synthesis	
<input type="checkbox"/> Generalization	
<input type="checkbox"/> Evaluating	
<input type="checkbox"/> Abstraction	

Figure 1. Lego WeDo 2.0 Module Quiz Question.

<p>Summative Reflection Questions:</p> <ol style="list-style-type: none"> 1.) How did this internship impact you personally? As an educator? 2.) What were the most challenging aspects of this environment? How did you overcome them? 3.) What is your #1 take-away from his experience? 4.) How do you anticipate the PedsAcademy® internship experience influencing your future career in education? 5.) What are some ways we can improve this internship experience for other teacher candidates?
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Figure 2. PedsAcademy® Summative Reflection Prompts.

Question 10	1 pts
<p>Which of the following is the most appropriate way for a second-grade teacher to ensure that a student who uses a hearing aid will be able to participate in class discussions?</p>	
<input type="radio"/> provide alternate assignments so that the student does not have to share verbal responses	
<input type="radio"/> turn toward the student when speaking and use an amplification system	
<input type="radio"/> reduce answer choices on assessments	
<input type="radio"/> assign a paraprofessional to work 1:1 with the student during whole group instruction	

Figure 3. Example of Pre-Post Test Question.

RESULTS

Summative Reflections

Rodesiler (2020) emphasized that reflection is an important aspect of PD, as it helps PSTs relate their experiences to their future practice and self-directed learning. Figure 2 is the end of semester summative reflection designed to encourage interns to review prior practices and thoughts as a lens into future practice or thinking (Beauchamp & Thomas, 2009; Conway, 2001). NVivo software was used to analyze reflections ($N=67$) from four semesters (fall 2020 - spring of 2022) to determine the words interns used most frequently. This led to the emergence of five themes. One theme identified was the role of professional development for continued growth as an educator (Jacob & Lefgren, 2002; Joyce, 1993).

Many interns describe how their knowledge of how to teach students with chronic illnesses has contributed to their teacher development and will help them be a better educator. These reflections demonstrate self-confidence for teaching (Ashton & Webb, 1986; Mojavezi & Tamiz, 2012; Smylie, 1989; Tschannen-Moran & Hoy, 2001). One intern wrote,

My number one takeaway from this experience is my newfound knowledge of the chronic illnesses and disabilities that plague our country's youth. I had no idea that so many children struggle with a chronic illness and the effect it has on their daily education. I learned about illnesses like Cerebral Palsy, Leukemia, Traumatic Brain Injury induced cognitive delay, and Strokes. I think this new knowledge makes me a better educator and human, because I am able to assist children with special circumstances better than I was before.

Similarly, related to technology PD, interns highlight how their knowledge and experiences using technology tools has increased. As one intern noted,

My #1 takeaway from this experience has to be the professional development offered here at Nemours with PedsAcademy. I have been thoroughly trained on the newest educational technology that students love such as Lego WeDo2.0, Augmented and Virtual reality, Ozobots, DashRobot, Quiver, MergeCube, 3D printing. These enriching experiences cannot be matched, as I have gained professional development that I can utilize all throughout my career.

The summative reflections also provide us with suggestions to strengthen PedsAcademy®. An intern recently recommended we add a module on hospital/homebound (H/H) services. In Florida, students absent from at least 15 school days due to a medical condition become eligible to receive H/H services via their public school district. The purpose of H/H services is to meet the student's individualized educational needs during confinement to the home or hospital. Many patients at NCH participate in their district's H/H program. The HST often initiates the H/H referral process, assisting families with completing the application forms, and supplying information related to the educational implications and limitations of the illness so that the H/H teacher can provide appropriate instruction. After taking part in the PedsAcademy® internship, many interns have expressed interest in becoming a H/H teacher, thus a H/H module would be a value-added PD experience, one they would not typically receive in our teacher educator program.

End of Internship Survey

Several questions on the interns' anonymous end of semester survey focus on the PDs offered at PedsAcademy®. Interns are asked to rate the effectiveness of each specific PD and how likely they would be to implement each PD. Table 2 represents an average of this data over each semester given. Over three semesters, 99% of interns reported that the disease specific PDs were effective or highly effective and 95% were likely or highly likely to use the content in their future classroom. 91% reported the technology PDs were effective or highly effective and 90% were likely or highly likely to implement in their future classrooms. They are also asked to identify which technology and chronic disease PD was most beneficial for them while in their internship. A different technology tool and chronic disease PD has been identified each semester, however this is not surprising since the patients and interns change each semester and this would influence their selection.

Table 2
Intern Perception of PD ($N = 35$)

Semester	Rated the Effectiveness of Chronic Disease PD Effective to Highly Effective	Rated the Effectiveness of Technology PD Effective to Highly Effective
Spring 2022 ($n = 9$)	98%	83%
Fall 2021 ($n = 9$)	100%	92%
Spring 2021 ($n = 17$)	100%	97%
Semester	Rated the Future implementation of Chronic Disease PD Likely or Highly Likely	Rated the Future implementation of TechnologyPD Likely or Highly Likely
Spring 2022 ($n = 9$)	87%	83%
Fall 2021 ($n = 9$)	100%	96%
Spring 2021 ($n = 17$)	98%	90%

Pre-post Tests

As previously mentioned, the pre-posttests were added as a requirement during spring 2022 to further determine internship PD effectiveness. With a sample of 11 interns, the pretest mean was 38.41 ($SD = 3.12$) and the posttest mean was 40.91 ($SD = 4.58$). We expected the scores to increase, however we did not anticipate the pretest scores to be as high as they were. One explanation could be due to the selectivity of the interns chosen, as they typically have some personal connection which led them to apply, such as experiencing a critical illness in their youth.

The dependent t test was conducted to determine statistical significance and the results indicate that the means were not statistically different ($t = -2.144$, $df = 10$, $p = .058$). Thus, the null hypothesis that the pretest and posttest means were the same at both points in time was not rejected at the .05 level of significance. The effect size d (calculated as the mean difference divided by the standard deviation of the difference) was .65. Using Cohen's (1988) guidelines, this is a medium effect. The results do not provide evidence to support that interns' mean score prior to PedsAcademy® is different from that after PedsAcademy®.

The lack of significance may be explained by the post-hoc power analysis, which revealed that the study was underpowered. A post-hoc power analysis was conducted given a two-tailed test, with an observed effect size of .65, an alpha level of .05, and total sample size of 11. Based on these criteria, the post-hoc power was .49, thus the probability of rejecting the null hypothesis when it is really false will be about 49%. To achieve an acceptable power of .80, a sample size of around 21 would be needed. Thus, to achieve more accurate results, the dependent t test should be replicated with future PedsAcademy® cohorts that equal or exceed 21 interns.

GroupMe

Social media, such as Twitter, can provide informal PD activities, through which PSTs can take part in professional discussions and network with in-service educators in ways not typically possible in traditional PD (Carpenter, 2105; Reilly, 2017). Faculty and interns at PedsAcademy® use GroupMe to facilitate communication and foster collaborative professional conversations. Figure 4 shows how the HST used GroupMe to follow up on a PD. On GroupMe, faculty and interns regularly post pictures from lessons completed with patients using the technology tools learned in a PD session. The photograph in Figure 5 is a lesson using the application Quiver with a patient. Figure 6 is a post that describes a lesson an intern did incorporating 3-D printing with a read aloud. This space is also used to share other resources related to PD learning, as noted in Figure 7.

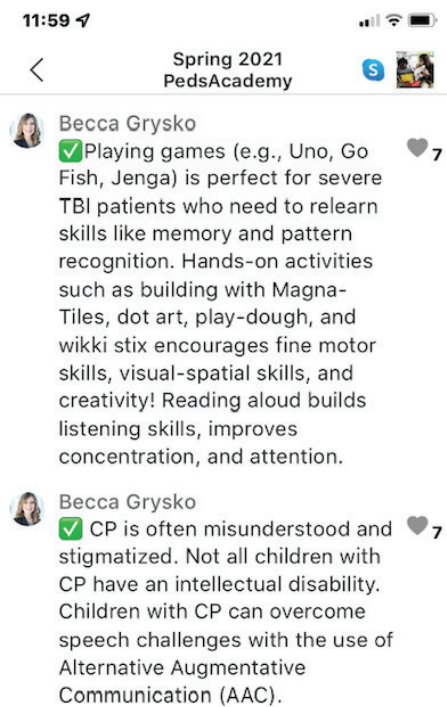


Figure 4. GroupMe Post: Example of PD Follow Up.

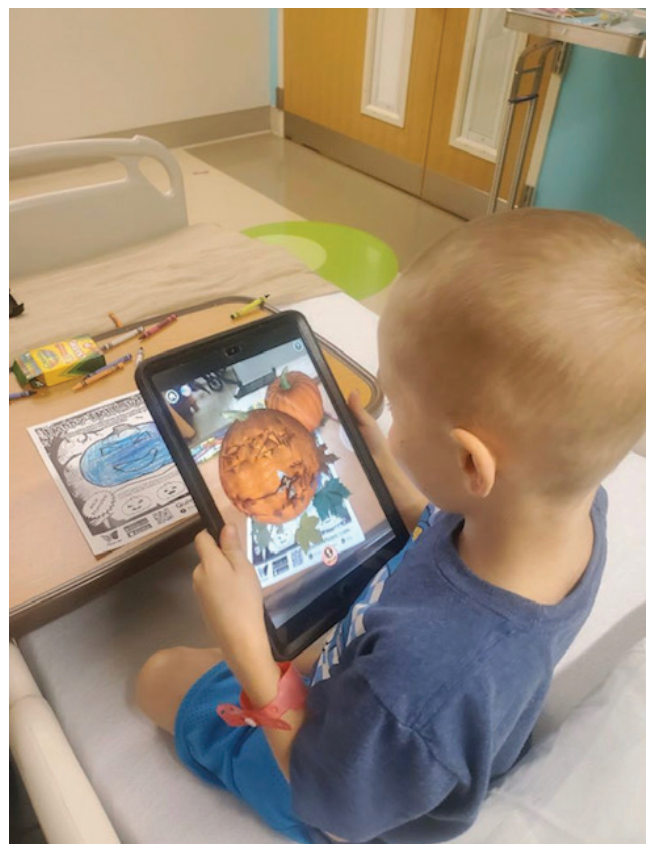


Figure 5. GroupMe Post from Intern Using the Quiver App with a Patient.

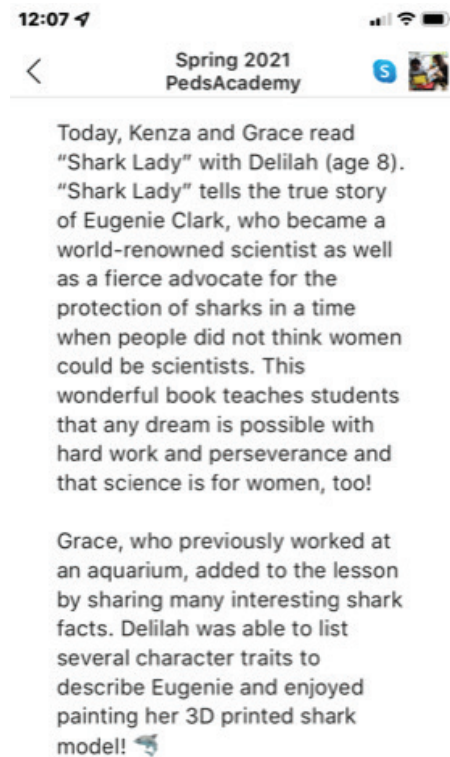


Figure 6. GroupMe Post of Intern Integrating the Use of 3-D Printer with Patient.

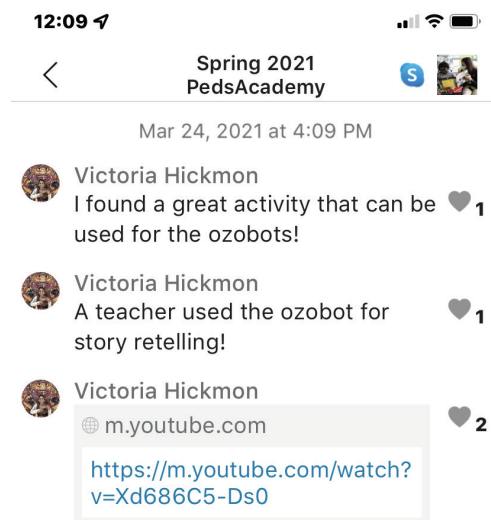


Figure 7. GroupMe Post of Intern Sharing Resources Related to Ozobot PD.

IMPLICATIONS

Educators improve their teaching through engagement in PD which is sustained, collaborative, occurs in a classroom context, and includes feedback and reflection (Darling-Hammond, et al., 2017; Mizell, 2010). PD for PSTs has shown promise in the fields of English-Language Arts (ELA) (Rodesiler, 2020) and science, technology, engineering, and math-

ematics (STEM) (Burton et al., 2020). PSTs engaging in STEM and ELA-related PD benefit from identity development opportunities as well as witnessing successful learning experiences and multiple pedagogical perspectives (Burton et al., 2020; Rodesiler, 2020). Tainin et al. (2018) found that technology PD enhanced PSTs' self-efficacy, value of educational technology, and frequency of technology integration. PSTs who learn about technology are more likely to use it as teachers, therefore technology education beyond coursework should model approaches akin to those of in-service teachers (Shannon & Cullen, 2020).

Our data demonstrates that PedsAcademy® interns benefited from engagement in our synchronous and asynchronous PDs which were directly related to their daily work and the internship goals. Similar to Crider et al.'s (2014) finding related to PSTs use of assistive technology (AT) tools, when given opportunity to explore technology through demonstrations, learn how to use it for instruction, and incorporate into lesson plans, our interns were more likely to employ it in their teaching. Coupled with embedded reflection and feedback (Yendol-Hoppey & Franco, 2014) intern learning and development was fostered (Kelley et al., in press). In our experience, COVID-19 limited educators' opportunities to engage in face-to-face PD, and the use of social media professionally expanded, filling a void. GroupMe assisted PedsAcademy® in creating a professional learning community. This unexpected finding demonstrates how social media can be used as a learning tool and as a data source for research. As we look ahead to the post-pandemic landscape of education, these pedagogical lessons and implications learned during COVID-19 should not be forgotten. PD for PSTs should be embedded, collaborative, reflective, and include opportunities for follow-up with feedback. We suggest that teacher preparation and teacher education programs keep these lessons learned in mind as they design PDs. By intentionally crafting embedded PD that includes both synchronous and asynchronous learning, encouraging collaboration and reflection, and providing feedback, teacher educators can effectively contribute to teacher development. Conducting PD virtually during COVID-19 taught us the value of online professional learning which we will continue to implement as we transition out of the pandemic.

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K-16 Educator Professional Development

Reflections on a Model Remote Learning Classroom as a Professional Development Strategy

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The transition to remote learning during the Coronavirus pandemic in March 2020 created a need to provide professional development to teachers in different formats. This article discusses how administration supported teachers in transitioning a small public high school in a historically underserved district within the New York City Department of Education to a remote learning environment along with the feedback gathered from the teachers. Results of a survey of teachers who participated in remote learning from March 2020 to June 2021 are shared, as well as implications for future research.

Keywords: Professional Development, Online Learning, Remote Learning, Modeling

HISTORICAL REVIEW

Supporting a school-wide transition to remote learning at the start of the Coronavirus pandemic in March 2020 found many teachers unprepared and hesitant about this new learning environment. As the research indicates, adult learning is challenging at best in an optimal school year with little disruption (Cercione, 2008; Kennedy, 1999, 2016; Reeves & Pedulla, 2013). Factor in a global pandemic that shifts learning across the nation and world to a virtual environment, and a whole new challenge has arisen. Teachers were expected to engage in virtual or “remote” online professional development at a time when they were simultaneously teaching in-person and virtually across the bulk of the United States, as well as locally in New York City as schools shifted between hybrid models and fully remote. Research conducted by Reeves and Pedulla (2013) suggests “that more teacher learning takes place when OPD [Online Professional Development] content can be transferred easily to a classroom setting.” (p. 62). This article will focus on the support provided to teachers from March 2020 to June 2021 and the feedback and survey results related to the support provided.

In March 2020, to support the transition and provide a professional learning space for the teachers, a ‘Remote Learning Model’ class was created in Google Classroom. Darbee Muelthaler (2020) states, “The purpose was to create clear, consistent performance expectations for faculty as they transitioned to remote learning, as well as provide professional development through resources, modeling, and creation of an online learning environment. This served as a model for how teachers should set up their Google Classrooms for their students.” (p. 576). The model classroom was utilized as a space for professional learning, including teachers sharing best practices and resources across content areas. This concept is still in use during this current school year based on feedback from the teachers that indicated this was a practice they wanted to maintain, even with a full return to in-person learning this school year and in-person professional development. Existing literature on professional development indicates that modeling and immediate application to practice are key indicators of successful professional development, regardless of whether it takes place in-person or online (Cercione, 2008; Kennedy, 1999, 2016; Reeves & Pedulla, 2013).

METHODS

The guiding questions for this research were: How will the creation of a model remote learning classroom impact teachers’ ability to create effective remote learning environments? and Can this strategy be applied to both remote and hybrid learning models? The strategy tested was the use of a model remote learning classroom as a vehicle for professional learning for teachers during the COVID-19 pandemic. The methods of data collection include informal feedback from staff during professional learning in June 2020, observation of Google Classrooms from the period of March 2020

through June 2021, and a survey conducted in April 2022 (See Appendix). The participants are teaching staff with a wide range of experience teaching and comfort with use of technology (See Table 1).

Table 1
Participants

Teaching Staff	Teaching Experience (Range of Years)	Teaching Experience (Average Years)	Regular Use of Online Learning at Start of Pandemic
10	1 – 20	7.1	4

The decision to collect informal feedback rather than conduct a formal focus group was made to avoid teachers feeling as if they were evaluating one another as opposed to providing feedback on the strategy itself. A remote professional learning session was held on the June 2020 Staff Development Day to reflect on remote learning practices and begin planning for the 2021-2022 school year. This session took place on Google Meet and was not recorded to ensure teachers would feel comfortable sharing honest reflections about their experiences with remote learning. Notes from this session were analyzed for common themes and responses containing instances of implementation as a result of the Remote Learning Model.

Observations of Google Classrooms to support creation of online learning environments were conducted during the periods of March 2020 through June 2020 and from September 2020 through June 2021. These observations were not evaluative in nature and were used to support teachers in creating and organizing their learning environments, as well as maintain consistency across the school community in support of student learning. The assistant principal and principal engaged in frequent monitoring of Google Classrooms and provided feedback to teachers on their Google Classrooms during both time periods.

A survey was conducted in April 2022 to collect additional data on this strategy. The survey contained six questions and was shared with 10 teachers via Gmail. The survey was anonymous, and 10 survey responses were received via JotForm. The results were sorted into a spreadsheet for data analysis.

RESULTS

The results of the data collected indicate that the model remote learning classroom was an effective support for teachers during both remote and hybrid learning, particularly as a model for organizing their virtual learning environments. Triangulated data from the informal feedback session, observations of Google Classroom, and survey results all support Knowles (1984) notion that adult learners must be included in planning and evaluating their learning, see immediate relevance to practice, and engage in problem-centered learning. The model remote learning classroom meets Knowles (1984) criteria in that it had immediate relevance to practice in that teachers were required to set up a Google Classroom as a result of schools going fully remote. The model was able to serve as a guide for teachers, especially those who were not already tech-savvy. The data also indicates that this strategy can be applied to both remote and hybrid learning environments, particularly where there is a need for teachers to either use learning management systems or create virtual learning environments in a hybrid model.

Informal Feedback

Informal feedback from the teachers gathered in June 2020 during a professional learning session indicated that the Remote Learning Model classroom was a useful tool to communicate expectations for creating an online learning environment for their students. During this session, teachers stated that the Remote Learning Model illustrated clear expectations for virtual environments and a method of organizing resources and information. They found this particularly useful for themselves, as well as to support students who were unfamiliar with using Google Classroom. Analysis of the notes from the session showed that majority of teachers agreed with this statement. Additional feedback suggested that teachers appreciated the use of the Google Classroom for teachers to post and find resources and supports, rather than having to search through the email database or Google Drive to locate shared resources. These findings support the preliminary results indicated by Darbee Muelthaler (2020) based on early feedback from teachers prior to June 2020.

Observations

Observations of Google Classrooms during the period of March 2020 through June 2020 showed a range of no organization of posted resources and assignments to environments with headings and topics to organize assignments and resources for students. Some classrooms had assignments and resources posted without any topic to separate them. The lack of topics caused confusion in that everything posted was mixed together, regardless of unit, topic, etc. Another area that needed work was the labeling of assignments. Some classrooms contained assignments posted all as ‘material’ so there was no way for students to submit their work in Google Classroom. Other classrooms had assignments clearly delineated as short response or multiple choice while resources were labeled as material.

The Google Classroom observations conducted during September 2020 to June 2021 showed growth in this area across all teachers, with all classrooms being organized similarly to the model classroom. All classrooms used categories to keep assignments and resources clearly separated. This level of organization has continued in the current school year, where Google Classroom is still used as a Learning Management System. This data supports the finding that the remote learning model classroom was effective as a model for organizing online learning environments, as well as an effective strategy for hybrid models. The organization of the learning environment was particularly useful in cases where students had to quarantine or attended in-person on a rotating schedule as it allowed them to easily track their assignments and progress through the courses. According to Holmes et al. (2010), resources provided are a key factor in the effectiveness of professional development as measured by implementation of strategies. These findings support that notion as the remote model classroom was a resource that could be replicated in teachers’ practices.

Survey Data

The data from the survey also supports the aforementioned findings for both research questions. When responding to the questions, ‘The Model Google Classroom was helpful as an example of how to organize Google Classroom’ and ‘The pre-recorded lessons posted in the Model Google Classroom were useful resources’, 90% of responses were ‘yes’. 80% of teachers indicated that the Model Google Classroom was one of the supports that was useful during remote learning (See Figure 1). Seven of the 10 responses included live sessions (i.e. Google Meet, Zoom, Teams) as a useful support.

The survey included opportunities for teachers to elaborate in a written response about the supports. These questions were designed to provide clarity in understanding the responses, as well as an opportunity to incorporate teacher voice and evaluation of the professional development, which is another of the key criteria for adult learning according to Knowles (1984). Two of the responses that elaborated on the Model Google Classroom as a helpful resource included: “These supports [Model Google Classroom; Live Sessions] were useful because they help me to sharpen my skills in using these resources” and “It [Model Google Classroom] helps with the transition from in-person to virtual. Having the tools and material makes a big difference.” These responses underscore the effectiveness of this professional development strategy, as well as its applicability to both virtual and hybrid learning environments. Again, this finding is supported by the research of Holmes et al. (2010) which suggests that online professional development can be effective, particularly when applicable and useful resources are provided.

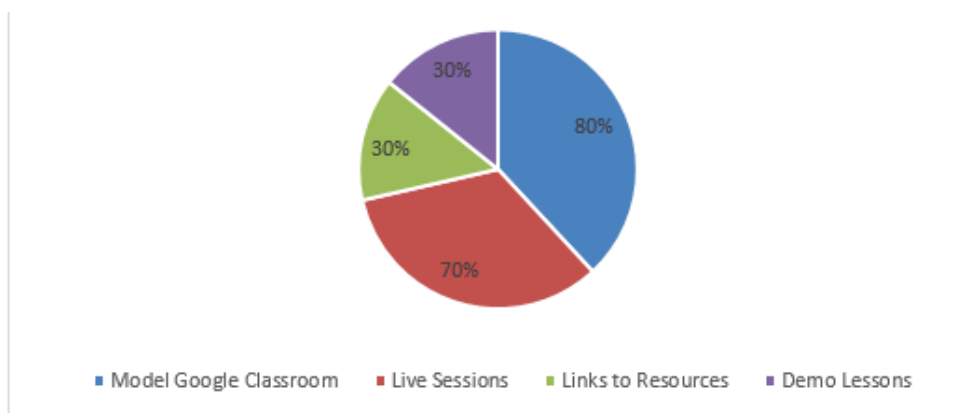


Figure 1. Useful Professional Learning Supports.

IMPLICATIONS

As schools return to full in-person learning, district and school level administrators must continue to be mindful of the ongoing needs of educators, as well as the potential need for some educators and students to continue to engage in some form of remote or hybrid learning environments. There will likely be a continued need for teachers to utilize learning management systems and new technologies to support student learning even as schools attempt to return to pre-COVID routines and practices. This need must be supported through professional development that incorporates modeling expectations and examples of how instructional practices will look in action (Darbee Muelthaler, 2020).

Training initiatives must also allow teachers to make connections between what they are learning and their instructional practice (Cercone, 2008; Kennedy, 1999, 2016; Knowles 1984). Cercone (2008) conducted a review of four adult learning theories: andragogy, self-directed learning, experiential learning, and transformational learning, and how these theories could support adult learners in an online learning environment. In her review, she notes elements of each theory and how well these elements would transfer to an online learning environment, as well as how well the theories support the characteristics of adult learners. In the case of this research, the model classroom provided an opportunity for teachers to engage in experiential learning as they created their virtual learning environments alongside one another. The resources provided in the model classroom provided numerous opportunities for teachers to engage in self-directed learning as well.

Cercone (2008) posits, “most adults conceptualize learning as an instructor-designed and instructor-led endeavor that occurs in classrooms where students sit to learn from the “sage on the stage.” (p. 138). We are asking teachers, adult learners, to shift that paradigm and participate as learners when they take part in professional development; often, professional development that they have had no hand in creating. Adult learning theories “emphasize self-direction, flexibility, and the process of learning, rather than the content. They are learner-centered and recognize the importance of a customized approach to learning.” (Cercone, 2008, pp. 150-151). It is of the utmost importance as teachers continue to build their capacity with these new skills and technologies that professional development includes modeling and immediate application to practice. Professional development must also consider that despite teachers having to rely heavily on technology for the past two years, they are still at different levels of expertise and comfortability with using these tools to impact student learning. Effective professional development must incorporate modeling and opportunities for teachers to access the resources they are expected to use so they can build their skillset to use these technologies in a productive and efficient manner that directly impacts student learning.

Holmes et al. (2010) found that there was a positive impact on the participants’ instructional practices and “social presence and teacher presence served as the greatest factors related to participants’ learning and satisfaction in this experience” (p. 82). In addition, participants specifically identified resources and ability to use the resources as key features of the professional development as it impacted their classroom practice: “Approximately 88% of the participant responses to this item [impact on teaching] claimed that the online professional development course had direct applications to the classroom instruction” (Holmes et al., 2010, p. 81). These findings are congruent with studies that find effective professional development, regardless of delivery format, must not only include content but practical, actionable strategies that teachers can implement into their pedagogical practices (Cercone, 2008; Kennedy, 1999, 2016; Reeves & Pedulla, 2013). The key ingredient for effective professional development is the ability for teachers to see the immediate practical application of the content or skills to their classroom environment and instructional practice. As the findings of Holmes et al. (2010) and Reeves and Pedulla (2013) indicate, effective professional development can be done in an online setting when it includes strategies and practices that teachers can see and replicate, such as the organization of a virtual learning environment.

Future research should be conducted determine the impact of this strategy not only on long term teacher practice but on student achievement. Student achievement data, including attendance and credit accumulation, can be analyzed to determine if improvements made in the online learning environments from remote learning from March 2020 to June 2020 as compared to the school year 2021 – 2022 impacted student learning in a positive manner.

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APPENDIX

Screenshot of Remote Learning Survey

The screenshot shows a web browser window with two tabs. The first tab is titled 'uilder' and the second tab is titled 'Remote Learning Survey'. The survey form is displayed in the second tab. The form has a title 'Remote Learning Survey' and a subtitle 'Consider March 2020 - June 2021 when responding'. The first question is 'What professional learning supports provided during Remote Learning did you find useful?' with five radio button options: 'Live sessions (i.e. Google Meet, Zoom, Teams)', 'Model Google Classroom (staff Google Class)', 'Links to Resources', 'Department of Education (Central, Borough, or District) trainings', and 'Demonstration lessons using resources (i.e. padlet, edgenuity)'. The second question is 'Why were those particular supports useful?' with a text input field. The third question is 'What supports would have been more useful during remote learning?' with a text input field. The fourth question is 'The Model Google Classroom was helpful as an example of how to organize Google Classroom' with two radio button options: 'Yes' and 'No'. The fifth question is 'The pre-recorded lessons posted in the Model Google Classroom were useful resources' with two radio button options: 'Yes' and 'No'. The sixth question is 'Select your preference for delivery of professional development. You may select more than one' with three checkbox options: 'In-person workshop', 'Live Workshop (ie. Zoom/Google Meet/Teams)', and 'Self-paced modules'.

uilder | x Remote Learning Survey x +

Remote Learning Survey

Consider March 2020 - June 2021 when responding

What professional learning supports provided during Remote Learning did you find useful?

☐ Live sessions (i.e. Google Meet, Zoom, Teams)

☐ Model Google Classroom (staff Google Class)

☐ Links to Resources

☐ Department of Education (Central, Borough, or District) trainings

☐ Demonstration lessons using resources (i.e. padlet, edgenuity)

Why were those particular supports useful?

Type here...

What supports would have been more useful during remote learning?

Type here...

The Model Google Classroom was helpful as an example of how to organize Google Classroom

☐ Yes

☐ No

The pre-recorded lessons posted in the Model Google Classroom were useful resources

☐ Yes

☐ No

Select your preference for delivery of professional development. You may select more than one

☐ In-person workshop

☐ Live Workshop (ie. Zoom/Google Meet/Teams)

☐ Self-paced modules

Building a Foundation for Ongoing Technology in Teaching: From Emergency to Sustaining Efficacy for Teacher Educators and Their Teacher Candidates

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This chapter offers a retrospective lens of the outcomes of the Remote Learning Community (RLC), a faculty-led initiative developed in March 2020 to offer professional learning for teacher education faculty engaged in emergency online teaching. A program-level iteration of the RLC professional learning model is shared in addition to data that highlights improved teaching practices with technology and current, reassessed faculty professional learning needs. Implications from 2020 are revisited and expanded upon, as future considerations related to professional learning and teacher preparation are explored. Outcomes describe how faculty navigated from emergency remote instruction to purpose-driven technology integration with increased efficiency, engagement, and efficacy.

HISTORICAL REVIEW

Introduction

In March of 2020, faculty and staff in the School of Teacher Education (STE) at a large public university in the Southeastern United States developed the “Remote Learning Community” (RLC), a collaborative support network for faculty professional learning. The RLC was developed through a “bottom-up approach” (Ward et al., 2015) to address the associated realities and challenges of “emergency remote teaching” (Lederman, 2020, para. 10; Milman, 2020, para. 3). Prior to the onset of the pandemic, faculty efficacy related to technology integration and use varied widely across programs, courses, and even among individual sections of the same course. Previous efforts to document both the use of technology tools and course activities with rich technology integration across courses in programs had been initiated yet lacked completion and consistent implementation due to a myriad of obstacles, including faculty apprehension for adopting new technology platforms (Borthwick & Hansen, 2017; U.S. Department of Education, Office of Educational Technology, 2016). Thus, “the new, rich conversations about our teacher preparation efforts and pedagogical practices” related to online teaching and learning were not only timely, but critical to navigate the changes in teaching modalities that would follow for two years after the initial pivot to emergency online teaching (Safi et al., 2020, p. 220).

Professional Learning and Efficacy: From Emergency Remote Teaching to Intentional Course and Program Improvement

As the culture of collaboration around the role and use of technology in teaching continued to strengthen, faculty in the Elementary Education B.S. program sought opportunities to extend their professional learning and tackle newly emerging questions such as: How might teacher educators identify course-related innovations implemented during the COVID remote teaching experience to refine for continued use? How might teaching educators use technology to teach concepts in ways that enhance teacher candidate and K-6 student learning experiences in a variety of elementary content areas? It had become clear that, in the field of elementary education, the competencies needed to effectively teach in face-to-face, hybrid, and/or fully remote contexts had evolved and were projected to be forever changed post-pandemic.

Research Question

The overarching research question guiding faculty efforts became: How does participation in ongoing professional learning impact both teacher educator and teacher candidate efficiency, engagement, and self-efficacy related to technology use in teaching? For the purposes of this chapter, the role and use of technology in teaching encompasses planning and teaching online (synchronous or asynchronous) and integrating technology into instruction both in instruction of teacher candidates and in the tools they are developing for their teacher skill set for use in K-6 classrooms. While this research question encompasses both teacher educators’ and teacher candidates’ technology use, this chapter will focus on teacher educators’ efficiency, engagement, and self-efficacy because this facet of the research question most closely aligns to the previously published work focused on faculty professional learning. Both course-specific and program-wide improvement efforts will be shared as a result, in addition to implications for teacher educators at large. The recently initiated data collection plan for teacher candidates’ efficiency, engagement, and self-efficacy will be shared, however, outcomes for this component of the research are not yet available at the time of publication.

PROCESS

A Program-Level Iteration of Professional Learning and Improved Teaching Practices with Technology

Transitioning from the early efforts of the RLC, faculty continued to informally share teaching practices and collaborate during the 2020-2021 academic year. When presented with a university-funded Course Redesign Initiative (CRI) opportunity in the Spring of 2021, a subgroup of faculty from the Elementary Education B.S. program organized to develop a multi-tiered project proposal to formalize collaboration around teaching with technology. The funded project, which will be highlighted in this retrospective chapter, marked the transition from emergency remote teaching to intentional course and program improvement related to technology in teaching.



Figure 1. 2021-2022 Program-Level Iteration of 2020 Remote Learning Community Efforts.

Identifying Goals

Faculty aimed to reframe the context of the pandemic as impetus to revisit, improve, and refine technology integration while simultaneously maintaining faculty engagement in professional learning on the topic. The CRI project proposal was written to include both course-specific and program-wide improvement as project goals.

Identifying Content and Course-Specific Faculty Leads

While the original Remote Learning Community (RLC) was initiated by eight faculty and staff leads across the School of Teaching and Learning, the efforts described in this retrospective chapter reflect the processes of eight content-specific faculty who teach in the Elementary Education undergraduate program. Each of the participating faculty brought a disciplinary-specific focus through the content courses they teach, collectively representing reading education, mathematics education, social science education, science education, and educational foundations/educational psychology. Additionally, these faculty have historically engaged in collaborative knowledge creation through a sociocultural approach to share teaching and learning perspectives for the development of elementary education teacher candidates (Kuusisaari, 2014).

Identifying Resources

Faculty sought resources to align with the CRI project goals and discipline-specific focus areas. These resources included 1) shared faculty knowledge of effective course design (from pre- and mid-pandemic learning and experiences), 2) faculty knowledge of their content area of emphasis with the lens to consider technology use as domain-general and/or domain-specific within coursework, and 3) topic-focused professional learning sessions offered by the university's Center for Distributed Learning (CDL).

Applying Resources

CRI project faculty engaged in review of their course syllabus and content in the learning management system, identifying areas for course improvement. In doing so, faculty considered ways to apply the previously identified resources to improve course design and organization of content, maximize student engagement, model and label meaningful technology use, and review course assignments with learning opportunities for teacher candidates to practice technology integration in mind.

Ongoing Data Collection

In addition to addressing the research question, the CRI project faculty also considered new realities and expectations of teacher candidate graduates who can teach with technology, including state legislation requiring teacher preparation programs to teach "remote teaching strategies" (FLDOE, 2021). The CRI project faculty developed and launched an Elementary Education program data collection plan designed to determine impact on efficiency, engagement, and efficacy for both teacher educators and teacher candidates. This mixed method data collection plan is outlined in Table 1.

Table 1
Mixed Method Data Collection Plan for Assessing Teaching with Technology in the Elementary Education Program

Data Collection Method	Data Source and Collection Plan	
Qualitative	Course-Specific	Document analysis of program course syllabi and course content in the learning management system to identify examples of technology integration
	Program-Wide	Document analysis of technology integration evidence previously provided for program accreditation to identify trends, areas of growth, and ongoing areas of improvement
Quantitative	Program-Wide	Re-Assessment of Course Modality Offerings to determine online teaching modalities (comparison of pre-pandemic course modalities to current course modality offerings)

Table 1 continued

Data Collection Method	Data Source and Collection Plan	
Mixed Method	Program-Wide	<p>Re-Assessment of Faculty Professional Development Needs through the development and dissemination of a modified version of the needs assessment survey from the 2020 RLC launch</p> <p>Identification of additional data sources to gauge the efficacy of teacher candidates as they plan for and deliver online instruction and/or integrate technology:</p> <ul style="list-style-type: none"> § An item assessing teacher candidate perceptions of preparation for remote teaching strategies was added to the program alumni survey (for completers in the past 3 years) to collect baseline data for future comparison § An item assessing employer perceptions of preparation of graduates to integrate technology and employ remote teaching strategies was added to the program employer survey to collect baseline data for future comparison

EARLY RESULTS AND OUTCOMES

This project sought to determine how participation in ongoing professional learning impacts both teacher educators' and teacher candidates' efficiency, engagement, and self-efficacy related to technology use in teaching using the data sources outlined in Table 1. Of the preliminary data collected, this chapter will focus on the results and outcomes related to teacher educators framed within course-specific and program-wide developments as a result of their increased efficiency, engagement, and efficacy.

Course-Specific Improvement Efforts

Course-specific improvement efforts included participation in a Course Redesign Initiative, development and modification of learning management system module content, course organization and design, matching modality(ies) to course objectives, and identification of assignments with technology integration and alignment with national standards - Teacher Education Technology Competencies (TETC) (Foulger et al., 2017) and International Society for Technology in Education (ISTE) Standards for Educators (International Society for Technology in Education, 2017).

Course Redesign Initiative (CRI) Project

The CRI project included both immediate and ultimate purposes related to improving teaching preparation. While the ultimate purpose was to strengthen the technological pedagogical content knowledge of teacher candidates so they develop self-efficacy related to technology knowledge and use, the immediate purpose was to expand upon and apply lessons learned during the pandemic to ongoing course and program improvements to increase efficiency, engagement, and self-efficacy. Faculty attended workshops on a variety of technological tools (e.g., use of Zoom, NearPod, online learning management systems) and attended regular meetings with the CRI project leaders and faculty from across the university. Faculty identified and developed course experiences to strengthen teacher candidates' use of technology for teaching by modeling and integrating technology within specific courses, engaging teacher candidates as learners using selected

tools, and then having teacher candidates plan their own use of similar technologies within their lesson plans and instruction.

Table 2 provides samples of the tools and activities used within courses during the CRI project year. These activities have been organized by area of previous concern in the 2020 faculty-administered needs assessment to visually portray the faculty growth in confidence, competence, and efficacy related to planning and delivering meaningful instruction with technology.

Table 2
Revisiting Previous Topics/Trends from 2020: Implementation in Course Redesign

Top 10 Concerns & Requests (2020 STE Survey)	Implementation of Technology Course Redesign Project 2021-2022 (Examples)
Facilitating whole class/small group instruction	Jamboard (SSE 3312, RED 3012, EDF 4467)
Incorporating interactive shared documents (i.e., Google Docs)	<i>Web 2.0 Tools:</i> Google Docs: Lesson Development / Feedback (RED 3012) Digital Notebook (RED 4519, EDF 4467) Research Log (RED 4942) PD Digital Notebook (EDE 4301) Teacher Work Sample (EDE 4301) Google Docs with Mote (EDE 4301)
Utilizing student responses before/during/following instruction	Google forms/ Exit Slips (RED 3012, SSE 3312) Padlet /Reflections (RED 3012, 4043, 4519)
Preparing and voicing over presentations	EdPuzzle (EDE 4301)
Collaborating and co-teaching with fellow instructors	Bitmoji Classroom (Collaborate, Plan, Create, Teach) (RED 4519) Internship 1 Co-Teaching Pilot Cohort (RED 4942 & MAE 4326)
Using manipulatives & available technologies	Jamboard /Word Sorts (RED 3012, 4942) Google Slides /Virtual Library (LAE 3414) Piktochart (LAE 3414) Nearpod (RED 4519) Google Earth / Mapping Skills (SSE 3312)
Connecting students & community-building	Flipgrid (RED 3012, EDE 4301) Parent Communication (EDF 4467)
Integrating document cameras and sharing screens	Elementary Spelling Inventory Feature Guide Completion and Interpretation (RED 4942)
Creating group work structures and collaboration	Padlet for Discussions (SSE 3312) Jamboard for Discussions and Literature Circles (RED 3012, SSE 3312, EDF4467)
Establishing discourse norms during synchronous classes	Norm-setting protocol (RED 4942); Use of protocols for presentations and discussions (RED 4942)

Review of Course Modalities, Organization, and Design

Prior to the pandemic, most courses in the elementary education program were taught in face-to-face mode. Of 22 courses in the junior/senior year, only five courses were offered completely online; two courses were offered in mixed

mode with most meetings in face-to-face mode. During Spring 2020, of course, all in-person courses were moved to synchronous online modality using streaming video meetings. In the gradual move away from emergency modes of online instruction, faculty recognized advantages in mixed modalities; some course activities could be more engaging through a video format (i.e., breakout rooms for small group choice activities / discussions, video presentations). Faculty began to identify courses that would benefit from the permanent move to mixed modalities and carefully considered the ratio of face-to-face meetings to online work that should occur based on course objectives and assignments. Of the 22 upper-level courses, 100% were modified to include online instruction, whether fully online, hybrid, asynchronous, or synchronous, marking a substantial shift from the pre-pandemic course offerings. In making the best of both modalities, students were strongly encouraged to bring electronic devices to face-to-face meetings to continue use of tools such as Jamboard, Nearpod, Padlet, and various Google doc applications to increase engagement during face-to-face class meetings.

Technology Integration Matrix

Faculty participants identified specific technology integrations within course assignments and aligned the integration with both ISTE Standards for Educators and TETCs, based on the work of Elwood and Bippert (2020) who developed a crosswalk for the two frameworks. At the time of publication, this matrix has initially only been completed by the CRI faculty team; however, it has been shared widely with full program faculty and will be expanded on in the Fall of 2022. Figure 2 includes a snapshot of the Technology Integration Matrix with samples of the alignment of technology integration with the ISTE Standards for Educators and the TETCs.

TETCs (ISTE Standards Integrated Below Each TETC). (Numbers in matrix cells refer to ISTE standard indicators.)						
	EDE 4301	EDF 4467	LAE 3414	RED 3012	RED 4043	RED 4519
1. Teacher educators will design instruction that utilizes content-specific technologies to enhance teaching and learning						
ISTE 2.5 Designer	2.5a 2.5b 2.5c *use of Ed Puzzle, Flipgrid	2.5a, 2.5b, 2.5c- Digital notebook, Google Doc	2.5 all- Author/IllWebsite Explr. 2.5 all- Lit Circle reflection 2.5 all- Virtual Library	Use of Jamboard: Word sorts, graphic organizers, CLOZE passages; Use of Google docs to provide interaction during lesson plan development.	2.5.a & b. Curation of lessons and creation of integrated reading components unit. 2.5.b Create writing to learn activities for text set	2.5 a & 2.5b AIP Digital Notebook(s) with tech ideas built in 2.5 all. Creation of word study activities into digital formats.
2. Teacher educators will incorporate pedagogical approaches that prepare teacher candidates to effectively use technology.	Capstone Trending Topics in Technology & Level 1 Google Certification Skills; WUCF PBS Professional Development			2.5 all.2.5 all. Creation of word study activities into digital formats		2.6 a, 2.6b & 2.6d AIP Digital Notebook (s)with tech ideas built in 2.6a & 2.6b Virtual class meetings; use of digital tools for lessons, learning activities in both in person and virtual settings
ISTE 2.6 Facilitator			2.6 all Author/IllWebsite Explr. 2.6 all- Lit Circle reflection 2.6 all- Virtual Library		2.6.b. Design and create google/bitmoji classroom to reflect the discipline the candidates will be teaching	

Figure 2. Elementary Education Technology Integration Matrix: TETCs and ISTE Standards for Educators.

Program-Wide Technology Integration

In considering program-wide technology integration applications, CRI faculty reviewed entrees for commonalities and unique experiences captured in the TETC/ISTE Technology Integration Matrix and will continue to do so as additional course activities are added. When completed, this matrix will also be shared with K-6 practitioners from our partner school districts to ensure that there is alignment between elementary teaching expectations and teacher preparation program experiences. CRI faculty also sought to develop a common thread across all courses in the program by prompting teacher candidates to consider reflective questions about technology integration related to that course/content.

A “technology integration icon” was developed for faculty to integrate into content pages of the learning management system as a common cue (see Figure 3).



Figure 3. Technology Integration Icon for LMS Content Page Integration.

Reconsidering Faculty Professional Development Needs

In March of 2020, the RLC developed and distributed a needs assessment to identify areas of need for faculty professional learning. A modified version of this survey was redistributed to the members of the CRI working group, with each of the areas of need from the 2020 survey reintroduced with the prompt to sort each practice into one of the following 3 areas: 1) I feel confident using this practice in online learning design and facilitation, 2) I’d be interested in learning more about this practice for online learning, or 3) I would need support to use this practice. This is still a need for me. Figure 4 depicts current 2022 faculty responses for each area of need, as identified in 2020.

As evident by the data displayed on the table above, faculty in the CRI project group have expressed increased confidence as it relates to instructional practices implemented while facilitating in an online environment. Specifically, faculty reported that they feel confident leading whole class and small group instruction and incorporating shared documents for collaboration during instruction. Some faculty continued to report a professional learning need for implementing specific technology tools and strategies. Based on the data collected, key topics for additional learning include using manipulatives and available technologies as well as collaborating and co-teaching with fellow instructors. For example, the Technology Integration Matrix suggests that many faculty are using Web 2.0 tools; however, opportunities to learn about additional manipulatives and technology tools has been identified as a need. As such, a possible next step for support could include a mentoring framework to pair faculty in professional learning partnerships for differentiated professional development (Uerz et al., 2018). In addition, many faculty expressed a need to establish discourse norms during synchronous online classes. Classroom examples in response to this need will be collaboratively created among faculty and implemented across courses prior to Fall 2022. Other areas where faculty expressed an interest and/or a need for support will also be explored.

The following instructional practices were identified as collective faculty...



Figure 4. Faculty Professional Learning Needs for Teaching with Technology: 2020 and Now.

Note: The themes on the y-axis of this figure were identified from the faculty needs assessment administered in March of 2020.

CONCLUSIONS AND IMPLICATIONS

The Impact of Professional Learning on Teacher Educators' Efficiency, Engagement, and Self-Efficacy Related to Technology Integration

The course-specific and program-wide efforts shared in the previous section provide examples of how teacher educators' efficiency, engagement, and self-efficacy related to technology integration have been impacted by ongoing professional learning opportunities. For example, the technology tools and assignments outlined in Table 2 provide just a snapshot of how faculty have demonstrated efficiency in identifying and using applications that effectively integrate technology to meet student learning outcomes. Professional learning experiences and multiple semesters of implementing and revising applications have also contributed to teacher educators' efficiency in integrating technology, especially when compared to pre-pandemic course activity examples.

Teacher educators' efficiency and engagement with technology integration are also demonstrated by the course modality changes that were implemented program wide. Prior to the pandemic, only 23% of upper-level teacher education courses were offered with an online modality, yet after faculty-led review, 100% of the same courses are currently offered with an online component, whether fully online or mixed mode (a hybrid of face-to-face class meetings and online instruction). This change was driven by a faculty-initiated request, and in addition to course modality designations, faculty identified parameters for each course to help determine which class meetings/course activities are best offered through online learning experiences.

Faculty engagement in technology integration efforts are further evidenced by the identification and alignment of the TETC and ISTE standards as a framework for a program technology integration matrix. In fact, this program-wide effort also demonstrates faculty's increased self-efficacy and modeling of teaching with technology, with specific interest in aligning how teacher educators' competencies with technology integration can and should mirror the expectations of their teacher education graduates.

The professional learning needs assessment that was adapted and readministered also provides clear evidence of the impact of professional learning on teacher educators' self-efficacy to teach with technology. Of the 10 areas originally identified from the 2020 needs assessment data, only two were identified as a current area of need by the faculty members of the CRI project. However, as faculty self-efficacy increases, they anticipate that new professional learning needs will arise and they have demonstrated an ongoing commitment to seek and engage in high quality, collaborative professional learning activities.

Lastly, while not included in this chapter, faculty have developed a data collection plan to determine how professional learning experiences through coursework impact the efficiency, engagement, and self-efficacy of teacher candidates and are committed to using the data from teacher candidates to further inform their course-specific and program-wide efforts.

From Emergency Remote Instruction to Purpose-Driven Technology Integration

The faculty/staff team developed the 2020 Remote Learning Community in response to the pandemic emergency. A "then and now" review of implications leads us to consider current implications with focus on continuing and increasing efficiency, engagement, and efficacy rather than response to emergency. Tables 3, 4, and 5 show implications identified by Safi et al. (2020). Discussion after each addresses the status of the previous implications and whether they continue to be relevant as we move past COVID emergency stage. Table 6 adds a new set of implications centered around faculty professional learning and the impact of teacher educator technology competencies on teacher candidates' preparation.

Table 3

Excerpt from "Table 4: Implications for Preservice & Inservice Teacher Education and Professional Development" (Safi et al., 2020)

Preservice Teacher Education (Phase I – Pre-Internship)	<ul style="list-style-type: none"> ● Enhancing discussion of teaching and engagement opportunities throughout the program starting with content and methods courses onto internships and beyond ● Authenticating mixed mode opportunities to prepare for remote instruction prior to internship and full-time classroom teaching ● Addressing issues of equity/access for prospective teachers due to internet, health, financial concerns ● Providing opportunities for co-teaching for faculty members and exposure to multiple experts for students as well as collaboration amongst colleagues
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Reflecting upon the work that was started in 2020, faculty have noted that, while many of these practices listed above were designed for emergency use, the implementation of these strategies continues to enhance current instruction. This aligns with Ellis et al.'s classification of change in teacher education as stimulation of an "innovative stance that was often perceived to be lacking in the sector" (2020, p. 559). The implications identified also help to ensure equity for all prospective teachers. For example, additional mixed-mode opportunities have been developed to support students beyond traditional face-to-face classroom structures, increasing access and engagement for teacher candidates who would other-

wise not be able to participate. Additionally, faculty continue to collaborate and share technology tools that can be used in multiple courses across varying content areas.

Table 4

Excerpt from “Table 4: Implications for Preservice & Inservice Teacher Education and Professional Development”
(Safi et al., 2020)

Preservice Teacher Education (Phase II - Internship)	<ul style="list-style-type: none"> ● Expanding diverse internship opportunities <u>within</u> schools and grades (similar to medical rounds) ● Expanding diverse internship opportunities <u>across</u> schools and including urban and rural districts ● Providing opportunities to shift away from one teacher/one educational setting to a more collaborative approach in planning, designing, and implementing instructional strategies <u>within</u> and <u>across</u> settings ● Engaging prospective teachers in preparing, reflecting, and revising lesson plans using online (synchronous and asynchronous) assessment strategies
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While the scope of this project did not address the first three bulleted considerations in Table 4, it did address the fourth. Beyond the scope of this project, faculty hope to enhance the instruction and knowledge of prospective teachers as it relates to technology. Examples across courses include the intentional use of digital notebooks, Google Docs with Mote, Flipgrid, and Jamboard, all of which are being used in a variety of discipline-specific teaching methods courses. The implementation of these resources throughout our teacher preparation program will enable teacher candidates to explore new tools, presented and used in alignment with their instructional purpose, which will better prepare teacher candidates for their future classrooms whether they are providing in person, synchronous or asynchronous instruction.

Table 5

Excerpt from “Table 4: Implications for Preservice & Inservice Teacher Education and Professional Development”
(Safi et al., 2020)

Inservice Teacher Professional Development	<ul style="list-style-type: none"> ● Impacting supervising teachers from the knowledge (including technological insights) shared by teacher candidates and university partners ● Creating learning opportunities to grow with a multitude of teachers & colleagues ● Addressing potential chemistry and collaboration issues with preservice teachers both synchronously as well as asynchronously ● Creating more consistent communication and exchange of school classroom ideas ⇔ university experiences including research to practice efforts to address student needs and learning
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The impact and reach of professional learning for teacher education faculty continues to extend beyond the preparation of teacher candidates to impact current inservice teachers’ instructional practices. For example, during teacher candidates’ internships, collaboration occurs with supervising teachers to integrate technology that was learned during teacher preparation coursework. Technology is implemented during lessons designed for K-6 students across multiple content areas. Several examples include the use of Bitmoji Classrooms, Jamboard, and Nearpod lessons. These internship experiences offer teacher candidates opportunities to use technology tools to engage and support all students in their classroom. Following each lesson experience, teacher candidates are encouraged to reflect and discuss with their supervising teachers about how the implementation of the technology impacted student learning, which expands the future reach and impact of adopted instructional practices.

Table 6
Implications for Teacher Education Faculty Professional Development

Teacher Education Faculty Professional Development	<ul style="list-style-type: none"> ● Providing opportunities for discussions on the extent to which teacher candidates need hands-on experiences with technology. <ul style="list-style-type: none"> ○ Identify kinds and types of assignments that will be most effective. ● Expanding TETC framework and ISTE alignment. ● Building faculty content knowledge around decision-making for course modalities based on purpose/goal vs convenience/preference.
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Through the multi-tiered CRI project, faculty were able to collaborate and develop a plan of action for course-specific and program-wide improvements in the undergraduate Elementary Education B.S. program. Each faculty member involved with the project identified areas within their specific course(s) that could be enhanced by the integration of technology. In addition, faculty expanded the TETC framework and ISTE alignment with the plan to implement all course modifications starting in Fall 2022. The implementation of this project has deepened efficacy among faculty's intentional integration of technology across multiple courses in the college, as well as supported decision making around course modalities based on purpose/goal. Further, it has laid the groundwork for more widespread program improvement efforts to come. The collaborative efforts highlighted through this work, while not explicitly identified as a community of practice, align with Smith and Becker's (2021) call to conduct additional research around how communities of practice can positively impact student learning and technology integration.

CONCLUSION

Retrospectively, considering the initial efforts of the RLC in 2020, it is evident that faculty professional learning opportunities have positively impacted the learning experiences of teacher education faculty. This documented growth in efficiency, engagement, and efficacy related to teaching with technology can be directly linked to the initial, immediate need to pivot to online instruction. However, many of these improvements were based on the ignited awareness to transition from emergency practices to purpose-driven uses of technology in teacher education that exemplify the innovative stance of the changing field of teacher preparation and K-6 classroom instruction (Ellis et al., 2020).

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A Retrospective of Professional Development in a College of Education During the COVID-19 Pandemic and New Directions

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The COVID-19 pandemic has undoubtedly caused a lot of disruptions in education. Classes, which were mostly face-to-face at the K-12 and undergraduate levels, had to be transitioned into remote and online learning. The colleges of education, especially the teacher education programs, were no exceptions. Most need to explore other ways of teaching and learning, as well as alternative solutions for placements in practicums and student teaching. From March 2020 to April 2022, to help faculty, staff, and students face the challenges presented by different phases of the pandemic, a technology team in the Bagwell College of Education has been utilizing various strategies to provide professional development (PD) to the college and beyond. Reflecting on these PD efforts and a chapter published by the authors back in 2020, we write this retrospective to discuss our experiences of using the PD strategies at various phases of the pandemic. Moreover, we discuss the new directions of PD for the future, including suggestions for both research and practice.

Keywords: professional development, teacher education, teacher educators, students, COVID-19 pandemic

HISTORICAL REVIEW

In March 2020, almost all educators had to transition to emergency remote teaching (ERT) due to the COVID-19 pandemic (Ferri et al., 2020). Bagwell College of Education at Kennesaw State University was not an exception. All teacher educators had about two weeks to get ready for ERT while closing their campus offices, classrooms, and labs and thinking of ways to continue their scholarships at home. To facilitate the process of transitioning to ERT, the instructional technology department immediately formed a technology team, which was comprised of an instructional designer, a distance learning coordinator, a technology coach, and the special assistant to the dean for technology (Jin & Redish, 2020). This team offered professional development (PD) sessions during the pandemic, focusing especially on five Teacher Educator Technology Competencies (TETCs) (Fougler et al., 2017) that were most pertinent (see Table 1). The strategies for PD include one-on-one mentoring, whole group sessions, phone calls, live webinars, and a technology challenge.

Table 1
PD for Five TETCs during the Pandemic (Foulger et al., 2017; Jin & Redish, 2020)

4. Teacher educators will use online tools to enhance teaching and learning.	
	<ul style="list-style-type: none"> a) <i>Communicate using online tools.</i> b) <i>Collaborate using online tools.</i> c) <i>Design instruction using online tools.</i> d) <i>Assess teacher candidates using online tools.</i>
6. Teacher educators will use appropriate technology tools for assessment.	
	<ul style="list-style-type: none"> a) <i>Use technology to assess teacher candidates' competence and knowledge.</i> b) <i>Model a variety of assessment practices that use technology.</i> c) <i>Provide opportunities for teacher candidates to use appropriate technology for assessment.</i>
7. Teacher educators will use effective strategies for teaching online and/or blended/hybrid learning environments.	
	<ul style="list-style-type: none"> a) <i>Model online and blended learning methods and strategies.</i> b) <i>Provide opportunities for teacher candidates to practice teaching online and/or in blended/hybrid learning environments.</i>
10. Teacher educators will engage in ongoing professional development and networking activities to improve the integration of technology in teaching.	
	<ul style="list-style-type: none"> a) <i>Define goals for personal growth in using technology.</i> b) <i>Engage in continuous professional development and networking activities promoting technology knowledge and skills.</i> c) <i>Support teacher candidates' continuous participation in networking activities to increase their knowledge of technology.</i>
12. Teacher educators will apply basic troubleshooting skills to resolve technology issues. Each competency is accompanied by a list of specific skills.	
	<ul style="list-style-type: none"> a) <i>Configure digital devices for teaching.</i> b) <i>Operate digital devices during teaching.</i> c) <i>Model basic troubleshooting skills during teaching.</i> d) <i>Find solutions to problems related to technology using a variety of resources.</i>

The team used different combinations of PD strategies at various stages of the pandemic. In March 2020, most teacher educators needed immediate support in transitioning to ERT, and the most commonly used strategies were one-on-one mentoring, whole-group sessions, and phone calls. Whole-group sessions and one-on-one mentoring were used frequently because at this time, faculty were the majority of participants and they needed immediate and targeted PD on using suitable technologies for ERT. Some topics included how to use our learning management system, deliver online sessions with students, host virtual office hours, hold virtual meetings, assess students online, help students communicate and collaborate using online tools, design instruction using online tools, configure digital devices for teaching, operate digital devices during teaching, model basic troubleshooting skills during teaching, and troubleshoot and find solutions. After these sessions, the team members answered phone calls from the participants for follow-up questions.

From April 2020 to July 2021, most faculty worked remotely. Accordingly, the team provided other forms of PD to accommodate the modalities and facilitate the sustainability of remote learning, which were live webinars and technology challenges. For the live webinars (<https://bagwell.kennesaw.edu/faculty-staff/tech-live-faculty-staff.php>), the team solicited suggestions on the webinar topics from faculty, staff, and students, and then offered weekly live PD webinars. The team also offered a technology challenge (<https://express.adobe.com/page/r9GW2STbQp4zz/>) for the whole college to participate in and earn badges. Besides these two main approaches, the team also offered some whole-group sessions and one-on-one mentoring on how to set up hyflex sessions. However, requests were low during this period since only a small number of courses used the hyflex model. Most of such requests were online while just a few were in person.

In August 2021, the university went back to “normal”. Therefore, since then, the torch of PD was handed to other units, such as the University Information Technology Services (UITs), Distance Learning Center, and the Library, due

to the changes in team members' responsibilities. For example, the instructional technology coach restarted the initiative for innovation and shifted back to support technology innovation and maker education. She could only have a small number of students in her labs, which as a result, doubled her workload when she offered workshops or lessons because she needed to provide the same workshop or lesson twice or more times to accommodate the whole class. Therefore, she could not offer more PD sessions as she did during the pandemic. Similarly, the instructional designer transitioned to other responsibilities. Going forward, we firmly believe that we should continue the PD efforts for all the stakeholders in our teacher education programs, considering the lessons we learned during the pandemic.

PROCESS

In this chapter, we investigated what lessons we learned about PD during the pandemic. We collected data from the websites hosting the webinar recordings, a semi-structured interview with the coach, a reflection and discussion section between the first author and the coach, and email correspondences. Participants include the first author and the instructional coach. The first author is a female assistant professor. She is Asian and has been working as a teacher educator for 12 years. The coach, who is the third author, is also a female teacher educator. She is white and has worked in the education field as a technology support specialist in K-12 and then as a teacher educator in higher education. Before the pandemic, she managed a maker lab and promoted technology innovation and maker education. Along with her student assistants, she had given more than 1,500 visitors tours to the maker lab and offered dozens of workshops for people in KSU and beyond.

Data from the websites hosting the webinar recordings showed the numbers of participants and views. The semi-structured interview was approved by the Institutional Review Board (IRB) and audio-recorded using Microsoft Teams. It was about 70 minutes long. Microsoft Teams automatically generated the transcript. The first author proofread the transcript for accuracy. An open-thematic coding method was used to analyze data from the interview (Miles et al., 2015). With another researcher, the first author coded the transcript individually to come up with initial codes. Then, two researchers conducted constant comparison (Creswell, 2014) to negotiate codes until they reached 100% agreement on all the codes. Later, they discussed until themes were generated. For the data collected from the reflection and discussion session, thematic analysis was used (Braun & Clarke, 2006). The first author coded the notes taken during the session.

RESULTS

The instructional technology coach talked about the lessons learned during the pandemic. First, PD needs to be ongoing and targeted and fully accommodate participants' needs and preferences. Before designing any PD, coaches should ask what motivates people to attend PD, what topics are needed, and what are the preferred modalities. She shared the motivating factors from her needs analysis - learn new and innovative things to improve teaching, improve courses by employing best practices of online learning, integrate technology more effectively, keep abreast of technology used in K-12 schools, be on the cutting edge of innovation, and learn about virtual learning in K-12 schools. She also shared the PD topics proposed by the college (see Table 2) and preferred methods - 1) microlearning with on-demand videos of 15 minutes or less, 2) one-hour live webinars, 3) fully online self-paced modules, 4) one-on-one coaching and troubleshooting, and 5) fully online technology challenge to earn badges.

Altogether, the technology team offered 60 live webinars (25 for TETC 4, 11 for TETC 6, 17 for TETC 7, and 7 for TETC 10, <https://bagwell.kennesaw.edu/faculty-staff/tech-live-faculty-staff.php>) to address the most urgent needs, which were consistent with faculty ranked preferences for PD. Data showed that there were more than 782 attendances at the live webinars and more than 850 recording views (see Table 3). Upon request, the accessibility webinars were uploaded to another website for people outside KSU to watch, which had 3-11 views each.

Table 2
Proposed PD Topics in Ranked Order

Ranked Order	PD Topics
1	Best practices for asynchronous and synchronous sessions
2	Building community in a virtual classroom
3	Creating alternatives to discussion forum
4	Learn about the university and college's complimentary licenses
5	How to support social-emotional learning in a virtual classroom
6	Online learning tools (D2L, Zoom, Ultra, Camtasia, Teams, ...)
7	Podcasting
8	How to integrate various K-12 technology tools into the assignments
9	Assessment tools for teaching and learning
10	Digital storytelling and video creation/editing
11	Design thinking process
12	Learning models-blended, online, hybrid, flipped & streaming live classroom
13	Maker education in both face-to-face and virtual classrooms
14	Augmented reality (AR) and virtual reality (VR)
15	Mobile devices in the classroom
16	Using Twitter in the classroom
17	Artificial intelligence (AI) for learning
18	Edtech courses, learn what candidates are learning in edtech courses
19	Gamification and game-based learning (GBL)
20	Digital citizenship
21	3D design and printing
22	Robotics in the classroom
23	Coding across the curriculum (required by Georgia State Bill 108 - By the 2024-2025 school year, all high schools and all middle schools in local school systems should offer a course in computer science.)

Table 3
PD Webinar Topics Focusing on TETCs and Numbers of the Live Webinar Attendance and Recording Views
(Foulger et al., 2017)

TETCs	Live Webinars
4. Teacher educators will use online tools to enhance teaching and learning.	<ul style="list-style-type: none"> ● *Collaborate Ultra Part I ● *Collaborate Ultra Part II ● Kaltura Capture I (18 + 24) ● Kaltura Capture II (14 + 14) ● Adobe Spark (16 + 15) ● iMovie (13 + 10) ● Twitter (13 + 7) ● Twitter chats (9 + 6) ● Canva (21 + 17) ● Nearpod I (11 + 18) ● Nearpod II (10 + 8) ● Bitmoji classroom (11 + 15) ● D2L overview (6 + 8) ● D2L intelligent agent (16 + 14) ● Genially (18 + 4) ● Sample video for tech presentation (/ + 11) ● Miro online whiteboard (17 + 9) ● Screen capturing (10 + 25) ● SoftChalk (12 + 21) ● VoiceThread (10 + 11) ● Zoom 1 (8 + 10) ● Zoom 2 (6 + 13) ● Zoom 3 (16 + 14) ● Intermediate Zoom 1 (19 + 9) ● Intermediate Zoom 2 (14 + 4)
6. Teacher educators will use appropriate technology tools for assessment.	<ul style="list-style-type: none"> ● OneDrive I (19 + 9) ● OneDrive II (15 + 1) ● OneNote (12 + 23) ● Forms I (13 + 10) ● Microsoft Forms I (13 + 10) ● Microsoft Forms II (12 + 6) ● D2L assessment basics 1 (12 + 17) ● D2L assessment basics 2 (1 + 21) ● D2L assessment basics 3 (14 + 16) ● Edpuzzle (11 + 28) ● Online assessment options (26 + 7)

Table 3 Continued

TETCs	Live Webinars
7. Teacher educators will use effective strategies for teaching online and/or blended/hybrid learning environments.	<ul style="list-style-type: none"> ● Culturally-Responsive teaching in the virtual classroom (20 + 15) ● Accessibility 101 (8 + 42) ● Accessibility 102 (9 + 15) ● Accessibility 103 (13 + 14) ● Basic online course design (11 + 21) ● Facilitating highly effective synchronous sessions (21 + 29) ● Hybrid learning 1(12 + 9) ● Hybrid learning 2 (10 + 4) ● Hybrid learning 3 (14 + 4) ● Best practices in online discussion (14 + 8) ● Online instructor presence (13 + 19) ● Streaming your F2F classroom I (26 + 36) ● Streaming your F2F classroom II (25 + 27) ● Streaming your F2F classroom III (21 + 17) ● Streaming your F2F classroom (9 + 6) ● Teaching synchronous sessions with Microsoft Teams (7 + 19) ● Modifying your D2L homepage (12 + 23)
10. Teacher educators will engage in ongoing professional development and networking activities to improve the integration of technology in teaching.	<ul style="list-style-type: none"> ● KSU Library Resources (14 + 5) ● Couponing 101 (16 + 7) ● Facilitating effective meetings in Teams (17 + 30) ● iPad basics (17 + 11) ● Microsoft Planner (8 + 4) ● Microsoft Teams basics (6 + 37) ● Microsoft Teams (23 + 13)

Note: *Blackboard Collaborate recordings did not collect view data. Bold shows more participation.

The team launched one technology challenge in the spring of 2020 to the whole college as an alternative approach for PD (<https://express.adobe.com/page/r9GW2STbQp4zz/>). There were six faculty and 15 staff participated, and 101 digital badges were issued. However, no more challenges were launched since then. The coach said that compared to the little involvement of faculty and staff, it was not cost-effective to have three coaches preparing for the challenge.

Another lesson is that preservice and in-service teachers also need PD and support. The coach mentioned that students experienced virtual and online learning and saw firsthand how K-12 teachers offered those in the classrooms. Although edtech courses are highly effective and beneficial, most of the courses do not thoroughly prepare students for virtual and online learning. A few instructors began the process of updating their courses to better prepare students for online learning. However, all teacher education courses could include more support on how to teach virtually or in a hybrid mode. Students expressed their feeling of loss to the coach and the difficulties in getting needed PD from the edtech course and school districts. Moreover, not all students take or have taken the edtech course. Those who did not take the course realized that they needed more preparation on technology integration and requested help from the coach. Some found out about the PD for faculty and staff and they utilized the opportunities. Upon their requests, the team also offered PD sessions specifically for students. Post-pandemic, they still need ongoing PD for technology integration.

Meanwhile, the coach shared her concerns. First, the coach wondered whether we could continue to offer targeted PD to faculty, staff, and students using multiple approaches. She commented that there was minimal participation in in-person PD while virtual PD enjoyed more attendance and engagement. She suggested continuing to offer virtual PD to the whole college, which should be flexible and targeted to accommodate participants' needs and preferences. Another concern is whether we will have buy-in from faculty, staff, and students post-pandemic on the importance of technology integration and digital equity, which still are critical topics in the future. We need to consider these factors carefully in order to offer ongoing and targeted PD to all stakeholders in the colleges of education.

IMPLICATIONS

During the two years of the pandemic, the technology team successfully led PD efforts using multiple methods for our teacher education program. This experience reinforced our belief that PD is greatly needed for teacher educators, staff, preservice and in-service teachers, which also has direct implications for teacher education programs.

First, administrators need to leverage resources strategically to continue the PD efforts post-pandemic to mitigate the challenges of limited personnel, resources, time, energy, and funding (Sprott, 2018). Looking ahead, teacher educators still need to master all 12 TETCs with support from the technology coaches (Foulger et al., 2017). It takes a whole team to produce quality and targeted PD. This momentum should continue post-pandemic. However, coaches all have several roles and different responsibilities. The tension between offering targeted PD and promoting innovation might prevent them from being fully devoted to either one. Thus, leadership teams should brainstorm alternative ways or creative solutions. In our case, the team collaborates with University Information Technology Services (https://apps.kennesaw.edu/files/pr_app_uni_cdoc/doc/faculty_staff_workshop_catalog.pdf), Distance Learning Center (<https://dli.kennesaw.edu/services/pd/index.php>), and Library (https://libguides.kennesaw.edu/edu_grad/faculty), which share responsibilities for offering PD related to their expertise. Research on PD strategies and policies is much needed.

Second, teacher education programs should not only continue to provide PD but also offer ongoing, targeted, and high-quality PD (MacPhail et al., 2019). According to the results, teacher educators had specific topics and tools they want to learn at distinct stages, which correlated with their learning needs and professional responsibilities. These findings indicate that we should conduct a needs analysis first and then design targeted PD sessions to address participants' learning needs and preferences. The results also implied the PD topics needed post-pandemic, including how to address the digital divide, how to prepare preservice and in-service teachers for K-12 online learning, and how to deal with students' attendance and engagement issues. Empirical research on these PD topics is greatly needed to inform the field. Furthermore, we should not assume everything will be face-to-face post-pandemic. During PD, we should still talk about different modalities and continue the conversations. PD also should not go back to only face-to-face, instead, it should support all platforms, accommodating different learning needs and preferences.

Third, the pandemic experience also taught us that our teacher educators, staff, preservice and in-service teachers need continuous technology and emotional support from both the coaches and their peers. The technology support will help elicit more buy-in of professional learning on technology integration and innovation. More importantly, our teacher educators, staff, preservice, and in-service teachers all need social-emotional support. The added stress from ramping up teaching and learning quickly, managing work in different modalities, monitoring students' behaviors in multiple environments, balancing work and home, and ultimately not feeling adequately prepared created burnout for everyone in the teacher education programs. We must not overlook these social and emotional factors and provide needed support and professional coaching. Meanwhile, personnel who provided the PD during the emergencies also went through tremendous stress having the weight of getting faculty and staff up to speed. It will be equally important to also think about the social-emotional support for those providing a large number of hours to develop and deliver PD, and the stress that comes from having that level of responsibility. Teacher education programs are also the ideal place to prepare our teacher candidates to support the social-emotional well-being of their students. In practice, we should integrate social-emotional learning into our curriculum, which helps build awareness and capacity for support (Duckworth & Putnam, 2022). PD sessions on social-emotional learning are needed for teacher educators, and exploration of this topic is a new trend in the field that warrants more research.

Overall, we should continue to offer ongoing, targeted, and high-quality PD in the post-pandemic era. Further, we should advance the PD efforts to focus on developing teacher educators' all 12 TETCs (Foulger et al., 2017) and continue to develop preservice and in-service teachers' TPACK (Mishra, 2019). We also need longitudinal studies investigating this process and the impact of teacher educators' TETCs on students' TPACK development.

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The Evolution of a Faculty Sandbox: Supporting Adjunct Faculty and Moving Beyond Technology

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In an earlier publication, initial results of a sandbox approach to professional development, designed to support faculty in the move to emergency online teaching were shared (Ervin-Kassab, 2020). This chapter presents data on how the sandbox has evolved in response to the interests and needs of participants, especially those of adjunct faculty in teacher education. Ideas for utilizing a sandbox approach for ongoing professional development and communication with adjunct faculty will be presented. Challenges to sustainability and future plans to mitigate these challenges and increase the use of sandboxes will be shared with the intent of providing guidance on using sandboxes to increase support for adjunct teacher education faculty in developing knowledge, skills, and beliefs to foster teacher candidate's enactment of 21st century teaching practices.

Keywords: Professional development, technological pedagogical content knowledge, teacher education, adjunct faculty, sandbox, anti-racist education

HISTORICAL REVIEW

Engaged adjunct faculty are more likely to connect students to college and campus systems, connect with the overall program of study as they see their course's place in the overall program, and receive professional development in support of pedagogy and technology. Supported adjuncts are more likely to return to teach their courses, which keeps program continuity. - Edwards, 2019

In March of 2020, COVID-19 caused an immediate transition to online teaching and learning throughout the world. Higher education faculty, including teacher educators, needed to transition to heavily utilizing learning management systems, the ease of which was dependent on how faculty feel about changes caused by technology and the educational climate (Liu & Geertshuis, 2021). As we became more accustomed to teaching online, the support needs of faculty shifted from an emergency approach to incorporating educational technology (Hodges, et. al., 2020) to those of rethinking paradigms not only for technology, but for social justice in education (Gorski & Dalton, 2020; Mbhiza, 2021; Pugach et al, 2020; Quezada et. al, 2020). This rethinking of paradigms has been a topic of conversation for full-time faculty at our institution, as in many others, however ensuring adjunct faculty are part of this process has been a challenge (Aldemir & Ardley, 2014; Edwards, 2019; Ward Parsons et al, 2021). This chapter presents an update on the initial incarnation of a professional development sandbox, with a focus on how it has functioned as an effective online space for adjunct faculty to learn, reflect, and grow together (Aldemir & Ardley, 2014, Ward Parsons et al, 2021) which would support consistency in courses across our teacher education programs (Edwards, 2019; Ward Parsons et al, 2021).

The initial development of the faculty sandbox grew out of an immediate need and was grounded in best practices in professional development (Darling-Hammond et al., 2017) including creating a blend of workshop, mentoring, and project-based approaches to effective design for technology integration (Yilmazel-Sahin & Oxford, 2010), developing communities of practice (Stark & Smith, 2016; Wenger-Trayner & Wenger-Trayner, 2015), and the roles of identity and context in developing technological, pedagogical, content knowledge (TPACK) (Foulger et al, 2016; Porras-Hernandez & Salinas-Amescua, 2013; Quezada et al., 2020; Rosenberg & Koehler, 2015). The need for an innovative approach to supporting faculty in transitioning to online teaching was great, as many faculty were reluctant to integrate technology into their teaching, let alone teaching online, prior to the spring of 2020 a barrier cited by Ertmer (2005) and others that persisted until the pandemic. Compounding this barrier was and continues to be the challenge of bringing faculty, both

tenure-track (TT) and adjunct physically together for support and training (Aldemir & Ardley, 2019; Ward Parsons, et al, 2021). Dr. Ervin-Kassab, an educator with over 20 years of experience leading and designing professional development as well as teaching in secondary and tertiary schools, developed the sandbox concept as a space for educators to be able to explore, test, and refine the use of technology tools prior to taking their practices live in a virtual classroom. Dr. Ervin-Kassab strategically designed the sandbox to be a continuous workshop and collaborative mentoring space (Guskey, 2002; Yilmazel-Sahin & Oxford, 2010) with just-in-time support that would lead participants to seeing the value of their developing practices on student progress in the course (Ertmer, 2005; Ottenbreit-Leftwich et al, 2010; Yilmazel-Sahin & Oxford, 2010). Weekly conversations and opportunities to try out technology tools together were called playdates and focused on looking at how what was tried in teaching effected student work/engagement. This offset concerns of not being seen as an expert in the classroom, and created a space for humanizing learning practices for both faculty and students to take place (Aldemir & Ardley, 2014). Many of the participants who joined in the regular playdates were adjunct faculty within the department of teacher education. The design of the sandbox leveraged situated learning theory (Lave & Wenger, 1991) as well as spaces for negotiating identity shifts and the learning of not only new technology skills, but of the role of a university adjunct (Boyd & Harris, 2010). All participation in the sandbox was both voluntary and uncompensated for both the participants and the facilitator.

The return to partially in person teaching lessened the pressing need for technology support and coincided with greater efforts in our college to tackle the issues of equity and social justice that came to national attention in the summer of 2020. As sandbox participants became comfortable with their developing TPACK, the conversations in the synchronous playdate conversations began to include thinking how we can support future educators in emancipatory, socially-just, and inclusive practices both online and in person. This shifting context led to a shift in the conversations and collaborative development taking place in the sandbox that continues to evolve based on the best practice of focusing on the interests and commitment of the participants (Yilmazel-Sahin & Oxford, 2010). In order to determine the supports for the following academic year, Dr. Ervin-Kassab utilized longitudinal data to respond to the research question: How and for whom is the sandbox professional development model working?

PROCESS/METHODS

This ongoing case study includes an emphasis on qualitative data, using quantitative analytic and survey data as confirmatory data. The time period included in the collection of data is from March, 2020 to March, 2022. Participants in the sandbox activities, both synchronous and asynchronous, included TT and adjunct faculty. Over the course of the sandbox's existence, adjunct faculty (35) outnumbered participating TT (20). While there was fluctuating participation in synchronous online meetings over time, four adjunct teacher educators were consistent participants in a majority of these meetings. In order to answer the question of for whom the sandbox model was working, data was disaggregated and analyzed by adjunct or TT status.

In order to evaluate how the sandbox was working for participants, qualitative and quantitative data was analyzed with attention to statements that indicated value, such as 'I learned a lot in this session' and by analytics of pages/content viewed in the platform. Participant engagement was measured utilizing the analytics feature of the learning management system (LMS) to gather quantitative data such as pages viewed, participant contributions to content, and amount of time spent in each shell. Engagement in the synchronous components of the sandbox was captured in both attendance logs and post-meeting field notes from the facilitator. Informal interviews and bi-annual surveys provided insight into the data collected by the analytics system.

Quantitative data was collected utilizing the LMS analytics collected including views of pages within each LMS shell. This data was cross-referenced with meeting and significant events from within the college of education, the university, and in the local community to attempt to establish patterns and trends of use. There were significant issues with the collection and interpretation of this data, as most participants were registered in the LMS shell as teachers whose individual data was not tracked by the LMS analytic system. This data is presented as aggregate data due to this limitation.

RESULTS

Over the two years of the sandbox, 50 pages with general tutorials, guides, and specific course material were shared. Examples of specific course material were syllabi, activities, and reading lists. The facilitator of the sandbox had strong

TPACK, with over 20 years of experience as both an educational technology coach and K-12 and teacher educator. As a result, a majority of uploaded files were populated by her with others contributing files they discussed in synchronous playdates. For example, during one playdate an adjunct early childhood teacher educator shared an activity used to support teacher candidates in shifting to strengths/asset-based views of students and communities. The other adjunct faculty requested copies of the activity which were uploaded to the LMS. The following session included time for other adjuncts to debrief and reflect on how they had used the activity in their own teaching.

Analytic data was limited by the default settings of the LMS. Available data indicated the amount of time participants spent in the shell varied from just over 30 hours to just under 3 minutes. Views of the sandbox pages were numerous at the beginning of the experience, then tapered off. A significant number of views occurred in Fall of 2020, as participants entered the first full semester of online teaching. Between November 2021 and March 2022 the facilitation of the sandbox was impeded by external events. There were few playdates and no new content was added this correlated with fewer views of the sandbox. Sandbox views seemed to have little connection to the start and end of semesters and/or college/department events, but experienced a significant uptick with the posting of new content in March, 2022 as seen in Figure 1.

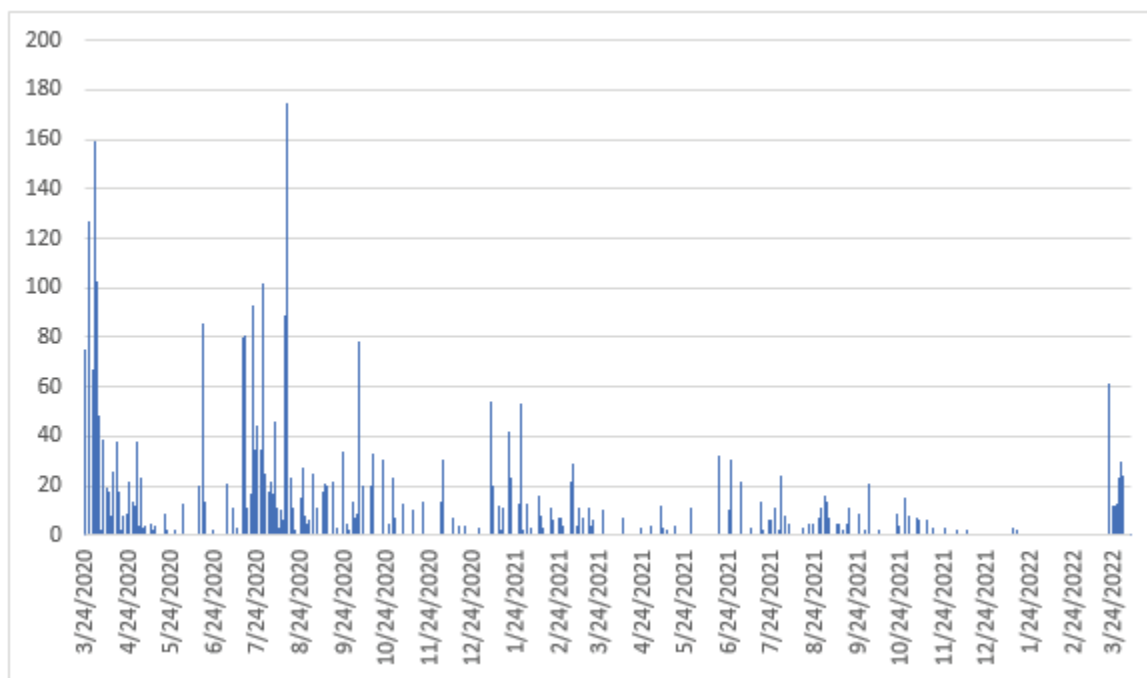


Figure 1. Original Sandbox Views by Date.

A total of 37 synchronous playdates were scheduled and attended. Attendance at the playdates varied widely at the start, with greater attendance at playdates that had specific topics. Four adjunct faculty in teacher education departments and the facilitator were consistently regular attendees by the end of the scheduled playdates. These four core participants represented early childhood education (1) and the K-12 teacher preparation (3) programs. The experience of the sandbox was valued by these participants, as expressed by one of the core playdate attendees:

As a Tech Diva in Training, I have found the LCOE Playdates invaluable as I continuously work to refine my teaching practice. A critical element to this success is watching and learning how to create a comfortable space so that each voluntary participant can pose questions and then try to the tips and tricks that we discover together. – Sandra, adjunct faculty in teacher education

While the first year of the sandbox focused on the use of the LMS and integrating free technology tools, the topics covered in the second year began to be more driven by the interests and needs of the participants. The core participants formed a collaborative, trusting group and frequently introduced topics about social justice, supervising teacher candi-

dates to foster equitable and inclusive teaching practices, and specific department values and skills such as social-emotional learning and universal design for learning. While technology was still part of the conversations, the framing and context shifted from tool-focused to pedagogical and ethical practices that were being encouraged by department leadership.

As the urgency of learning technology lessened, conversations in the sandbox reflected longer-term department and college goals of teaching for social justice. Analytic data indicated adjunct faculty utilized the sandbox more than TT faculty and conversations within playdates showed they valued the just-in-time nature of problem-solving conversations with peers and experts. This confirms research into effective support of adjunct faculty (Aldemir & Ardley, 2014; Edwards, 2019; Ward Parsons et al, 2021). Many of our adjunct faculty described the sandbox as a safe space to debrief and reflect (Yilmazel-Sahin & Oxford, 2010) not only on changes in teaching practices such as trying out a shared activity (Guskey, 2002), but on the struggle of shifting identities around TPACK and from K12 to the university (Boyd & Harris, 2010).

IMPLICATIONS

The continued use of the sandbox space, as shown by views over time, indicates that a sandbox would be a useful augmentation to ongoing and sustained professional development in technology and as a space for sharing content in anti-racist teaching methods. While this support is valuable for all faculty, the virtual, familiar space of an LMS-based sandbox is especially helpful for adjunct faculty who may have other temporal, logistical, and geographical constraints on attending traditional professional development (Edwards, 2019). As we move towards more in person instruction, research is needed into how the sandbox could be utilized in conjunction with face-to-face development experiences such as blended or hybrid delivery models.

The use of the sandbox presented affordances and constraints for both supporting professional development and for research. Utilizing an LMS provided participants with the opportunity to try out tools and activities with one another before bringing them into the classroom, essential to the development of TPACK (Foulger et al, 2016; Liu & Geertshuis, 2021). The sandboxes both became repositories for course- and college-specific resources that could be accessed anywhere, anytime. Teacher education departments with significant numbers of adjunct faculty could adopt a sandbox approach to supporting these faculty in becoming a crucial part of achieving department missions (Aldemir & Ardley, 2014; Edwards, 2019) while also providing experiences that can be used to advance the careers of adjunct faculty (Ward Parsons et. al, 2021). Utilizing a sandbox approach was been successful in providing adjunct and TT faculty with space for participating in a synchronous and asynchronous community of practice around challenging content (Wenger-Trayner & Wenger-Trayner, 2025; Yilmazel-Sahin & Oxford, 2010). The focus of the space as a community in which they were collaboratively playing with, building, and trying to break tools, pedagogies and ideas in order to be prepared for use with students ensured that the learning occurred in a safe and familiar space. The online and shared nature of the sandbox also allowed for flexibility in aligning to shifting accreditation and department priorities. Topics were generated by participants and leveraged to meet overlapping needs. For instance, during the 2022-2023 academic year sandbox participants will be exploring the affordances of technology-based formative, project-, and problem-based assessments in ensuring a sense of belongingness and success of under-represented students. Overall, the sandbox is a viable approach to action-oriented, highly effective (Yilmazel-Sahin & Oxford, 2010) professional development in technology and beyond.

Note: If you are a researcher or education leader and have interest in obtaining the sandbox tool-kit under development, please contact the author of this chapter for review copies.

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Staying on Track in Curriculum and Pedagogical Innovations Despite Pandemic Disruptions through Multilevel Connected Learning in Networks

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The disruptions caused by the COVID-19 pandemic has challenged us to rethink the design and implementation of professional development (PD) activities for in-service teachers. In Ko et al. (2020), we reported on the redesign of the PD activities in a STEM Innovation Network organized in the form of a School-University Partnership (SUP) project. The redesign retained adherence to the original MultiLevel MultiScale approach to PD but adjusted to support schools and teachers in surviving the transition to remote teaching and learning. For the schools to succeed in re-engaging in the original project goals of school-based innovations in self-directed learning in STEM education, it was hypothesized that schools would need to go through three stages—re-initiation, re-coalescing, and re-activation (Ko et al., 2020)—in the recovery process. In this paper, we further investigated the extent to which different schools were able to advance through the three stages across three half-yearly periods, as well as whether and how such advances were connected to the engagement of their teachers and school leaders in the PD activities at the network level. Our findings reveal the importance of engaging both teacher and school leader level staff within a school in the project PD activities for successful recovery. Further, the tempo of recovery differs across schools. Schools that were slower at the start might be able to catch up. School leaders need to be able to motivate and create conditions for their teachers to re-engage in the innovation.

Keywords: In-service teachers; professional development; online learning; multilevel approach; school-university partnership; STEM education; self-directed learning

HISTORICAL REVIEW

The COVID-19 outbreak in 2020 brought serious challenges to a School-University Partnership (SUP) Network in Hong Kong that relied heavily on place-based Network meetings and school-based support. The SUP project's goal was to foster integrated STEM curriculum innovation that adopt self-directed learning as the pedagogy of choice in primary and secondary schools (hence the project will be referred to as the SDL-STEM project for short). The SUP program adopted a layered multilevel approach based on the MultiLevel-MultiScale (MLMS) framework (Law et al., 2016) which emphasizes the interdependence of learning across different levels. For example, innovative practices at the classroom level need to be facilitated by accompanying changes in curriculum, assessment, staff appraisal, technological and human infrastructure at the school level. Learning at the network level promotes knowledge building through communities of practice as schools tackle new problems in the process of innovation. The MLMS framework thus also highlights the need for the learning taking place at the different levels to be *connected*. In the SDL-STEM project, connected learning was achieved through designed architectures for learning (AfL) (Penuel, 2019; Stein & Coburn, 2008), comprising organizational structures, interaction mechanisms and artifacts (Law et al., 2015).

Four layers of AfL were designed to support SDL-STEM innovations in the Network, each comprising mechanisms for interaction (M) and artifacts (A) for guiding and consolidating the learning outcomes. The first layer of the AfL comprised a STEM workshop series for teachers to learn how to design and implement SDL-STEM innovation units (M), and a framework to connect SDL with STEM as well as a set of learning design templates (A). This layer thus supports learning at teacher and Network levels. The second layer comprised workshops for sharing of goals, challenges, strategies and plans among schools (M) and presentation materials shared by school leaders (A), targeting learning at school and Network levels. The third layer comprised school-based consultation meetings during which teacher teams in individual schools arranged CO-planning and Lesson Observations of planned implementations (COLO) with their assigned Network consultants, addressing learning at teacher and school levels. Layer 4 comprised large scale, community-wide experience sharing and/or celebratory activities during which teachers and school leaders in the Network shared their good practices at classroom and school levels with others outside of the Network. Layer 4 activities provide opportunities for the consolidation of learning at teacher, school, and Network levels. In the design of these layers of AfL, care was taken to foster the agency and peer learning of Network participants.

In Ko et al. (2020), we reported that the layered Multilevel approach to PD had re-engaged most schools to participate in the Network's online professional development (PD) activities by summer 2020, even though most schools in Hong Kong had limited experience with technology-mediated learning (Reichert et al., 2020) until the pandemic struck. A major additional component on how student-centred learning and teaching could be designed and implemented online (Layer 1) and what kinds of school level support would be needed (Layer 2) were introduced into the suite of PD activities. This helped to steer teachers away from perceiving their online work as emergency remote teaching (Bozkurt & Sharma, 2020) and to instill a perspective that online learning and teaching can be a productive pedagogical practice within teachers' professional repertoire even after the pandemic. In this chapter, we report on the progress made by schools in their efforts to resume engagement in their goal of pursuing SDL-STEM innovation after the initial three months of transitioning.

Table 1
Layered Multilevel Approach to Designing Learning for Network Communities

	learning needs to align with innovation goals	Layers of AfL (M being the PD activities and A being the reification artefacts) to provide conditions for learning to address learning needs at different levels			
learner* level targeted		Layer 1 (For teachers to understand the why & how of SDL-STEM)	Layer 2 (For school leaders to understand conditions & strategies for success)	Layer 3 (to support school-based classroom implementation of SDL-STEM)	Layer 4 (for dissemination of concepts and implementation experience beyond the project)
		M: STEM workshop series on design & implementation of SDL-STEM curriculum units A: SDL & STEM framework & design templates	M: workshops for sharing of school-level goals, challenges, strategies, & plans A: ppt & artifacts shared by school leaders	M: CO-planning and Lesson Observation (COLO) sessions in schools A: SDL & STEM framework & design template	M: online/on-site/hybrid sharing of innovation experience @ classroom & school levels A: innovation dissemination materials beyond the Network
Teachers	Knowledge & skills to design and implement integrated STEM adopting SDL approach	X		X	X
Schools (involving leaders)	Strategies to establish goals and capacities for implementation of SDL-STEM innovation		X	X	X
Network	Mechanisms & artifacts to strengthen Network as a community of practice for SDL-STEM innovation	X	X		X

N.B. "X" below each layer indicates that the AfL within that layer addresses the learning needs of the respective learner groups in that row.

* The MLMS framework considers institutions (e.g., schools) and networks to be entities that need to engage in learning, beyond those of individuals within them. Learning outcomes of these entities would be exhibited in the form of new organizational structures, routines, activities, etc. developed to achieve new goals or to adapt to external changes resulting from decisions made by these entities.

METHODS

This study addresses two key research questions: (1) How many of the Network schools were able to progress through to the re-activation stage by summer 2021?, and (2) Whether the schools' recovery trajectories were related to their staff members' participation in the Network-based PD activities (i.e., layers 1, 2, and 4)?

To answer the first question, we first defined the criteria for categorizing schools' SDL-STEM recovery based on the three stages as hypothesized in Ko et al. (2020):

- Stage 1, Re-initiation: schools that participated in some of the online Network-based PD activities but not in any COLO;
- Stage 2, Re-coalescing: schools that engaged with their Network consultants in co-planning (CO) to explore the design of STEM curriculum units but were not ready to implement the plans as classroom practices with lesson observation (LO) involving outsiders;
- Stage 3, Re-activation: schools that engaged with their Network consultants to complete at least one COLO cycle, and generated artifacts from their implemented SDL-STEM innovation practices for wider dissemination.

It is important to note that the criteria for a school to be categorized as belonging to stages 2 or 3 are based entirely on their school-based project engagement (Layer 3), independent of whether any of the teachers or school leaders participated in the activities in Layers 1, 2, or 4. A total of 30 schools stayed in the Network throughout the three periods: Feb – Jul '20 (Period 1), Aug '20 – Jan '21 (Period 2), and Feb – Jul '21 (Period 3). The categorization of schools into the stage of development reached within each period was conducted using the participation records kept by the SUP project for all four layers of PD events listed in Table 1. The categorization was further triangulated with the descriptions in the individual school reports prepared by the SUP project staff on the general state of SDL-STEM development in each school based on a collation of all data collected by the project team, including teachers' designed lesson plans, online/on-site video-recorded lesson observations, and interviews.

The MLMS framework (Law et al, 2016) hypothesizes that multilevel connected learning can only be achieved if teachers with and without leadership roles can both be involved in the agentic implementation of a pedagogical innovation. Thus, to answer the second research question, we analyzed the extent to which school staff with different roles (differentiating between those with teaching duties only and those with different leadership functions) engaged in the different PD activities over time. For leadership roles, we include those with senior management positions (e.g., principals, vice principals) as well as middle managers (e.g., subject panel heads, STEM coordinators, e-learning coordinators).

Activities in layers 1, 2, and 4 were all held online during the period under investigation, but the layer 3 COLO activities could be conducted online or on-site. The project kept detailed participation records for the COLO activities in each school, including whether each of the activities were held on-site or online. Our analysis thus also includes the modes in which the activities were held.

RESULTS

Before we address the two research questions set out earlier, we provide below a summary of the schools' involvement in the different layers of PD activities over the 18 months from the start of the pandemic, broken down into three 6-month periods. The results are presented in Table 2.

Table 2
School Engagement in Different PD Activities Across the Three Periods

	Period 1 Feb-Jul '20	Period 2 Aug '20 – Jan '21	Period 3 Feb-Jul '21
No. & % of schools not engaging in any PD activity	2 6.7%	0 0%	0 0%
No. & % of schools participating in at least one online* PD workshop	28 93.3%	30 100%	26 86.7%
No. of schools engaged in CO-planning (CO) with university team members (figures in brackets are those with online CO)	10 (6) 33.3% (20%)	26 (12) 86.7% (40%)	22(12) 73.3% (40%)
No. of schools conducting Lesson Observations with debriefing meetings (LO) (figures in brackets are those with online LO)	0 (0) 0% (0%)	5 (3) 16.7% (10%)	26 (4) 86.7% (13.3%)

* All network level PD workshops were held online during the three time periods under consideration.

It can be seen from Table 2 that there were distinct patterns of engagement across the three 6-month periods. During Period 1, only one third of the schools were able to engage in school-based co-planning of SDL-STEM curriculum units, and none of the schools were able to realize the project goal of innovation implement at the classroom level. In Period 2, all schools participated in at least some of the online PD workshops (layers 1 and 2), a large majority of the schools (86.7%) had started school-based co-planning of SDL-STEM curriculum units, and five of the 30 schools had already held lesson observations for their innovation implementation. It was clear that by Period 3, a large majority (86.7%) of schools were able to implement their co-planned curriculum innovation in their classrooms.

The Network Schools' Recovery Trajectories

To answer Question 1, we identified the stage of recovery for each of the 30 schools during each of the three periods based on the categorization criteria described in the method section. Schools were regarded as disengaged if they did not participate in any layer of PD activities. Table 3 summarizes the results.

Table 3
Number of Schools in Different Recovery Stages During the Three Time Periods

Recovery Stage		Period 1	Period 2	Period 3
0	Disengaged	2	0	0
1	Re-initiation	18	4	0
2	Re-coalescing	10	21	4
3	Re-activation	0	5	26
average stage reached		1.3	2.0	2.9

Table 3 shows a clear progression in terms of the stage reached by most schools over the three periods: re-initiation, re-coalescing, and re-activation respectively. However, in terms of the recovery trajectories of individual schools, our analysis shows that these were more complex. For example, of the two disengaged schools in Period 1, one advanced to Stage 2 (re-coalescing) and the other to Stage 3 (re-activation) during Period 2, and they reached/remained at Stage 3 during Period 3. There was also one school that reached Stage 2 in Period 1, regressed to Stage 1 during Period 2, and then jumping to Stage 3 in Period 3. Another school regressed from Stage 3 in Period 2 back to Stage 2 in Period 3. This shows that while all of the 30 schools were committed to staying on track to achieve their original vision when joining the SDL-STEM project, there could be complex factors at the school level that influenced the progress trajectories of individual schools at different points in time.

While 90% of the schools were able to complete at least one complete cycle of COLO for at least one school-based SDL-STEM curriculum unit by Period 3, there was a large diversity across schools in terms of their readiness to make use of online technology in conducting the COLO activities. As shown in Table 2, only 40% of the schools had held CO-planning sessions online in periods 2 and 3 respectively, indicating that teachers preferred to meet in face-to-face mode for these more intensive interactions. Teachers were even less willing to design and conduct their SDL-STEM curriculum units with pedagogical innovation elements as fully online classes—even in Period 3, only 13.3% of the schools had experience of holding LO sessions online.

We further analyzed the teachers' and school leaders' engagement in the different layers (1, 2, and 4) of Network-based PD workshops for schools at different stages of recovery during the three periods.

Schools' Recovery Trajectories and Their PD Participation Profiles

In this section, we report on our findings for the second research question: whether the schools' recovery trajectories were related to the extent to which teachers and school leaders engaged in the Network-based PD workshops (i.e., layers 1, 2, and 4), as predicted by the MLMS framework. Here, school leaders refer not only to principals or vice principals, but also teachers with middle management roles, such as subject panel heads of STEM subjects and e-learning co-ordinators. Table 4a shows the participation of teachers in Layers 1 and 2 workshops during each of the three periods for schools categorized under each stage of recovery. Two participation figures are presented for comparison across periods and stages of recovery reached in Period 3: the total number of schools with teachers participating in at least one of the workshops during that period (Sch_n-wT) and the average number of unique teachers participating in at least one of the workshops during that period (avT/Sch). A comparable set of participation statistics for school leaders is presented in Table 4b.

It is clear from Tables 4a and 4b that the participation statistics were highest in Period 2. This was probably because Period 2 was at the beginning of the school year when schools keen to engage in curriculum/pedagogical innovations would kick off their annual planning. It is also evident that, as reflected by the values of avT/Sch, there was a higher level of teacher engagement in the workshops activities for schools that reached the re-activation stage in Period 3 compared to those that were only at the re-coalescing stage. On the other hand, the average level of engagement of school leaders (avL/Sch) was similar across these two categories of schools over the first two periods. Moreover, the values of avL/Sch were much higher than avT/Sch for the respective periods for schools that only reached the re-coalescing Stage in Period 3, whereas the ratio avL/Sch: avT/Sch was much lower for schools that reached the re-activation stage. This seems to indicate that leaders in the schools that were less successful in their recovery process made similar efforts to their more successful counterparts during the 12 months after the pandemic outbreak. However, they were less successful in motivating their teachers to engage in the Network-based PD activities.

Table 4

Participation Statistics in the Monthly PD Activities of Teachers and School Leaders According to their Stage of Post-Pandemic Recovery During the Three Periods

a. Teacher participation

Stage in Period 3	N (sch)	Period 1		Period 2		Period 3	
		Sch_n-wT	avT/sch	Sch_n-wT	avT/sch	Sch_n-wT	avT/sch
Re-initiation	0	NA	NA	NA	NA	NA	NA
Re-coalescing	4	1	0.25	3	1	1	0.25
Re-activation	26	20	2.00	22	4	17	1.96

N.B.:

Sch_n-wT=no. of schools in that category having teachers participating in that period.

avT/sch=average no. of unique teachers per school participating in that period.

b. School leader participation

Stage in Period 3	N	Period 1		Period 2		Period 3	
		Sch_n-wL	avL/sch	Sch_n-wL	avL/sch	Sch_n-wL	avL/sch
re-initiate	0	NA	NA	NA	NA	NA	NA
re-coalesce	4	4	1.25	4	2.50	3	1.25
re-activate	26	18	1.27	21	2.46	19	1.96

N.B.:

Sch_n-wL=no. of schools in that category having school leaders participating in that period.

avT/sch=average no. of unique school leaders per school participating in that period.

IMPLICATIONS

Our research findings show that after 18 months, all of the 30 schools that stayed in the SDL-STEM SUP Network were able to make substantial recovery as indicated through the resumption of school-based (Layer 3) innovation activities. Twenty-six out of the 30 schools were able to complete at least one school-based COLO cycle, while a few in fact completed more than one cycle, involving different grade levels and STEM themes. Of the remaining four schools, all of them were able to engage in the school-based co-planning of at least one SDL-STEM curriculum unit.

The MLMS framework was developed based on the analysis of the scalability of pedagogical innovations in a SUP network (Law et al., 2015), and applied as a theoretical model of connected levels of learning to guide the design of indicators for the monitoring of the progress in the implementation of educational innovations involving changes in curriculum and/or pedagogy (Law et al., 2016). This framework has also been adopted to guide the design of pedagogical innovation networks (Law & Ko, in press) and in the analysis of the factors influencing the scalability of a self-organizing network of innovative schools (Law & Liang, 2019). In this study, we investigate whether the layers of AfL designed through the application of the MLMS framework can support schools in their process of recovery despite the disruptions caused by the COVID-19 pandemic.

Overall, the results indicate that the schools were able to make steady progress in their recovery, as reflected by an increase in their average stage from 1.3 in Period 1 to 2.0 in Period 2, and 2.9 in period 3 (see Table 3). On the other hand, our investigation of the relationship between participation in network PD and the stage of recovery reveals more nuanced observations. The average number of unique teachers participating in the Network-based PD activities were indeed much higher in the schools that reached the re-activation stage in Period 3 than those that did not, as predicted by the MLMS framework. However, this relationship was not replicated by the participation statistics of the school leaders in these two categories of schools. As reported in the results section, what differentiated the schools that successfully re-activated from those that were still re-coalescing in Period 3 appears to be the ability of the school leaders to motivate the engagement of teachers. This difference in engagement is rather different from the findings reported in earlier studies that the lack of school leader engagement in the Network-based activities was found to be a crucial factor associated with the lack of scalability of a school's innovation trajectory (Law et al., 2018). Continuing engagement of school leadership in both network and school levels ensures that the human resources allocation, school routines, and other elements of a school's AfL can be maintained/ adjusted as necessary as the innovation further develops. Earlier studies have thus found the absence/withdrawal of school leadership engagement to adversely affect the scalability of pedagogical innovations of schools participating in the same SUP network.

What is the reason for the apparent difference between the school level scalability of pedagogical innovations and the recovery trajectories of schools towards re-activation of pedagogical innovations in terms of the relative importance of school leader engagement? It could be the case that during recovery from pandemic related disruptions, there is an added barrier to engagement in school-based innovation—that of crisis management. Unless immediate challenges such as ensuring that all teachers and students are able to engage in online teaching and learning, that new routines, timetabling, and human resource allocation are in place for smooth day-to-day operations under uncertain external circumstances, teachers would not be able to shift their attention beyond fulfilling their basic calls of duty to achieve the higher-level goals of engaging in pedagogical innovations. It is also observed from our data that both of the “disengaged schools” in Period 1 were able to achieve re-activation, one in Period 2 and the other in Period 3. The leaders in these two schools might have made very accurate judgement of the situations in their schools and focused on laying the

groundwork for establishing the conditions for satisfactory online teaching and learning before planning for the resumption of their schools' innovation goal. The fact that the recovery trajectories were not unidirectional but include situations where a school may "regress" to an earlier state also speaks to need for schools to attend to their own unique situations.

In this paper, we are only able to capture the AfL designed at the network level, and how schools' participation in these might have contributed to their recovery. It is clear that the design and implementation of the school level AfL play an important role too for the schools' crisis management and recovery. Future studies should investigate how different schools design and plan their own recovery trajectory, and in particular how school leaders in the more successful schools motivated their teachers to continue to pursue their innovation goals despite tsunami-scale unanticipated disruptions.

This study also uncovered two issues that warrant further investigations regarding the application of the MLMS framework to agentic school change and/or recovery. First, prior work did not investigate the ratio of avT/Sch to avL/Sch. The innovation process entails changing teachers' practices, it requires teachers to learn through experimentation with their lesson designs, accompanied by reflection and feedback (Clarke & Hollingsworth, 2002). This requisite teacher learning relies critically on school level conditions—the opportunity to engage in COLO, which is layer 3 in the AfL. COLO takes place within school contexts and school leaders play important roles in ensuring that school-level conditions are in place to foster the necessary teacher learning through practice (Kelly, 2006). It is not clear whether there is an optimal range in terms of leadership vs. teacher participation for school success in these two contexts, and if so, whether the optimal range would be different.

Another question that warrants further research is whether and how a school's online learning and teaching readiness (including technology infrastructure and teachers' online teaching and learning capacity) influenced the school's speed of recovery. In Table 2, we reported on the proportion of COLO activities that were held online. Theoretically, schools that were more ready could have more flexibility in their scheduling of COLO. On the other hand, teachers who were committed to more interactive forms of STEM pedagogy might prioritize their use of on-site teaching and learning time for COLO. Our preliminary analysis does not reveal identifiable relationships between schools' engagement in online COLO and their recovery trajectory. It would be valuable to further explore whether the nature of the COLO activities differ for those conducted online vs. those in person on-site. Findings will help us to understand whether there is a need to design future PD activities and supporting resources to broaden teachers' capacity to design and implement STEM pedagogical innovations that can be conducted online.

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Supporting Research Informed Teaching using a Mobile Application

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A repositioning of research within teacher education is vital to the profession. Supporting teachers becoming active agents and producers of research within their school settings, is pivotal to their professional development and the development of the teaching profession. In this chapter, we present how the European Union-funded project, Building a Research Infrastructure for School Teachers (BRIST), progressed through the COVID-19 pandemic. The chapter presents a retrospective of the teaching and teacher education in fulfilling the project objectives which was designed to develop technology to coordinate and support teacher-research at a European level. The principled participatory design collaborative project, across five national jurisdictions, engaged with teachers and teacher education stakeholders in developing a mobile application to support teacher research. The challenges posed by the COVID-19 pandemic are captured, along with the innovative approaches in overcoming these roadblocks to progress the research.

HISTORICAL REVIEW

In meeting the challenges to educate our next generation, with the support of the globally networked human and ICT ecosystem, the BRIST project was commissioned to engage with teachers to research their own practice, moving them from being a teacher to a teacher researcher (Hammersley, 1993). The aim of the project was to make teachers research producers, not just consumers of research, thereby reducing the gap between research and practice and simultaneously strengthening the profile of the teaching professions (Hammersley, 1993).

Our previous work presented “a number of professional development, open educational systems which exist or are currently being developed to support teachers internationally, to engage with, use and do research.” (Connolly et al., 2020, p. 609). While the pandemic created a necessity to restructure or in some cases overhaul teacher education the opportunities in regard to adopting and adapting mobile technology were many (Hall et al., 2020). Designing and building a mobile application and a research infrastructure for teachers, supporting their lifelong learning through evidence informed ‘case studies’ was central to the BRIST project. Sharpe et al. (2006) determine that effective blended learning implementations are characterised by active learning designs which maintain face to face contact but respond to the local affordances and constraints. Alammery et al. (2014) distinguish between low-impact, medium-impact and high-impact blends ranging from adding extra online activities to a total course redesign. It has been suggested that innovative blended course design can be best achieved through an iterative design, utilising rapid prototyping and reflective practice (Stein & Graham, 2014), with blended learning having the potential to transform learning and teaching by compelling re-

flection on educational design (Garrison & Kanuka, 2004). Digital education, and more specifically mobile learning solutions, are for many teachers a feasible solution ensuring access, functionality, and a continuation of education, facilitated by the portability of devices (Hall et al., 2020).

Another challenge presented, as a result of the COVID-19 pandemic, was a catalyst to reimagine project communications, embracing the digital infrastructure in fulfilling the project aims. The design based educational research approach, which guided the project, included the collection of evidence to measure impact and this was hampered due to the constraints, pressures and stress teachers and schools faced (Burke & Dempsey, 2020; Clark et al., 2021). Undoubtedly the pandemic shocked teachers and at all levels, pre-service as well as in-service teachers (Flores & Swennen, 2021; Mohamad Nasri et al., 2020) and this curtailed recruitment of participants for our project in some countries. From a project implementation point of view team meetings became virtual, collaboration was somewhat impeded and redesigned to online interaction. Involvement with stakeholders also. Nevertheless the project is fulfilling its objectives and the project process, implications and future developments are detailed in the following sections.

PROCESS/METHODS

A key output of the project was to engage with teachers and teacher education stakeholders in developing a mobile application to support teacher research. The project aim was to inspire teachers to look at their own practice with criticality so that they engage in researching their own practice moving them from being a teacher to being a teacher researcher (Hammersley, 1993). Complimenting the work by Hammersley (1993) our primary research question is ‘how do we support teachers to become teacher researchers and evidence-informed practitioners?’

The main project elements were in developing a systematic literature review on translational teacher research (Jones et al., 2022); the development of the mobile application and a training programme for in-service teachers; as well as the establishment of a Transnational Teacher Researcher Network.

This section details the adapted process we followed, due to COVID-19 travel restrictions. This output was underpinned by a preliminary systematic literature review (SLR) carried out by the team, that identified an initial set of themes, which highlighted the importance of certain factors influencing the ability of teachers to engage in research. One of these themes was ‘teacher agency’ which appears to be the pressing problem of practice (Wiliam, 2019). With this in mind, this study followed a Design Based Research (DBR) approach. DBR is ideally suited because of the principled, participatory, systematic, sustainable and valued approach which engages the diverse and dynamic variables that characterise universities, schools and classrooms (Penuel, 2019).

In light of travel restrictions, all meetings were moved online with the whole team meeting for 2 hours at monthly intervals and for two full days twice a year. We harnessed Zoom online conferencing and a suite of tools in Google Drive supported by a googling filing system and one Google Doc which acted as a list of contents for everything we created in the online space. To create the mobile application, we followed a 7-stage process:

- Stage 1 - Initial Designs: Following the SLR, in teams of 3 during a 2 day online team meeting, we adopted a blue sky approach to creating a set of initial designs for what a mobile application might look like.
- Stage 2 - Incomplete Narratives: On the following day at that same meeting, we developed a series of incomplete scenarios (Jarke et al., 1998) that we could use with teachers and teacher education stakeholders in a series of focus groups.
- Stage 3 - Focus Groups: Over the course of several weeks, each national team ran two online focus groups with teachers and teacher education stakeholders. The first one asked them to reflect on the SLR findings and the second asked them a) a set of questions about mobile application design using a survey, to determine the broad requirements for a mobile app and b) to complete the incomplete scenarios. Participants were selected from within each country’s professional networks and then cascaded out.
- Stage 4 - Focus Group findings per country: Each national team then assimilated all the findings from their country into a single structured report which was shared with the App developers.
- Stage 5 - Ranking Survey: The App developers used these reports to develop a ranking survey tool using Google Forms, which was then completed by teachers and teacher education stakeholders from across the five national jurisdictions. The ranking asked questions about the types of content that they would be interested in but also the kinds of interactions and networking opportunities that the App would be able to facilitate.

- Stage 6 - Prototyping - (Diagram / App Pages xls / Badges & Gamification): Based on these results, the App developer created a google spreadsheet that laid out a plan of the app which was discussed at a monthly online meeting and from this they created a mobile application design document using Miro. During this phase we again sought online focus group feedback from our focus groups to help refine the design and to address terminology concerns for multiple languages. The feedback from these focus groups led to minor amendments and the development of a prototype mobile application.
- Stage 7 - Testing & Final Feedback: We are currently still in Phase 7 which consists of revisiting the Mobile Application prototype with our online focus groups to identify any final issues and to give these early adopters (Rogers, 2003) the chance to populate the App with their own classroom-based research.

RESULTS

The project systematic literature review was completed just prior to the COVID-19 pandemic and the article recently published, Jones et al. (2022). Another component of BRIST is the design based research and development of a mobile application to support teacher researchers. DBR typically starts with a prototype design model, which is a conjecture of what the final design or technology will look like. Then, through iterations of conceptualisation and theorisation, implementation and evaluation of that design, the conjecture is refined until the distance between the initial problem and ultimate solution is minimized, and the technology/design aligns well with the educational context and attendant needs of teachers and learners.

The results presented in this chapter relate to this component of the BRIST project, the development of the teacher research mobile application. Over the course of the mobile application development, a scoping study online questionnaire was deployed to collect user requirements in the five countries before more in-depth focus groups were run. A total of 153 teachers and teacher education stakeholders across Greece, Ireland, Poland, Spain and the UK took part over the course of 3 months. The respondents worked across a range of roles, with 45.5% of the sample working in either primary or secondary schools and 34.7 % of the sample working in either higher education or teacher education. The remaining 19.6% worked in a range of associated areas such as Special Educational Needs (SEN), educational management and policy development.

Respondents highlighted that the design of the mobile application needed to be simple to navigate, clear and provide ease of access to the content. Respondents wanted opportunities to network with other teacher-researchers and experts in their field. Content needed to be subject specific, practical, including research on pedagogy and opportunities to discuss with the author, but also support for developing their own research. What respondents didn't want was lack of clarity, a non-intuitive interface, patronising content, too many clicks to navigate the App and too much detail or complexity. Overall time to use the App came out as an issue. The App needed to be quick to navigate and able to fit in with busy teachers working practices. Table 1 shows the top five types of content that participants suggested should be included on the App.

Table 1
Content Participants Suggested to be Included in the APP

Reading research summaries	80.3 %
Bite-size information (for quick engagement)	77.5 %
Interact with other teacher-researchers	74.6 %
Links to research training materials	73.2 %
Interact with experts	70.4 %

It can be seen from the table that access to research summaries and bit-size information were important, so that research can be quickly engaged with by the teachers. Thus in the App titles and summaries need to be engaging leading to longer, more in-depth pieces. Equally teachers wanted to network and interact with other teacher researchers but also with experts within the field. Research training materials were also highlighted as being important.

A further question on the usefulness of an associated teaching training programme found that 71.6% agreed that such a programme would be useful in reducing the distance between experts and in-service teachers and the majority of comments would like a training programme to provide credits towards further academic qualification such as Masters degrees and postgraduate professional studies. Furthermore 64.3% of respondents indicated that they would like research methods resources to be included in the App.

IMPLICATIONS

Future, ongoing research is needed to support the development of infrastructures, such as the BRIST Project that make research easily and openly available to student teachers, in-service teachers, researchers and teacher educators. The emergence of BRIST and related technology-supported platforms holds significant promise for bringing research to teacher educators, researchers and teachers in ways that they can really use within their educational practice. The BRIST mobile application development, corresponds to the emergence and need for increased technological immersion exasperated by the pandemic.

As detailed in the above section, key implications of our research in the BRIST Project became manifest in the design of our app for teacher researchers. For example, signature features of the BRIST app include sharing, where teachers and researchers can post their research findings for others to access, review and use. They can also use the app to potentially connect with other teachers and researchers, thereby building a community for teacher research. Furthermore, as a methodology that tries to be theoretically-led in practice, DBR can help us avoid responding uncritically to practical issues but rather reflecting potentially more deeply on educational challenges and questions in classrooms and schools. This can help us to be more systematic and research-informed in our educational practice.

A further key implication to emerge from our project, and indeed this was reflected in educational developments globally, is the utility of design-oriented methods and, in particular, design-based research as a research and development methodology. The usefulness of DBR becomes very apparent especially when our educational future is uncertain and unclear, akin to what we have experienced over the last 3 years in education globally. As demonstrated in the above results, DBR has enabled us to respond creatively and flexibly to inevitably indeterminate problems and loosely-sequestered questions in educational contexts, in ways that are reflexive and responsive. Furthermore, DBR prioritises participatory methods of inclusive design, which helps us to embed the principles of agentic and agonistic democracy by engaging teachers as protagonist design researchers who lead and enact change in their classrooms and schools.

As we endeavor to enact this significant implication of teacher access to research, the approach to how we support teachers as researchers is paramount; it must be done in a fundamentally inclusive way. This starts with a strong philosophical orientation in our technology design, one that is avowedly and intrinsically collaborative and led by teachers. This leads us to strongly recommend that design thinking and educational design research/design-based research methodologies be integrated within teacher education programmes internationally. The design based research (DBR) approach of the BRIST Project repeatedly shows that teachers do not want patronizing research content, dictated to them in a manner removed from the exigencies and realities of their classrooms. In accessing and using research, they want to engage with other teachers and experts; however this needs to be done in a fundamentally participatory way; where there is parity of esteem between teachers as researchers and so-called professional researchers. Any efforts to promote research with teachers in schools must place their concerns and needs at the both the start and heart of the process. The development of the BRIST mobile application aims to facilitate this and support teachers to be research leaders.

Finally, when we think of pre- and post-COVID we contend that there are opportunities for learning and research from both, rather than necessarily regarding them as competing. Design-based research methods, including conjecture mapping, can enable us to systematically navigate difficult challenges we face in education and society, including a global pandemic.

Reflecting on our historical review of the BRIST Project, we conclude with this final thought, that the point is perhaps not to attempt to resume pre-COVID education practices but rather, using design-based research methods, inclusively involve in-service teachers as researchers, in new hybrid and hyflex practices that enable them to authentically and impactfully deploy research to enhance learning, teaching and assessment in schools and classrooms globally.

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Digital Tools

Combining Simulations and Hands-On Learning in Robotic Programming Courses

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The pandemic of 2020 forced technology education teachers to teach online the skills that are normally done hands-on and in-person. One of those skills involved programming robots and learning basic programming, all of which moved to online simulations in spring 2020. Since returning back to in-person classes, the robotics course for preservice teachers has combined simulations with in-person labs. A survey was conducted with students based upon their experiences. This paper discusses the lessons learned from 2020 from combining simulations with hands-on learning for technology education preservice teachers and offers implications for technology education courses into the future that implement these topics.

HISTORICAL REVIEW

The pandemic in 2020 brought challenges to preservice technology education, especially for coursework involving technology that could not be brought home such as robotics programming. In spring of 2020, our faculty were tasked with teaching our technology education preservice teachers (PSTs) how to program robots without having a robot in front of them (Baumgartner, 2020). There were also many other courses in the curriculum that require hands-on experiences that were unable to be completed due to all coursework going online such as welding, machining, electric circuits, and woodshop, most of which are impossible to complete online. The robotics course originally required PSTs to be present in lab with a smaller-sized industrial robot to learn basic programming skills and pick-and-place motions. Students learned about variables, loops, motion, and Programmable Logic Controller (PLC) connections utilizing the robots. With the rapid move to online learning, these tasks were no longer possible as the robots are difficult to move and transport and purchasing smaller robots was impossible.

With the move to online learning, the lack of free training resources for robotics programming became apparent. The brand of robots that are utilized in the lab has no free training resources (in fact, they were thousands of dollars for one participant). Universal Robotics had a free online training program utilizing simulations that teaches users the basics of robotics programming. While students did not have the robots directly in front of them, it was an acceptable alternate way to provide training without spending thousands of dollars. Additionally, the students could see how robotic systems work with conveyors and PLCs without needing to simulate a system running in the lab. Simulations have been effective in education and have been utilized previously with teaching robotics programming (Doswell & Mosley, 2006; Sottile & Brozik, 2004; Tellez, 2017). Figure 1 below shows how a simple robotics skill of point-to-point programming can be taught on a simulation.

Since coming back into the traditional classroom, students were able to transition back to the lab and complete the lab work on physical robots and they have continued utilizing the online simulations. One benefit of the online training is that students are able to do a task (such as utilizing the gripper, or tracing a letter) on a physical robot and then learn about it online from a different robot manufacturer and are able to complete the task virtually. This helps students to transfer their skills to other types of robots in the future, as the school cannot have all the different brands available for training. Additionally, the manufacturer of the robots utilized in lab has a simulation software that was purchased for educational training. This is not a free resource but was implemented in the curriculum since 2020. Figure 2 shows students learning point-to-point skills by tracing letters in the in-person robotics lab.

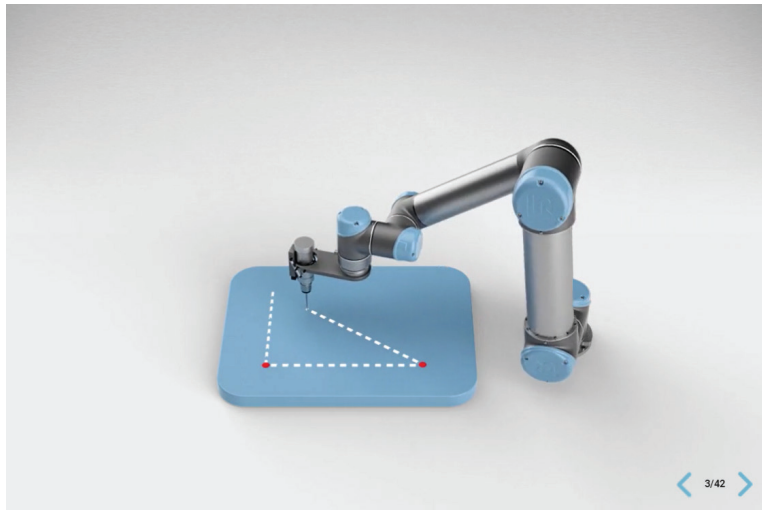


Figure 1. Teaching point-to-point on the simulation. Retrieved from Universal Robotics.



Figure 2. Teaching Point-To-Point During the In-Person Lab.

PROCESS/METHODS

Our university was in-person for fall of 2020 and beyond, so there was one semester fully online. However, the online simulations remained in the curriculum. The course is three credit hours and meets three times a week for 50 minutes. The first day, the entire class meets for lecture in which they learn the concepts that will be introduced in the simulations and in lab. The second and third class, half of the students are in the lab working on the robots and the other

half will complete one or two robotic simulations that correspond with what they learn in lab. The third class requires the groups to switch. This is due to limited space in the lab and the opportunity for all students to get a chance to work on the robots.

Each semester, the students are asked questions about specifics of the course in an anonymous and optional survey via Google Forms. This is separate from the typical course evaluations, but there are often comments about the simulations in the evaluations as well. Students answer the following questions on a five-point Likert scale regarding the online simulation training.

“The robotics training was helpful to me and my future career”

“I learned valuable information from the robotics training”

“I believe future students should use the training”

They were also asked an open-ended question to add comments regarding the online simulation. Of the three times the course was offered in the last three years, there were a total of 33 students enrolled as the technology education and manufacturing technology classes are small. Since not all students responded of the 33 total, the sample size is low ($n=15$). However, it gives promise that the robotics training is indeed helpful.

RESULTS

The students in 2020 struggled to remember a lot of the skills they learned from the simulations a year after taking the course, while the students in 2021 and beyond had a better experience since they had both the in-person labs on the robots that corresponded to the online training. One student from 2020 mentioned he really liked the simulations, but because he was not physically there to do it or see it in action, it was hard to retain the knowledge. He also mentioned one year after taking the course that he did not remember how to do basic point-to-point programs after not interacting with an in-person robot. Four students from 2020 noted they were happy to have a replacement for the hands-on training as in-person classes were prohibited. Three of the students agreed they could see themselves utilizing the skills learned from the simulations in their future careers.

In 2021 and beyond, a majority of the students noted that completing the online simulation and then doing it in-person helped them understand the concepts better. The simulations also have some extra aspects to a robotic work cell that are not in the lab so they are able to see it on the simulation (such as conveyors, sensors and pallets) and the students noted it was helpful to see those as well.

Of the total 33 students in the course over three semesters, 15 of the students participated in the survey. Fourteen of the respondents were male whereas one was female. 40% of students noted “strongly agree” when asked if they found the training helpful to them and their future career, while 53.3% of students said “agree”, and 6.2% responded “neutral”. When asked if the student learned valuable information from the training, 53.5% said “strongly agree” while 26.7% said “agree” and 20% were neutral. 93.3% of respondents said future students should participate in this training while 6.7% responded as “strongly disagree”.

The final project involves creating a robotic code to perform a task. The quality and understanding of the processes were significantly improved with the addition of the online simulation plus the in-person labs. The students in 2020 struggled to see how the systems worked together due to not being able to program it themselves and struggled with the final project.

IMPLICATIONS

From the results of the survey as well as the additional indicators from the final projects, the addition of the online simulations with the in-person labs has proven to be successful in helping students understand the concepts of the course. Since this is a shared course between PSTs and manufacturing technology majors, there needs to be some aspects of the course that focus more on the teaching side of things instead of purely training on robots (Baumgartner, 2020). One option is having PSTs create a lesson plan for a robotics topic for a final project instead of a program. In regards to the PST aspect of the course, there are implications from these findings that can be considered into the future.

Robotics courses need to offer different types of robots to learn programming. Often times, teachers do not have access to industrial robots (unless they are in career tech) and do not teach that aspect of programming (Baumgartner, 2020). Instead, they should be learning with pick-and-place robots such as a DoBot (<https://www.robotlab.com/store/dobot-classroom-pack>). The PSTs that take the course note that they are helpful for understanding concepts but do not apply as much to their future classrooms. There have been many advancements in the past few years that provide educational packages to teach conveyors, pick-and-place, and movement of robots. Some smaller educational robots also have writing ability, laser engraving ability, and magnetic arms, all of which can help students learn basic programming skills and would be beneficial in a STEM classroom (Eguchi, 2014). One of the respondents of the survey noted that having different types of simulations from different brands of robots would be beneficial to understanding how robots are programmed differently.

Simulations paired with in-person learning are very beneficial. Simulations have already been known to provide positive learning outcomes (Chamas & Nokali, 2004; Tellez, 2017), but when they are paired with in-person learning as well, it can help to reinforce those concepts (Gupta et al., 2017). The quality of the final projects vastly improved once in-person courses were allowed again and students could learn on both the simulations and the robots in lab. For the PST students, the reflections of the labs were much more in-depth, and they were able to picture how to use these concepts in their own classrooms using more concrete examples. “Simulations can still be utilized for learning prior to implementing hands-on activities in the classroom” (Baumgartner, 2020, p. 727).

PST educators should implement more classroom-based tasks in their curriculum. Because this is a shared course and focuses more on the manufacturing aspects of robotics programming skills, there should be more assignments that are focused on the PST aspect of the course. Students should visualize their classrooms and how they could implement these skills. They should be creating lesson plans that utilize them and they should be thinking of the types of technologies they would need to fulfill that vision. Reflections can help with these in STEM areas (i.e. Thomas & Bauer, 2020). This area was one aspect of the course that needed improvement since 2020 and is continually improving and changing for those students. Because of the limited number of students in the Technology Education major, this is an aspect that has been discussed by faculty throughout the past few years and is a goal to improve moving forward.

Ensure the simulation topics align with the hands-on topics. One tricky aspect of this course was finding a low-cost or free simulation to supplement learning in the lab. While the program used (Universal Robots) was helpful, it was important to align what the students were learning in their simulations with what they were doing in lab. This took some re-working of the labs to line up with the simulation topics. Additionally, the simulations were able to provide more knowledge in equipment that is not in the lab.

Simulations can be utilized in addition to hands-on learning as they do not make up for those experiences (Corter et al., 2007). Utilizing them alone during the pandemic was helpful (Baumgartner, 2020), but the survey and results have shown that combining them with the in-person labs helped students solidify their knowledge in these areas.

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Adapting In-service Professional Development to Meet the Needs of Preservice Teachers During the COVID-19 Pandemic through Design-based Research

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In this retrospective, we review the work of two professional trainings that prepared 200 in-service teachers to use QR codes to expand the breadth of instruction for young learners using picture books. Teachers were encouraged to incorporate high-quality, web-based resources to enhance student background knowledge and to support parents as they sought out safe educational resources to share with their at-home students. We then introduce the work that has followed with 64 preservice teachers as they were trained in this practice. Using design-based research, three iterations of the work have taken place. Through the first iteration additional supports were created to foster the thinking process of what materials would be best included. In the second iteration, additional scaffolds were put in place to foster text selection. In the most recent iteration and responsive to statewide curriculum and policy changes, preservice teachers have been provided High-Quality Instructional Materials eliminating the need for text selection. They then deeply engaged with these materials before seeking out additional web-based resources that might extend the children's learning through embedded QR codes. Implications for future research and classroom implementation are discussed.

HISTORICAL REVIEW

As the nation moved to a distance learning model, we shared the details of two professional trainings that provided 200 in-service teachers with complex, content-rich picture books and prepared them to implement a strategy building layered networks of understanding through the use of QR codes for young learners. Trainers explicitly modeled how to integrate multimodal, diverse web-based resources such as websites, podcasts, photos, songs, texts, etc. into their lessons to enhance students' background knowledge and facilitate greater comprehension and engagement. Particularly timely, this practice also facilitated parents' ability to extend students' learning at home by directing them to high-quality, safe resources easily navigable by young learners. Then, they worked with peers to replicate the process during professional development and extended the cycle of implementation into their return to the classroom. Participating teachers reported richer understandings of the standards and content, improved lesson pacing, and increased curiosity that led to more time devoted to finding high-quality resources to share with their classes. Currently, teachers are still using the professional development materials, but opportunities for new PD have slowed due to changes in required curriculum. District level PD has focused on the new curriculum. Anecdotally, teachers have reported adapting the practice to the nonfiction texts found in their new required curriculum.

In our original work (Schrodt et al., 2020), we planned to extend the research in Fall 2020. Preservice teachers would employ the strategy with elementary students in their clinical elementary school settings and collect data regarding their experience and content knowledge throughout implementation. However, in Fall 2020, the university was still hosting classes online and the reality of launching new projects in addition to developing online curricula was over-

whelming – for both the teachers and the researchers. After a full year of remote learning, the university returned to in-person classes and the researchers extended the strategy to preservice teacher candidates. The research question driving this study was, what scaffolds and supports do preservice teacher candidates need to successfully participate in a professional development model for building networks of layered content knowledge by integrating multimodal web-based resources within children’s non-fiction picture books?

PROCESS/METHODS

This study took place across two semesters with 64 preservice teachers in four literacy methods courses at a university in the mid-south. In Fall of 2021, 28 preservice teacher candidates participated in the study, including 12 from one undergraduate course, and 16 from a graduate level course. In Spring 2022, 36 preservice teacher candidates participated, including 21 undergraduates and 15 graduates.

During the last two years, preservice teachers lost many opportunities to teach children in classrooms through field experiences due to COVID-19 restrictions. Many had been in remote-only classes for an entire year before they came to the literacy methods course for this study. As a result, they were lacking in experience and background knowledge. We predicted these preservice teachers would require more support and scaffolding than the in-service teachers had prior to the pandemic. This led us to choose design-based research, as we sought to learn the most effective ways to train preservice teachers in using QR codes to build knowledge through picture books.

Design-based research allowed us to refine and rework this educational practice to fit the needs of a new population, preservice teachers. It is also pragmatic, flexible, systematic, iterative, and interactive. Throughout the research process, design and theory are mutually developed through collaborations with practitioners in the real-world context (Wang & Hannafin, 2005). The work of design-based research involves testing, stretching, reflecting upon, and reconfiguring practices systematically in response to practitioner needs and shaped by the complex, dynamic system in which they operate. Instead of trying to control all variables, design-based researchers embrace and design for the realities of the context, which is more likely to result in interventions that are meaningful and more likely to be implemented by practitioners because of how the interventions were developed. Design-based researchers use the iterative design process to “innoculate” interventions and practices to the factors that often debilitate those created in more controlled environments.

The professional development model table found in our original work was used as a baseline for the training model (Schrodt et al., 2020). Table 1 adds to this original table with implementation changes from our current study for this manuscript. The preservice teachers attended a 2-hour professional development as detailed in the previous chapter (Schrodt et al., 2020). The professor used both teacher reflection and student feedback to revise and adapt the teaching practice in order to support effective implementation with preservice teachers. Data were collected through the university’s online learning platform, D2L. Data included completed student QR code assignments and written reflections. Data were analyzed through multiple readings and feedback discussions, each time going back to the original research question, what scaffolds and supports do preservice teacher candidates need to successfully participate in a professional development model? Professors collaborated in professional learning communities to improve the design and increase scaffolds and supports for preservice teachers.

Table 1
Adapting a 2-hour PD for Implementation with Preservice Teachers

Identify high-quality instructional materials (HQIM) from surrounding districts	Partner with surrounding districts to identify the curriculum being used in the classrooms. Choose a unit of study from the curriculum and obtain the anchor texts.
Module Deep Dive	Teacher candidates are given a unit of study from a high-quality curriculum and are asked to follow this cycle: understand the unit, take the unit assessments, study the lesson, lesson rehearsal, and then teach and reflect on the lesson. Teacher candidates use the anchor text from the curricula as a foundation for their knowledge building QR codes.
Create QR codes with graphic organizer	Teacher candidates use the provided graphic organizer to find multimodal content to expand the knowledge of the texts.





ITERATIONS AND RESULTS

Three iterations of the educational practice emerged from our experiences across the two courses. In each iteration, student feedback and teacher reflections were considered and used to identify aspects that could be changed or adapted to improve the teaching practice (Reeves & McKenney, 2018). In each instance, the first author analyzed the feedback (teacher and student), identifying language indicating what worked and what needed to be altered for the context. Codes were used to classify statements as being positive, negative unchangeable, or negative changeable. Feedback across iterations served as one aspect of triangulation to determine if the design changes were responsive to stated needs (Reeves & McKenney, 2018).

Iteration One

Preservice teachers were able to effectively follow along as the professor modeled an interactive read aloud with knowledge building QR codes. However, they struggled to find resources and create their own QR codes for the text *What if There Were No Bees?* (Slade, 2011). They were stuck, having trouble thinking of ideas for extending the knowledge in the book. In the model lesson, the preservice teachers were shown QR code links to music, maps, artwork, primary sources, articles, and photos, but they required more scaffolding to think through these categories and find sources to link. The first iteration added a graphic organizer to support their planning (see Table 2). This organizer identified specific categories for students to consider, with thinking questions and tips to prompt them into action.

Table 2
Graphic Organizer and with QR Codes from *What if There Were No Bees?* (Slade, 2011)

<p>Song: Are there any famous songs that relate to the content of this book? Did this book take place in a historical era that can be represented with songs (such as jazz and the Harlem Renaissance).</p> 	<p>Artwork: Art can help us understand a topic or experience in a different way than an article or other fact-based documentation. Is there any artwork connected to the setting or topic that will help a reader get an expanded view of the knowledge in the book?</p> 
<p>Video: Videos can allow the reader to experience a time or place or topic in an authentic, visual format. Search youtube for a video that could help a student understand the topic at a deeper level.</p> 	<p>Primary Sources: Primary sources are original documents and objects which were created at the time under study. Search the library of congress or the internet for original content about your topic.</p> 
<p>Photo: Teaching with photographs allows educators to convey complex ideas with just a single image, helping students make deep connections. Is there a concept, idea, or content knowledge in the book that could be clarified by a photograph?</p> 	<p>Free Choice: What else could help the reader understand the time, place, and content of this text? Consider maps, articles, podcasts, etc.</p> 

Iteration Two

Teacher candidates selected their own books to integrate QR codes and knowledge building. As they attempted the QR code assignment, it was evident the preservice teachers needed more practice on selection of high-quality, complex text. Assignment reflections indicated the majority chose books based on accessibility, rather than quality and complexity of the text. Teacher candidates selected texts that were too easy for a targeted grade level, such as the text *National Geographic Reader: Seed to Plant* (Rattini, 2014) for 3rd grade. This text has a 470 Lexile level and contains common knowledge about plants that a 3rd grader is likely to have encountered years earlier. Text quality was also considered in this iteration as teacher candidates selected texts such as *How to Catch a Leprechaun* (Wallace & Elkerton, 2016). Although this is an engaging text, it does not lend itself to knowledge building.







The second iteration focused on adding instruction for text selection, including explicit instruction on the Common Core text complexity triangle. This triangle encourages text selection based on a text's qualitative and quantitative features, while also considering the assets and needs of the student (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010). Preservice teachers also practiced identifying the qualitative and quantitative features of a text using the Common Core qualitative feature rubrics. Students began to select higher quality and more complex texts, such as *The Crayon Man: The True Story of the Invention of Crayola Crayons* (Biebow & Salerno, 2019). Children loved this book, and were especially engaged in the QR codes which included pictures of old Crayola packages, links to videos of how crayons are made in the Crayola factory, art projects using melted crayons, and lists of Crayola crayon names.

Iteration Three

In the last year, many states have focused legislation and curriculum changes in hopes of closing the gap on COVID learning loss. Since our last chapter, the State of Tennessee implemented literacy laws emphasizing the importance of high-quality instructional materials (HQIM). New, high-quality curricula and training have been provided for teachers across the state. With access to these HQIM, there has been a shift from teacher *planning* to teacher *preparation*, as teachers immerse themselves in the curriculum to intellectually prepare to teach, rather than spend time planning their own lesson ideas. This shift triggered another iteration of our work. Instead of teacher candidates identifying their own texts, we pulled texts from common curricula being used across the state, including *Wit and Wisdom* (Great Minds, 2022), *Expeditionary Learning* (EL Education, 2022), and *Wonders* (McGraw Hill, 2021). Each of these curricula use content-rich, complex texts that build student knowledge of important topics. The teacher candidates would spend their time building their own knowledge and these preselected high-quality texts would serve as a foundation for developing their knowledge networks.

Teacher candidates were given a unit of study from a high-quality curriculum and were asked to follow this cycle: (a) understand the unit and take the unit assessments, (b) study the lesson, (c) complete a lesson rehearsal, and then (d) teach and reflect on the lesson. By completing this preparation protocol, the teacher candidates did the intellectual work of preparing to teach, building their own knowledge of the content along the way. This immersion served as a scaffold for creating more networks of knowledge through the QR codes. For example, the preservice teachers observed the lesson plan protocol for a portion of *Wit and Wisdom*'s first grade "Creature Features" unit which contains an anchor text titled *Me...Jane* (McDonnell, 2011). As they prepared to teach, they were able to anticipate potential student confusions and create QR codes to build on and extend the knowledge of Jane Goodall and her chimpanzee discoveries (see Table 3).

Table 3
Example QR Codes from Curriculum Required Text, Me...Jane (McDonnell, 2011)

<p>Song: Are there any famous songs that relate to the content of this book? Did this book take place in a historical era that can be represented with songs (such as jazz and the Harlem Renaissance).</p> 	<p>Artwork: Art can help us understand a topic or experience in a different way than an article or other fact based documentation. Is there any artwork connected to the setting or topic that will help a reader get an expanded view of the knowledge in the book?</p> 
<p>Video: Videos can allow the reader to experience a time or place or topic in an authentic, visual format. Search youtube for a video that could help a student understand the topic at a deeper level.</p> 	<p>Primary Source: Primary sources are original documents and objects which were created at the time under study. Search the library of congress or the internet for original content about your topic.</p> 
<p>Photo: Teaching with photographs allows educators to convey complex ideas with just a single image, helping students make deep connections. Is there a concept, idea, or content knowledge in the book that could be clarified by a photograph?</p> 	<p>Free Choice: What else could help the reader understand the time, place, and content of this text? Consider maps, articles, podcasts, etc.”</p> 

IMPLICATIONS

Teaching has always been a profession of pivoting and adapting, but COVID-19 has required a new level of flexibility and change from educators (Kim et al., 2022). As professors in educator preparation programs, it became crucial for us to partner with surrounding districts and adapt our practices to prepare preservice teachers for their future work. We knew there would need to be changes to our original work so we asked ourselves what scaffolds and supports would be needed to make this work successful for preservice teachers. One of the most significant shifts in our practice came with the state shift from teacher *planning* to teacher *preparation* (Zazkis et al., 2009). Many preservice teachers lost critical field experience during COVID-19 (Cho & Clark-Gareca, 2020). By first immersing preservice teachers in high-quality curriculum, they were then able to make connections to the classroom through the modeled scaffolds and language support providing them a lens into effective instruction and implementation. This shift could also be helpful to teachers experiencing overwhelm, encouraging them to spend less time creating their own lessons and more time preparing to teach evidence-based curriculum.

Our original work was easily adaptable and will continue to adapt and expand. Using QR codes to create multimodal picture books grows teacher content knowledge, promotes research skills, and allows parents to easily be involved with learning at home (Schrodt et al., 2020). Table 1 includes the original model from the previous work and also demonstrates the adapted steps for implementing knowledge-building QR codes with preservice teachers. Future iterations of this work include elementary students researching and adding QR codes to non-fiction writing, making their own work

multi-modal. Elementary students could also add QR codes to their own independent reading books as a part of an “accountable independent reading” assignment.

Although our experience was primarily positive, there are potential challenges to the future of this work. As districts increasingly move toward scripted curriculum, teachers are made to understand there is room for little else (Fitz & Nikolaidis, 2020). At the same time, states like Tennessee are censoring books and websites, usually for containing information that help students understand and consider different perspectives, people, and cultures - expectations represented in the learning standards of nearly every state. While some politicians use fabricated outrage in acts of feigned public piety, librarians and teachers may be intimidated into reducing access to information that would broaden, rather than narrow, a student’s perspective (Branyon & Dawkins, 2020). Such censorship reduces opportunity to discuss differences and understand the experience of others. It must be an aim of education to teach children how to view, analyze, and critique ideas from different perspectives, including controversial ideas as well as their own ideas. Democracy rests on having an informed electorate that knows how to choose to respectfully disagree.

We live in a global society, and it serves us to understand each other and our differing perspectives so we can consistently find the will and ways to work together for the greater global good. Efforts at censoring access to diverse perspectives also makes it difficult to create the QR codes with critical content. Lastly, some schools still lack the technology needed for students and teachers to effectively implement this work.

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Teachers' Digital Pedagogies During the Emergency Remote Schooling Period in Australia

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This paper examines digital teaching approaches adopted by Australian teachers in an emergency remote schooling period occurring during the pandemic. We examine these practices using a digital pedagogical framework presented in our 2020 chapter that highlights the features of personalisation, authenticity and collaboration. Data were collected from four case schools that were selected because of their reputation for effective management of student learning and wellbeing during this remote teaching period. Findings reveal that despite minimal preparation time, teacher participants from the case schools found ways of designing and implementing digital learning tasks that leveraged student agency and collaboration, and where possible, elements of authentic learning. Teachers' confidence levels with new digital pedagogies improved during this period, and many practices continued upon return to normal schooling.

HISTORICAL REVIEW

In our original 2020 paper (Kearney et al., 2020a) we anticipated the various resources and digital pedagogical framework (Kearney et al., 2019) we had created prior to the pandemic would assist teachers in designing digital learning activities to meet some of the challenges posed by COVID-19, such as school lock-downs and the shift to more remote learning with less direct teacher intervention and support. The framework is underpinned by a sociocultural perspective (Wertsch, 1991), highlighting features of personalisation, authenticity and collaboration (hence, the acronym iPAC) as distinctive pedagogical approaches associated with teaching and learning with mobile devices (see www.ipacmobilepedagogy.com for a detailed description). We refer to these approaches as digital pedagogies, and to learning activities mediated by the use of technologies (typically mobile devices such as laptops, tablet computers and smartphones), as digital learning tasks. In our original 2020 paper, we explored how teachers might address some of the challenges posed by enforced remote teaching, such as less scheduled timetabling, restricted access to physical and outdoor spaces, and the difficulties associated with collaborative patterns of learning, such as group work and peer-to-peer social interactions. In particular, we illustrated how digital pedagogies might be used to alleviate the problems associated with isolation and solitary learning, by linking students' learning with their peers and with experts outside their normal networks. We postulated that the pandemic and school closures might offer teachers an opportunity to reconsider digital pedagogies by focusing more on activities students could undertake either in the home, with 'experts' such as grandparents, or in other out-of-school environments where the promise of mobile learning had not been fully exploited (Kearney et al., 2020b). We offered a variety of validated tools and evaluation instruments (Kearney et al., 2020a) to support teachers in designing and evaluating the efficacy of these new designs and strategies.

Unfortunately, the various school lockdowns and disruptions to learning in Australia and around the world were more severe and far-reaching than we had anticipated. In the initial stages of this period, teachers and schools were driven to find short term solutions that did not always encourage more considered thinking about the role of digital technolo-

gies in ways we describe above. Emergency remote schooling appears to have been dominated by the use of technologies such as video-conferencing (e.g. Zoom) that allowed replication of non-digital pedagogies (e.g., see Ewing et al., 2021), rather than reconsideration of digital pedagogies. This is not surprising given the disruptive nature of the lockdowns and minimal preparation time granted to teachers. However, there were some interesting examples of effective digital approaches tailored to the pandemic context. Consequently, we seek to answer the following research question arising from Kearney et al. (2020a): *What effective digital pedagogies were adopted during the emergency remote schooling period of the pandemic?* We address this question by drawing on data from four case studies conducted during the pandemic.

PROCESS AND METHODS

Over 2020-2021, the authors were sponsored to conduct a qualitative study to identify the digital practices of four schools identified as being effective in supporting student learning and wellbeing during the emergency remote schooling period. The study occurred in New South Wales (NSW), Australia and focused on the nation-wide lockdown periods. This chapter considers the data from these case studies to address the research question.

Participants

The research sponsors were the research office of a NSW education sector. They selected schools that effectively managed the emergency remote period in vastly different ways. They comprised an all-girls K-12 metropolitan school (Brightwater), a religious K-12 metropolitan school (Manlala), a country town primary school (K-6) with an emphasis on learning in the natural environment (Fairmeadows), and a regional school catering to students with special needs and young parents (St Theresa's). Participants in the study were 21 volunteer primary and secondary teachers, and eight school leaders from these schools. Secondary teachers were from a range of subject areas. The remaining participants were 63 school students grouped according to their year of schooling, from Year 1 to Year 11, plus a group of young parents.

Methods

An interpretive approach was used, aligning with a qualitative paradigm. Methods comprised 30-minute semi-structured interviews with teacher participants in groups of two to four, and with principals and executive staff members. Participants were interviewed about their experiences, strategies and students' experiences. Eight 30-minute student focus groups were also conducted, each with five to ten students from participating teachers' classes. Students were asked about their experiences during the emergency remote learning period, what they had enjoyed, what was found to be difficult and how they had interacted with peers and teachers.

Analysis

For this chapter, the data for each school were categorised using the iPAC features outlined above and in the previous chapter (Kearney et al., 2020a). The data were initially scanned for any themes related to iPAC features (that is, to personalisation (P), authenticity (A) and collaboration (C)), and where data mentioned these dimensions, they were placed into the appropriate category. Two of the authors collaboratively did the initial categorisation and this was checked by the third author to ensure inter-researcher consensus. The three categories (PAC) were then examined for common themes arising in relation to the three categories. These formed the basis of the results section.

RESULTS

The remote teaching period highlighted the need for case study teachers to develop a broad and inclusive set of digital pedagogies to support student learning. Their approaches featured aspects of the three major dimensions of iPAC,

personalisation and collaboration, and to a lesser degree, authenticity. They catered for the needs and circumstances of all students, including those with additional needs, and those with home technology access or connectivity limitations.

The results below are organised according to the three iPAC dimensions. Reported themes represent strong common patterns emerging from the qualitative data analysis. Examples are shared as illustrations of these themes.

Personalisation

Encouraging student agency was a prominent part of case school teachers' digital approaches. Schools minimized whole-class, 'live' online teaching, and instead focused on tasks designed to leverage student autonomy and more independent work. Students enjoyed the extra control and choice involved in these digital learning activities. Parents appreciated the flexibility afforded by these tasks, as they strove to balance their own work with their new roles as facilitators of their children's remote learning.

Young children at Brightwater school enjoyed the autonomy of documenting their own learning. Students used their devices to capture and share photos or work samples of their choice, and then reflect on their learning experiences. K-6 teachers at this school are subsequently using digital portfolios with students post-lockdown, and according to an executive staff member, they are more proficient at giving personalised feedback in the online spaces associated with these tasks: "Teachers learnt to use targeted feedback effectively. In terms of professional growth, I saw more progress in four weeks of online learning than exploring that topic [of feedback] at other times" (Brightwater executive staff member interview).

Teachers at St Theresa's school sought a balance of guided and self-paced activities. They worked on building their students' capacity to learn more independently, as these students with special needs were accustomed to having more structured support. Like the Brightwater school students, St Theresa students would choose, and share photos of work samples to provide evidence of their learning. Teachers were able to adjust the task for each student's differing circumstances, and felt that many students benefited from this more self-controlled environment: "Students felt empowered that they could take control of their learning" (teacher interview).

Authenticity

Case school teacher participants strove to design and implement digital learning tasks that exploited relevant contexts, and supported realistic and meaningful processes and use of tools. Teachers at all schools asked students to use real-life materials from their homes in their digital learning task designs. Science teachers, for example, asked students to make use of apps for capturing evidence from home experiments, analysing data, and reporting through photos and videos. For an experiment on mixtures and solubility, a Science teacher at Brightwater required students to use their devices to take photos of their setups and to check their progress and understanding of learning. The students also used their devices to film and share their experiments. Teachers were able to watch their students' videos and then analyse their explanations of phenomena. This process provided opportunities for formative assessment.

Fairmeadows teachers designed activities suitable for learning in permitted locations during school lockdowns, such as the backyard, nearby parks and the beach. Students would use their digital devices to record photos of experiments and later share these in video-conferenced classes. A Year 1 teacher described an activity where students were exploring patterns in nature, "sorting and classifying leaves by shape and colour, nature mandalas, threading patterns, using natural resources" (interview). The teacher emphasised the importance of the outdoor settings for students, "allowing them to go and connect with things in their backyard" (interview).

Teachers at Fairmeadows were challenged by their inability to implement excursions and field trips—a core part of their normal curriculum design. They found simulated solutions, such as digital incursions. In these activities, students used iPads to access interactive sites such as the city zoo and museums for research activities in small groups. In this way, activities remained aligned with the school's emphasis on outdoor education: "I'm proud of the way that we designed learning that was still authentic to our context, that 'looked and felt' like us" (Fairmeadows principal interview). These incursions are now used post-lockdown to supplement first-hand, face-to-face experiences.

Collaboration

Teachers at all four case schools were conscious of the benefits of peer collaboration and promoted digital practices to leverage learning conversations and group work. Teachers emphasised the provision of opportunities for students to use their devices to connect and talk with each other, often multi-modally, both to enhance collaborative learning, and also to combat isolation: “If you can facilitate group work where students Zoom each other and then share ideas, that’s actually really valuable and much better for their wellbeing” (Brightwater teacher interview).

Manlala teachers used Microsoft Teams to mediate peer learning conversations as part of online peer debates in senior Social Science subjects, and for peers to assist each other in Mathematics. One teacher described a group facility in his Year 12 Mathematics class: “I have a homework help channel, and this is where the students will ask a question and they’ll reply to one another, and help each other through anything that they’re working through, or pose any questions they have.”

Students also used their digital devices to engage in collaborative processes that featured co-creation. For instance, the Year 8 Science teachers at Brightwater used cloud-based software such as Padlet and Google Documents to allow students to brainstorm, share and record ideas in groups.

IMPLICATIONS

The results indicate that the emergency remote schooling period was challenging for teachers and students. However, they also suggest that some effective practices were developed and implemented, and many of these approaches have been continued as teachers resume post-lockdown schooling. Further, teachers appeared to become more open to using digital technologies in different ways during the lockdown period, thus broadening their skills and confidence in digital pedagogies.

The case schools addressed well-documented challenges arising from the emergency remote teaching period, including teachers feeling under-prepared for pivoting to remote teaching (Trust & Whalen, 2021); students adapting to new ways of learning (Gore et al., 2020); and teachers finding and adjusting to suitable digital pedagogies (Ewing et al., 2021). The results shared in this chapter offer an overview of such digital practices through the lens of our iPAC framework. We have also recently reported on separate studies that used our validated iPAC survey instrument—mentioned in our 2020 paper (Kearney et al., 2020a)—to further explore school teachers’ digital pedagogies, including approaches supporting students with special needs (Kearney et al., 2022). We recommend further research that elicits ‘student voice’ to supplement teachers’ perspectives, for example, using our student iPAC surveys (Burke et al., 2021).

The case schools invested considerable time supporting students’ families during the school lockdown period. This initiative was in recognition of the key but unfamiliar role that many parents and carers were adopting as facilitators of their children’s learning, particularly in primary schools. The extra support was in acknowledgment that family wellbeing was at risk due to the isolation, particularly for parents trying to balance their own work and family commitments. As mentioned, part of the rationale for enhanced student agency in digital learning task designs was to give parents flexibility with facilitating their child’s learning. Indeed, parents and carers became increasingly appreciative of teachers’ professional expertise, with the digital learning environment providing “a little window for them to see inside what a classroom might be like” (Brightwater teacher, interview). Therefore, in preparation for future lockdowns, it is valuable for parents to be included in school discussions of digital learning initiatives, including opportunities to develop digital skills associated with the use of school-endorsed apps and devices. This will enable a more seamless pivot to future remote teaching periods.

In terms of digital pedagogical innovation—also mentioned in our previous chapter (Kearney et al., 2020a)—case study teachers were clearly implementing different practices from those they had previously adopted in their pre-COVID classrooms. However, there were few examples that aligned with our digital innovation principles (Burden et al., 2019), with the exception of intergenerational learning (one of the principles) that was evident between students and their parents across the four cases, as discussed above.

The study shows that despite the difficulties of adjusting to new ways of teaching during the remote schooling period, effective digital pedagogies were implemented by the case school teachers. Such digital practices supporting students’ agency, co-creation and relevant, contextualised learning need to be rehearsed by pre-service teachers in a range of physical and online learning spaces in preparation for their future teaching.

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A Tale of Two Outcomes: Time- and Space-flexible Revision Instruction for Preservice and In-service Teachers During the COVID Pandemic

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As schools moved to distance learning, we reported results of two studies that evaluated the impact of practice-based professional development to support in-service elementary and middle school teachers in delivering asynchronous audio feedback on student writing drafts. In response, students completed more revisions and improved overall writing quality. Students were satisfied with the individualization of feedback, the ability to apply the feedback at their own pace, and the privacy with which it was received. Teachers reported improved engagement in the writing process, a cognitively demanding task that requires much from students, and suggested the use of embedded technology may be the cause. Teachers also appreciated the flexibility of asynchronous delivery. Since that time, the strategy has been used in two university writing strategies courses that prepare preservice teachers for licensure and in a graduate literacy course in which all students were elementary in-service teachers. In the writing courses, students were able to offer asynchronous audio feedback successfully following explicit genre instruction, reading a practitioner article on the practice, and only one session of modeling and practicing. The most common challenge was prompting their students to pause the technology and respond to the suggestions. This may have resulted from the limited knowledge of how students may respond due to abbreviated clinical experiences during the pandemic. With in-service teachers, most thought the practice would be helpful, but could not prioritize the practice amidst other demands. In the stressful and chaotic context, these in-service teachers prioritized digital tools that offered immediate, automated feedback.

HISTORICAL REVIEW

As the pandemic began, we reported results of two recently completed single-case studies that evaluated the impact of practice-based professional development (PD) in supporting in-service teachers as they offered elementary and middle school students asynchronous audio feedback on their writing drafts – a practice that could easily be adapted to distance learning (McKeown et al., 2020; McKeown et al., 2015). Through the two multiple-probe across participant designs, teachers engaged in practice-based PD – a structured PD model that uses systematic and dynamic interaction between experts in the strategy and teachers as lessons are explicitly modeled, then taught by all participating teachers, and responded to with rich feedback focused on opportunities for differentiation (Ball & Cohen, 1999). In response, students completed more revisions and improved their overall writing quality following provision of detailed, differentiated feedback. Both students and teachers reported high social validity. Students were satisfied with the individualization of feedback, the ability to apply the feedback at the pace that suited them best, and also the privacy with which it was received. Teachers reported improved engagement in the writing process – a cognitively demanding task that requires much from students, – and suggested the use of embedded technology may be the cause. Teachers also appreciated the flexibility of asynchronous delivery. Moreover, the entire implementation was low-cost and, in many cases, free, depending on teachers' technology choices.

Since that time, the strategy has been used in two university writing strategies courses that prepare preservice teachers for licensure and in a graduate degree program in literacy that serves in-service teachers. In this manuscript, we report the work that has been done with these preservice and in-service teachers in preparing them to offer asynchronous audio feedback.

PROCESS/METHODS

In two university writing strategies courses, 43 preservice teachers were explicitly taught an evidence-based practice for writing instruction – self-regulated strategy development – across three genres in a six- to eight-week period (McKeown et al., 2021). Following explicit instruction in writing within each genre, preservice teachers were assigned a practitioner article that explicitly outlined the practice (see FitzPatrick & McKeown, 2020) and in one class session, were taught to give asynchronous audio feedback in response to a writing sample. Preservice teachers were then asked to (a) choose a writing sample from a student in their clinical placement, (b) effectively use recording software to show the student's writing, (c) record themselves reading the essay aloud, (d) record at least three clear, explicit suggestions for revisions, (e) make clear why and how these changes will improve the essay, (f) prompt the students to stop the recording and make each revision when feedback was offered, (g) plan and record at least 2 examples of praise for specific skills the student did well, and (h) submit their recording to the university's learning management system (LMS), Canvas, for evaluation.

At another university, in one graduate course on literacy assessment and instruction, 18 in-service teachers initially chose to use asynchronous audio feedback as an intervention with students who needed additional support in writing. The project involved (a) identifying a student who needed literacy support (both reading and writing), (b) selecting a series of targeted assessments for both reading and writing, (c) delivering the assessments and conducting error analysis to determine an instructional path, (d) providing interventions to address the identified literacy skills, and (e) submitting a report via the university's LMS. One of the available intervention options for the writing skills was to provide asynchronous audio feedback to students in response to written composition work (not spelling or handwriting).

By early March 2020, teachers had chosen their students, delivered the assessments, and were designing the intervention plans. All of the in-service teachers enthusiastically chose to use audio feedback as one component of their interventions. Teachers were given a practice-oriented paper to read on the topic (FitzPatrick & McKeown, 2020) and watched video demonstrations of the process. They practiced using the tools and process during class. They received feedback on their practice, were able to ask questions, and were encouraged to reflect on how this intervention could be used in different contexts and with a range of students. Finally, teachers created a checklist to address the areas of improvement their instruction would target which would be used to deliver the audio feedback.

Just two weeks later, the in-service teachers were tasked with teaching their classes both in-person and online. All the in-service teachers in this course were expected to teach in-person classes and design and deliver online instruction for students who were staying home to be schooled. About a quarter of the teachers worked in a school where they were able to trade off timeslots to prepare the online instruction, but most were not. Additionally, few were given any additional resources. While being asked to prepare lessons to teach in two different modalities and to grade work in two different ways, living with perpetual unpredictability in a state that provided few health protections for teachers and their families, these teachers changed their approach to complete the course assignment. Instead of employing asynchronous audio feedback, they turned to less effortful interventions, out of necessity.

RESULTS

In the two classes of 43 preservice teachers that completed the assignment of offering asynchronous audio feedback to a student in their clinical setting, 65% met all expectations of the assignment and received full credit. Those that made errors fell into two categories. The first group, 21%, failed to prompt the student to stop the recording at the appropriate time to make the suggested revisions. Rather they waited until the end and prompted the student to make all of the revisions at once. The other 14% failed to prompt the student to stop the recording and make the changes at all.

The teaching candidates reported that they enjoyed giving the feedback this way and that it seemed like it would save time and be less overwhelming for a student to receive compared to writing comments directly on a student's written work.

There were no results to report from the asynchronous audio feedback implementation with in-service teachers because every teacher reported they needed to abandon the intervention to have time for creating and adapting lessons for both in-person and online content for their students. Fourteen of the teachers chose, instead, to use content that was mostly pre-programmed (such as from a learning website), with automatic scoring, and with automated feedback (if any). Four others used a paper/pencil task, reverting to their cognitive default during a time of stress (Clark, 2001; McKeown et al., 2022). To summarize, students of the in-service teachers received no individualized feedback on their writing from the teachers.

Implications

The majority of the preservice teachers were successful in offering the audio feedback with prior instruction across genres, assignment of a practitioner article explicating the practice, and only one class session dedicated explicitly to modeling and practicing. The few who did not receive full credit failed to prompt students to immediately stop the recording and employ the suggestions but waited until the end asking students to make all of the revisions at once, and in rarer cases, failed to prompt the students to stop the recording to make the revisions altogether. This may be a reflection of the reduced in-person clinical work the students had had due to the pandemic. That is, they may not have had enough instructional interaction with students to understand how cognitively demanding this request would be if not separated into component steps. Writing is the most cognitively demanding task asked of students in school settings (Alevriadou & Giaouri, 2015; McKeown, 2019).

The implications may be that asynchronous audio feedback is relatively simple for preservice teachers to adopt, but the freshest lot of teachers in schools have limited clinical experiences due to the realities of access to schools during the COVID-19 pandemic. In response, schools may need to invest in PD to further support their development in scaffolding instruction appropriately in the earliest stages of their careers.

All of the in-service teachers abandoned the asynchronous audio feedback intervention because they had to restructure their time to create and adapt lessons for delivery to both in-person and online students. The COVID-19 outbreak in this state, and likely most other places, resulted in an undue burden being placed on teachers. In this time of crisis, these teachers rose to the impossible challenge. However, they used tools that were less burdensome on themselves in terms of planning, designing, and giving feedback to students rather than adopting a new practice. A paradigm shift seems to be taking place across states as educational leaders try to reduce the planning and designing burden of teachers, encouraging them to follow scripted curriculum instead (Schrodt et al., 2022). This begs the question of where the balance might lay between individualized, differentiated writing instruction, and strictly following a prepackaged curriculum.

While research is clear that individualized feedback is one of the most effective practices teachers can engage in to improve student writing (Graham et al., 2012), there is no shortcut around the time it requires to read what is written and provide constructive feedback. Using asynchronous audio feedback offers teachers an opportunity to provide more detailed feedback more efficiently through digital tools at minimal or no cost. However, such individualized feedback cannot be prioritized when teachers are burdened with unreasonable amounts of work and stress. Even in less stressful times, teachers must be responsive to a variety of demands and may not prioritize time to hold individualized face-to-face writing conferences with students (McKeown et al., 2014).

Future research may consider if other school personnel could be trained to deliver audio feedback to increase the amount of individualized feedback students receive on their writing while also decreasing the amount of instructional time that rests solely on the shoulders of the teachers. University teacher preparation programs should also consider the ways they might leverage partnerships with local schools. Effective partnerships could allow teacher candidates more field experience while also providing services for elementary students. Teacher candidates could conduct asynchronous audio feedback for student writing, relieving some burden from the classroom teacher and creating a win-win situation for everyone. Asynchronous audio feedback has been employed with university students (Bilbro et al., 2013; Cann, 2014; Sipple, 2007) and upper elementary and middle school students (McKeown et al., 2015, 2020); future research across grade levels and in various educational settings is necessary. Additional research across genres will also support researchers in determining how differentiation can best meet the needs of all learners. In the future directions from the previous chapter (FitzPatrick et al., 2020), we suggested exploring the effectiveness of online professional development while using breakout rooms to offer one-on-one modeling and expert feedback to meet the expectations of practice-based PD (Ball & Cohen, 1999; Wijekumar et al., 2018). This remains a future direction to explore.

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Reflecting on Screencasting as an Assessment Resource, and Implementation for the Future

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COVID-19 caused many rapid changes to the education system, often involving technology in one way or another, and assessment was no outsider to these transformations. Many educators quickly realized that traditional methods of assessment were not always the best or most practical way to assess students in online environments. Screencasting is a multimedia assessment approach that was previously suggested. As we transition back to more in-person learning, the use of screencasting for assessment in a variety of learning environments is examined.

HISTORICAL REVIEW

The rapid move to online course formats that occurred due to the pandemic left many educators scrambling to find authentic and effective ways to assess students. While educational research has constantly demonstrated the importance of assessment (Black & William, 1998; Dunn & Mulvenon, 2009; Fuchs & Fuchs, 1986), traditional methods of multiple-choice tests and essay questions did not often translate well to online formats (Reeves, 2000), and left a great deal of room for concern over accuracy and accountability with students having a wealth of access to other resources while taking courses remotely.

With the variety of learning formats offered in K-12 and higher education courses during the past two years, educators struggled with finding the best ways to assess students in online environments (Baleja, 2020; McLaughlin & Yan, 2017). Most existing research on screencasting has focused on instructor-created screencasts. As Christensen (2022) recently noted, while screencasts have been widely adopted in higher education, they are often utilized to address larger audiences or allow self-pacing, and rarely focus on student-produced screencasts for assessment. Reyna and Meier's (2018) literature review expressed how there is no consensus on Learner-Generated Digital Media (LGDM) and what it should be called. Even with various terms for LGDM such as multimedia assessments and screencasts, these areas are considered to lack research and rigorous studies evaluating effective theories and frameworks (Reyna & Meier, 2018). One study focused on student-created screencasts in a computer programming course for note-taking purposes to increase student outcomes (Powell & Wimmer, 2015). These screencasts, while student-created, were for personal use and not an assessment.

Despite the lack of specific research relating to using screencasts for assessment, research has supported the use of multimedia assessments to demonstrate student learning (Cox et al., 2010), thus leading to this study where screencasting was used to assess students as courses turned to mostly online formats during the pandemic. Multimedia assessments, like screencasts, require students to produce and demonstrate more than simply rewriting abstract ideas in their own words. A recent study has shown that screencasts are a valuable resource for process-focused, overview-focused and demonstration-oriented assignments (Christensen, 2022), so while students could provide written explanations, screencasts were used to afford instructors a more in-depth opportunity to evaluate the students.

When first starting with screencasts, most preservice teachers and instructors had not heard of Zoom or screencasts, and very few, if any, had created a screencast before. Initially, many of the preservice teachers struggled with the technology used to create screencasts and the idea of creating a video recording of themselves and their screen. The concept of using something like a screencast for teaching was foreign to them, and the idea of using them for assessment purposes was inconceivable.

Today, most preservice teachers, along with K-12 and higher education instructors, are very familiar with Zoom. Although many preservice teachers still have not had to create their own screencast recording, they are not as intimidated by screencasting programs and are quite familiar with the recording and screen sharing features of Zoom, or similar re-

sources. Most educators, after creating their own screencasts, can identify and describe how they might utilize them in their classrooms and how they can be beneficial for students. Some of the preservice teachers are able to identify ways for students to use and create screencasts in the classroom as well.

This work extends current research by focusing on student-created screencasts for assessment. A unique perspective is provided as the participants were preservice teachers severing in both the student role in the University course creating their own screencasts for assessment and also serving in the teacher role, determining how they might use screencasts in their own classrooms for assessment.

METHODS

This study aimed to look at preservice teacher perspectives on comfort levels and frequency of integrating technology in their classrooms, particularly focusing on screencasting as an assessment resource. The research also focused on learning how technology resources, such as screencasts, could be used in classrooms in varying content areas and grade levels.

A mixed-method approach was chosen to collect data through surveys that were distributed at the beginning and end of an introductory educational technology course, and through the collection of artifacts from the course. The survey included Likert-style questions, categories of technology use, and open-ended questions, to allow participants to elaborate on ideas and thoughts on educational technology use, particularly with resources related to screencasting. Artifacts included lesson plans that incorporated the use of technology along with reflection papers.

The participant population included 234 students from undergraduate and graduate teacher certification programs who had enrolled in and completed the introductory educational technology course over the past two years. Participants ranged from freshmen to seniors in the undergraduate courses. The graduate students mainly included those who had not previously obtained a teaching degree and were returning to school to become certified in teaching, although many of these educators were currently working in classrooms during the time of the study.

Data analysis included coding data into categories that corresponded with topics related to screencasting and assessment and the larger context of teacher education. Descriptive statistics provided a contextual and demographic analysis of the participant survey data and thus allowed the researcher to glean a greater understanding of the potential impact of the technology use. Screencasting as an approach for assessment in education is a rather new strategy, and thus the overall goal of the data collection and analysis procedures was to capture the beliefs of preservice participants.

RESULTS

Results from the initial survey produced mixed findings. While 71 percent of the participants initially felt confident in their ability to integrate multiple technologies into their instruction, many commented in their final survey how they truly did not have a good initial grasp on technology integration or the many resources that are available to use with education. Several participants noted how the introductory educational technology course was not what they thought it would be, and a few noted how they initially did not believe including technology in student learning was necessary. From the final survey, 89 percent of the participants felt confident in their ability to integrate multiple technologies into their instruction. Participants provided examples of technology integration in their surveys and through their lesson plans.

Only 29 percent of the participants initially saw screencasting as something they would use regularly in their classrooms. By the end of the course, 61 percent indicated their plan to use screencasting on a weekly or monthly basis. Many participants listed the screencasting task as the most beneficial assignment from the course, with some noting how they can use technology like screencasting, to give students options for assessments instead of always writing papers.

From the reflection and lesson plan artifacts, participants described how they might use screencasts in their classrooms with a range of applications including instructor tutorials and differentiating instructions. A few students had examples of screencasting as an assessment in their lesson plan or had students create screencasts to demonstrate various topics they were learning.

IMPLICATIONS

Screencasts can be a powerful resource for both formative and summative assessments by making student thinking and learning visible (Baleja, 2020). Formative assessments can be completed by using screencasts with students providing short explanations about topics and questions that correspond with visual images. Multimedia assessments, like screencasts, allow students to create unambiguous representations of their understanding (McFarlane et al., 2000). Students can also use screencasts to explain correct or incorrect choices on exams and present the data and information that supported their decision with summative assessments.

There are countless opportunities and ideas for educators to use screencasts for student assessments in all content areas and with many ages. Digital whiteboards can be used as students record their explanation or solution to a math problem or equation. Students can explain virtual labs or simulations or the parts of a process or cycle with screencasts in science courses. Creating recordings of a student reading can be used to help demonstrate reading fluency. Students can also create a screencast about historical documents or explaining a timeline of events.

This research can also be used to help determine best practices when using screencasts for assessment. Christensen (2022) noted a few best practices that were particular to their study. Continued research and data would help get a better overall understanding of best practices for assessing with student-created screencasts.

While using new technologies, like screencasting, can seem intimidating for students and educators, beginning with a low-stakes assignment that uses a pass/fail system or a low number of points provides a more stress-free opportunity for everyone to familiarize themselves with the technology resource (Baleja, 2020). Expressing initial expectations to students can go a long way in helping to encourage the use of new technology and understanding that short pauses or breaks in explanations do not deter the overall message or impact the instructor's ability to determine the student's understanding in explaining their topic and learning (Christensen, 2022).

While research has continually emphasized the importance of formative and summative assessment (Black & William, 1998; Dunn & Mulvenon, 2009; Fuchs & Fuchs, 1986), there is still little research focusing on multimedia assessments, particularly with screencasting (McDougall & Karadag, 2008). Current research on screencasting in education continues to focus mostly on student feedback and for instructional purposes, not on student-created screencasts for assessment (Christensen, 2022; Powell & Wimmer, 2015; Reyna & Meier, 2018).

Multimedia assessments, like screencasts, afford students the opportunity to demonstrate deeper learning and provide more detailed explanations about their learning. There is great potential in using screencasts for student assessment as they can be customized for the content, age, or skills of the learner. As technology continues to play an important role in our everyday lives, educators need to embrace technology to ensure our students can become productive members of society and know how to navigate, create, and express ideas using technology. Technology should not just be used for presenting information to students, but also for students to use, create and demonstrate their learning.

Considering the constant advances in technology and the expectations to include more technology resources and skills as part of our education system, continued research is needed in the area of multimedia assessment, particularly with screencasting. Even as education has mainly returned to in-person learning, the integration of technology with education should not be viewed as a separate entity or pushed aside. The use of creative and authentic assessments, many of which educators created using technology during the pandemic, will hopefully not diminish as we return to more normalized learning environments. Technology is part of our everyday lives and the changes in education that COVID-19 thrust upon educators forced them to revisit how they use technology to teach and assess students. With our educational learning environments continuing to adapt and change, the types of assessments educators use must expand and align with societal expectations of technology use and integration.

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Multimodal Reflections on Literacy Experiences

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This chapter describes a project where preservice teachers reflected on their early literacy and schooling experiences. Students were prompted to consider the possible impacts on their future classrooms through multiple modes of communication. The research questions were: (1) How did students present multimodal reflections of their literacy history? (2) What modes were used in presenting their literacy history? Students overwhelmingly presented their information using narrated slideshows, which encouraged the use of four modes of communication. The format of the assignment encouraged students to use at least three modes of communication.

HISTORICAL REVIEW

Reflection is a critical component of a teacher's practice, ideally encouraging them to learn from their experiences (Jay & Johnson, 2002). Most reflections about teaching are verbal or written and rarely use multiple modes of communication. Multimodality focuses on the use of multiple modes within one piece (i.e., visual, spatial, gestural, audio and/or language) (Jewitt, 2008). Multimodal composing in the 21st century provides many opportunities for meaning making and communication (Miller & McVee, 2010b). "Modal affordances refers to what it is possible to express and represent easily" (Jewitt, 2008, p. 247). How modes have previously been used impacts their modal affordances. Further, "we must prepare teachers (and they must prepare their students) for designing and interpreting multimodal texts for 21st-century learners" (Miller & McVee, 2010b, p. 7).

Tochelli-Ward (2020) highlighted inservice teachers in a Master's program who were prompted to reflect on their teaching and personal experiences in the early days of the pandemic with the shift to online learning. Overall, the results indicated that the directions and prompts impacted how students reflected on their teaching experiences. One group of teachers engaged in coursework was given more specific directions and a rubric, which encouraged a higher rate of multimodal reflections. The other group of teachers engaged in a portfolio project did not have a rubric nor were the directions specific in asking for multimodal reflections. This group tended to respond in a written format unless the prompt required a multimodal response.

While the project highlighted by Tochelli-Ward (2020) was only used once, the findings led to the revision of an assignment and rubric in another course. This project focused on creating multimodal reflections on early literacy and schooling experiences to consider the impacts on their future classrooms. The assignment for preservice teachers occurred within the first three weeks of their initial literacy methods course, encouraging them to reflect on their identity and history. The directions included:

The purpose of this assignment is to help you think about literacy, your identity, and how your history with literacy may impact your future classroom. You will create a multimodal literacy autobiography. You should include and describe artifacts that represent dimensions of your literate life (i.e., poems, favorite books, authors, websites, blog posts, video clips, photographs, awards, writing pieces, songs) to reflect your literacy history.

Your literacy autobiography should tell *stories / anecdotes* of your literacy experiences, and *reflect on / analyze* those stories to think about what they might mean about teaching literacy. You may be inspired to look back over old pieces you have written, look at favorite children's books, talk to parents. This will be a multimodal project; you could include samples of your writing or teacher assignments, interviews with teachers, parents or classmates, recreated dialogue, poetic expression/analysis, memories, illustrations, etc. You will not report in a solely written format in completing this assignment.

While there were other elements of this project, the focus in this chapter is on two research questions: (1) How did students present multimodal reflections of their literacy history? (2) What modes were used in presenting their literacy history?

PROCESS/METHODS

The initial version of this assignment was a written paper while the revised version required multimodal reflections on their experiences. Figure 1 shows the portion of the assignment rubric related to multimodality. The project was used in 2021 and 2022 with a total of 44 undergraduate and graduate preservice teachers. Before submission of their work, they viewed models of completed projects. In 2021, there was one model in the form of a physical scrapbook with a paper while in 2022, there were several technology focused models (narrated slideshows and a movie) shared.

	Proficient	Developing	Novice
Use of Multimodal Elements (3 points)	Format used to share his/her literacy autobiography that includes multimodal elements (visual, writing, auditory, gestural, spatial). (3 points)	Some multimodal elements included with the written information. More elements/supports would be useful in understanding history/perspectives. (1-2 points)	No attempt at using multimodal elements. Only a paper submitted. (0 points)

Figure 1. Rubric Element Related to Multimodality.

To answer the first research question on how students presented their multimodal reflections, descriptive statistics were calculated. These included: a frequency count of the rubric score, average of the rubric score, and a frequency count of the format of their projects. To answer the second research question each project was reviewed to determine how many modes of communication were used and an average was calculated.

RESULTS

For the first research question, on how students presented their multimodal reflections, Table 1 shows the frequency count scores (in percentages) for the multimodal component of the rubric. 27% of students in both years scored a two out of three on using multimodal elements, while 73% scored a three. Students needed to use at least four modes to earn a three on the rubric. The average score for this section of the rubric was 2.73. Overall, most students (73%) used four or five modes to communicate their information. Miller and McVee (2010a) discussed the importance of using identities while composing multimodally. Students engaged in the multimodal composition process used their identity to reflect on their experiences and analyzed how this may impact their future teaching.

Overall, 29 of the 44 students submitted narrated slideshows, using four modes, for the format of their projects (see Figures 2 and 3 for examples of these projects). Six students submitted slideshows without any narration included, using three modes. Five students submitted papers that included some pictures in the writing also using three modes. One student presented her information in a scrapbook format using three modes while another submitted a video with no interview/live action components using four modes. The last two students submitted movies with interviews and live action sequences using all five modes in their presentation. The design decisions students made for the format of the project allowed for different modal affordances (Jewitt, 2008). Some formats allowed for more modes to be included, such as the videos and narrated slideshows while other configurations limited what could be included.

Table 1
Frequency Results for Rubric (Percent)

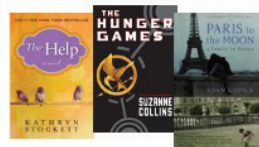


Figure 2. Student A (Undergraduate Preservice Teacher) Reading Timeline Slide.

In the “Working” World

- Recognized for being an excellent writer
 - Speeches
 - Briefing Books – synthesizing a lot of information
- Researching issues
- Everything must be clear, final products must be impeccable

And... time to read for fun again!!!



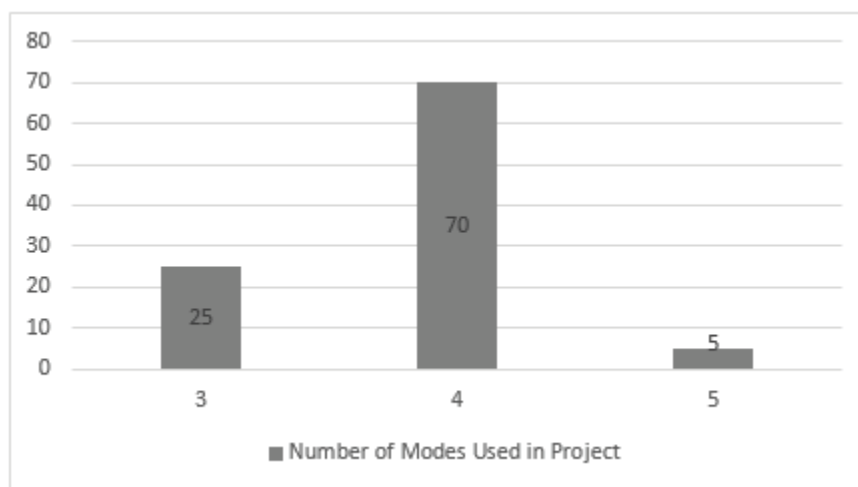
DEMOCRACY
HUMAN
RIGHTS
LABOR ★★★★★
U.S. Department of State



Figure 3. Student B (Graduate Preservice Teacher) Literacy Working Experience Slide.

The second research question focused on the modes used in the projects. Table 2 shows the frequency results in percentages. The majority of the projects featured four modes (70%). Overwhelmingly, the projects that featured four modes were created as narrated slideshows (see Figures 2 and 3), that featured: spatial layouts, verbal (voiceover), linguistic (written mode), and visuals. The affordances of this format allowed students to use four modes (Jewitt, 2008) though students could have included videos in slideshows to include the gestural mode. In 25% of the projects three modes (i.e., spatial, linguistic, visual) were used. These excluded the verbal mode (no narrated explanation). Two students submitted videos that included live action interviews and interactions with others. These are the only two projects (5%) that included all five modes (spatial, verbal, linguistic, visual, and gestural). The format students chose to create their project impacted the number of modes and the potential the modes had for representation and communication (Jewitt, 2008).

Table 2
Frequency Results for Number of Modes (Percent)



In 2021, the average number of modes used was 3.69 while in 2022 the average number of modes used was four. Ten students used three modes in 2021 while 18 used four modes and one used five modes. In 2022, one student used three modes while 13 used four modes and one used five modes. It is possible that part of the increase in the use of modes in 2022 was related to the five models of former students' work shared in 2022 and their format (narrated slideshows and movie).

IMPLICATIONS

Reflection is an "active, persistent, and careful consideration of any belief or supposed form of knowledge" (Dewey, 1933, p. 6) and through this process "one reaches newfound clarity, on which one bases changes in action or disposition" (Jay & Johnson, 2002, p. 76). Multimodal composing is a critical component of teaching and learning in the 21st century and preparing preservice teachers for this process is a key part of teacher education (Miller & McVee, 2010b). There are few research studies where fields of reflection and multimodality are connected (Tochelli-Ward, 2020).

Tochelli-Ward (2020) found that the format of assignments (e.g., the prompts, and directions) encouraged or discouraged multimodal reflections. In reframing the assignment away from a paper, there was a concerted effort to focus on multimodality and leave the expectations open so students could determine the best ways to present their experiences. Overwhelmingly, students selected to submit narrated slideshows (66% or 29/44) where the modal affordances encouraged visual, verbal, linguistic, and spatial modes. These typically have not included the gestural mode though it is an option within the affordances of the applications they used to create the projects. These students earned a 3/3 on the portion of the rubric focused on multimodality, showing their use of various modes of communication. Other formats, such as videos, afforded the inclusion of all five modes. Future students need to consider modal affordances as they make decisions about how to best communicate their ideas.

In addition to the assignment description and rubric, models of former student work were shared each year. However, these models may have impacted the work students created. In 2021, one model was shared and it was in a physical scrapbook format with a paper attached. More students submitted work that did not include verbal narration as an included mode (ten) than the second year (one). In 2022 several models of former students work were shared with many of these in the narrated slideshow format with the inclusion of the one live action video as well. Given that the assignment remained the same between years, the differences in the number of modes may have impacted what students created.

It is important for students to have an understanding of theories of multimodality before engaging in multimodal reflections (Tochelli-Ward, 2020). While showing models of former student work appears to have helped encourage students to engage in using multiple modes in their reflections, they are unlikely to understand why this is a useful part of communication without explaining theories of multimodality. Making multimodal composing and design knowledge explicit within instruction is a critical component of this 21st century process (Miller & McVee, 2010a). Introducing theories of multimodality to students at the start of the semester before they engage in this project will encourage them to think about modal affordances and help them to understand why this is a critical concept within communication.

Given the importance of reflection in teacher education and the potentials for the 21st century skills of multimodal composing in K-12 classrooms, there are many reasons to engage preservice teachers in using multimodal reflections on experiences. Teacher educators interested in using multimodal reflections should consider how they: (1) present assignments and (2) introduce multimodality and modal affordances to students. There are many potentials for using multimodal reflections but preparation is a critical component for teacher educators.

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Resilience, Relationships and Rigor through Digital Performance-Based Projects

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The pandemic shook the foundations of education; however, from the initial turmoil, innovative instruction emerged and lessons were learned. Elements of sound pedagogy were reinforced and solidified in practice like those surrounding performance-based projects. The nature of teaching during the pandemic inspired teachers to seek efficient and effective ways to teach content and connect with students. Performance-based projects created a solid foundation and necessary flexibility. Within these projects rigorous content was embedded and networks were made that promoted students to engage with content while fostering needed relationships that had the potential to wane or get neglected during online or hybrid instruction. The power of relationships was reinforced and its impact on academic resilience and rigor was realized.

Keywords: Performance-based projects, relationships, resilience, rigor

Normalcy, it's happening gradually. However, what will this new normal look like? As society turns the page on the pandemic, teaching is shifting from balancing unique instructional practices and triage teaching during the pandemic to post-pandemic instruction. Within education there is palatable excitement with deep breaths and glimmers of reprieve. Innovative instruction has taken a foothold in many classrooms. Many of the hard, challenging, and unrelenting lessons learned during the pandemic have proved beneficial for both students and instructors moving forward.

HISTORICAL REVIEW

Two years ago, it was a scramble to adapt teaching and learning as a result of unprecedented obstacles and constant changes. Holding strong to the knowledge of sound pedagogy practices, and how best to best create a culture of respect and rapport, a digital performance-based project was shared (McKeeman & Oviedo, 2020). The basis of these performance-based projects is pedagogically powerful, and by creating a purpose for them that is meaningful and relevant, student attention is sustained and learning becomes personally dynamic and engaging. It has been touted for years that technology is not a frill in teaching and digitally based lessons are not necessarily old wine in new bottles (Prensky, 2001). Rather, technology is a learning tool that enhances sound pedagogical practices when integrated well. As a result of the pandemic, more technology has been introduced into schools. As educators, we must not only stay abreast of technologies, but take advantage of professional development in order to learn how to integrate and optimize technology effectively.

During the early stages of the pandemic, students used the language they learned to complete a performance-based project to bring closure to the semester. As the pandemic lingered into subsequent semesters, students and educators embraced digital learning and innovative instruction. Academic expectations remained the same; however, relationships slowly weakened or faded when not being actively fostered. Of the many lessons learned, three are highlighted; the power of resiliency, relationships, and rigor within digital performance-based projects.

Resiliency, relationships, and rigor while separate concepts are interrelated (Figure 1).

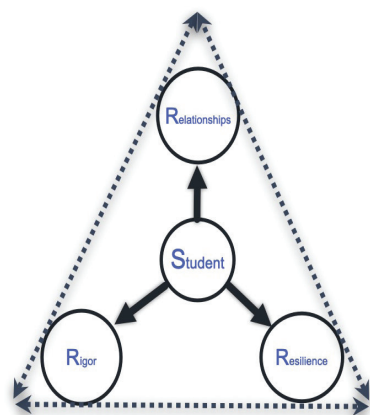


Figure 1. Interactions Between Relationships, Resilience, and Rigor on Students.

Relationships fortify resiliency which allows for increased rigor within learning. “Students want and need work that will enhance their relationships with people they care about,” (Strong et al., 1995, p. 12). During the pandemic both students and teachers faced daunting challenges; their relationships often made the difference in how resilient they were when facing these challenges. When solid relationships are established, teachers can become *warm demanders* or *supportive pushers* because of these trusting relationships (Hammond, 2014). Due to this student/teacher dynamic, the rigor of instruction can increase, fostering opportunities for increased development of student proficiency.

Relationships are the proverbial backbone to an effective classroom. It became clear that relationships were even more paramount as the pandemic drone on, in order to support students’ mental, emotional, and academic well-being. Grounded in the desire to connect with students and create meaningful, interesting, and relevant projects, we developed digital performance-based projects. Backward design (Wiggins & McTighe, 1998), differentiation (Tomlinson, 2014), performance assessment (Glisan & Donato, 2017), and learner-centered instruction (Weimer, 2013) are cornerstones in sound pedagogy; the pandemic fortified this knowledge. Students and teachers alike did not and do not have the bandwidth for extra; work has to be focused and relevant while simultaneously being flexible. The pandemic reinforced the power of pivot; flexibility is paramount when designing instruction.

PROCESS

A case study design was used within Level 1 Spanish courses at a local community college (Yin, 2002). There were 40 participants, over 5 semesters, between spring 2020 and spring 2022. The study aimed to explore the effectiveness of these digital performance-based projects compared to more traditional assessments. Guiding the study were the overarching questions: how can teachers support student resiliency through instructional design? how do digital performance-based projects foster rigor within learning? and what is the benefit of developing relationships within instructional design? Data were triangulated through researcher observation, assessments, and qualitative surveys. The midterm remained more traditional, consisting of multiple choice and short answer questions. The final assessment integrated an innovative digital performance-based project that stressed rigor within the learning outcomes and aimed to support relevancy through building relationships.

Digital Performance-Based Projects

“The environments created when learning is offered through well-crafted digital technologies affords students the chance to engage in authentic learning, encouraging them to see these experiences as applicable in the “real world” (McKeeman & Oviedo, 2017, p. 47). Using performance descriptors (ACTFL, 2012), performance tasks were created that supported language development of communicative competencies within a quasi-authentic, personalized task. Digital performance-based projects were framed so that students had choice to show what they know (Trach, 2018).

Putting it Into Practice

Travel was a huge casualty of the pandemic. Many trips were canceled, postponed, or rescheduled. As an illustrative example of these digital performance-based projects used within the final assessment, a meaningful connection was made with the most recent group of students, centered around a future trip they plan to take. Prior to this assignment and as pandemic restrictions began to ease, students would comment on their longing to travel. Therefore, the final project for the spring 2022 participant cohort was created to meet students' interests as they made a personal connection with the project.

The project incorporated elements of differentiation in how they were able to demonstrate their comprehension, whether it be through the option of a brochure (Appendix A) or essay (Appendix B). Both assessments were summative, incorporated the same expectations, had the same benchmarks for success (Appendix C). These options were chosen because of the natural fit between the task and the artifact students were asked to produce. In addition, the brochure was thought to decrease a student's affective filter (Krashen, 1988) by breaking up the overall output into sections. Adjusting the format allowed students' perceptions of the task to be reframed, supporting resiliency to successfully complete the project. There was an organic buy-in from students since they were researching and planning for an actual trip they hoped to take (Appendix D), there was relevance and authenticity to this.

This performance-based project was designed to be completely digital. Within the first paragraph (essay)/section (brochure) showcased students' ability to understand basic greetings and descriptive traits using simple strings of sentences, subject pronouns, and adjective agreements. The second paragraph/section allowed students to demonstrate verb conjunctions, and using days of the week to transition between activities. Finally, in the third paragraph/section students made cultural comparisons. The directions combined both the L1 and L2 based upon the objective and to dissuade any misunderstanding. To ensure accountability, checklists were a useful tool to help ensure all elements were completed and not overlooked (Table 1).

Table 1
Digital Performance-based Assessment Checklist

Performance Based Assessment Checklist:
<input type="checkbox"/> Use content from each row within the heading in your monologue. (Where you are from, first & last name etc...)
<input type="checkbox"/> Talk about a trip or vacation you will plan For, example, one that did not take place due to the pandemic.
<input type="checkbox"/> Narrate the trip/each slide with supporting visuals
<input type="checkbox"/> Mention family members
<input type="checkbox"/> Use Vocabulary from previous textbook chapters
<input type="checkbox"/> Apply Creativity and enthusiasm into your monologue with a minimum of 5 slides (not including the introduction)
Project submission through VoiceThread
<input type="checkbox"/> Login to https://Voicethread.com
<input type="checkbox"/> Create a VoiceThread account
<input type="checkbox"/> Watch VoiceThread tutorials
<input type="checkbox"/> Submit your Voicethread project on Canvas
<input type="checkbox"/> Email your link to XXXX@XXX@edu

RESULTS

Data analysis was conducted through constant comparative analysis (Glaser & Strauss, 1967) and framed on the guiding research questions. When exploring how digital performance-based projects foster rigor within learning, it was apparent that overall, more students met or exceeded standards when assessed through the digital performance-based projects compared to the more traditional midterm (Table 2).

Table 2
Midterm and Final Assessment Outcomes

	Does not meet Standards		Meets Standards		Exceeds Standards	
	Midterm	Final	Midterm	Final	Midterm	Final
Spring 2020	1	3	6	3	4	5
Fall 2020	2	3	8	4	3	4
Spring 2021	1	1	4	2	1	3
Fall 2021	2	2	2	0	2	4
Spring 2022	1	0	2	3	3	3

Despite all of the isolation, constant changes and adversity that students endured during 2020, their resilience was evident in the classroom. Results showed that 100% of all the digital performance-based projects were completed by their due dates. Furthermore, students not meeting all standards for the project achieved four of the five course outcomes. The rigor of the assessment tool when enhanced through digital performance-based projects that are contextualized in a meaningful and relevant way are shown to encourage students to do their best and highlight how they can show what they know.

When examining how teachers can support student resiliency through instructional design, there was general consent that students connected and were motivated by the digital performance-based project. During the 2020 academic year, there was an overall sense of disconnect; socially, academically, and emotionally. It was stated that when the digital performance-based final project was introduced to, “a light turned on.” Students remained resilient throughout the semesters (Figure 2).

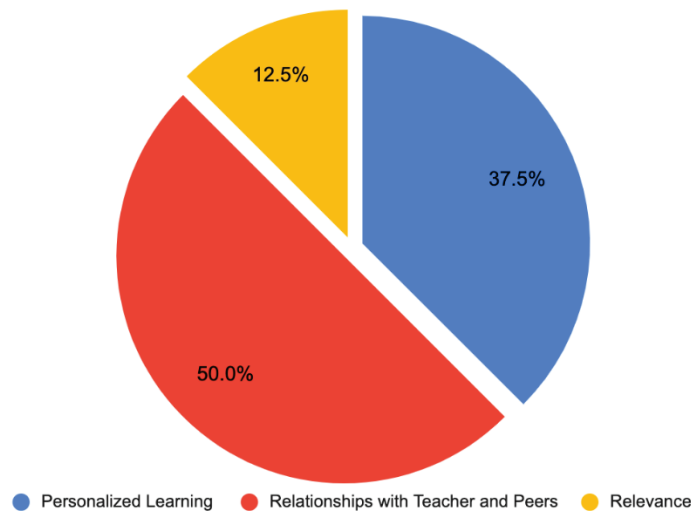


Figure 2. Generating Resiliency Throughout the Semester.

For 37.5% of participants, resiliency was found in personalized learning. Personalized learning opened up opportunities for differentiation. To a lesser extent, 12.5% of participants noted that the relevance or their learning helped maintain their resilience throughout the semester. One student stated, “My mother-in-law speaks Spanish, and it is my wish to have a conversation with her soon. This is what keeps me going.” Another said, “the project impacted my motivation to learn because it gives me the opportunity to learn about many Spanish cultures.” Digital performance-based projects are made meaningful when the context strikes a chord of relevance for students.

While exploring resiliency, data emerged that stressed the value of relationships (Figure 2). Half of participants reported that the relationships they developed with the teacher and their peers helped maintain their resiliency during the semester. One student stated, “We (classmates) supported each other, and the teacher was wonderful, she always encouraged us, she wanted to us to do well. She inspired me.” There is an interconnectivity between relationships students have within the classroom environment, regardless the format, and the resiliency they feel toward learning, thus greatly impacting the instructional rigor that can be embedded within learning experiences.

IMPLICATIONS

The relationships students develop as a class community are the cornerstones for success. This was often achieved through intentional, structured acts by the teacher. Frequent opportunities to engage, communicate, learn about one another’s interests, hobbies, goals made it so relationships did not wane, but were rather at the forefront of all things, including performance-based projects. Intentional opportunities to communicate and share strengthened relationships and student’s resiliency to succeed. Students recognized this connection too; participant remarked how learning opportunities were centered around THEM which helped them remain resilient during the year. Teacher education programs stress creating positive learning environments. Regardless the format, online, face-to-face, or hybrid, teachers do more than design learning experiences, they create the classroom culture. One participant stated that, “choice in the activities and the relationships between her classmates and teacher” made a difference in her success. One student affirmed, “By choosing your project it makes you take responsibility for your learning and incorporate your knowledge of the material and subject matter throughout the cycle.” Choice and differentiation allowed for personalization and efficacy as a student. All students met the course learning outcomes, even if they missed the mark on meeting all performance-based objectives. Additionally, 100% of students reported feeling more confident, competent and capable in their language production. There is a predictive power between self-efficacy and academic resiliency (Martin & Marsh, 2006).

As the world and education recalibrates, there is value to reflect upon what works, what needs fixing, and embracing requisite changes. It is paramount that teacher education and professional development continue to reinforce these foundational elements, like establishing meaningful relationships with students in a positive classroom environment, but also offer development for innovative instruction, such as exploring new ways to foster student resiliency and integrating digital tools into meaningful and rigorous learning experiences. Performance-based assessments whether delivered traditionally through face-to-face instruction, hybrid, or virtually in an online environment, these types of projects are the pinnacle of good teaching. Students are actively engaged through relevant and rigorous content, where there is a floor to the expectations of learning but not a ceiling. Exceptionality lies within the relationships created within these learning environments. Through these relationships, students become more academically buoyant and resilient to push themselves a bit more, and embracing the rigor to achieve more.

FUTURE RESEARCH

Technology and innovative instruction with digital tools are constantly evolving. In order to be highly effective, we need to remain current, recognizing student needs and meeting them where they are developmentally, mentally, socially, and academically. There is not a singular technology, tool or method that will be perfect for every student within every content. However, more research can be done to explore ways in which Digital Language Learning Platforms (McKeeman & Oviedo, 2016) could be used support personalized learning that supports interdisciplinary instructional opportunities, and motivates students through relevant and engaging contexts and tasks. Through continuing to innovate instruction learning experiences can be optimized, regardless of the learning environment.

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APPENDIX A









You will be a personal guide to a Latin America Country of your choice from Sol y Viento Chapters 1-4. Instructions for your Brochure are given below. All information must be written in Spanish.

- ☐ Introduction of the personal guide, (3 sentences). Physical traits(3 sentences) (20 pts)
- ☐ Introduce the country that you will be talking about in your final project.(2 sentences) (10 pts)
- ☐ Make a comparison with another Latin American Country (write 1 similarity 1 difference) (10 pts)
- ☐ Mention a total of 2 cultural components (5pts)
- ☐ You can combine verbs and days of the week for any activities. However, all 7 days must be included and 6 different verbs/forms of conjugation.
- ☐ Write one sentence which expresses to *need or to desire* within the brochure. (5pts)
- ☐ --Total of 7 sentences. Use all forms of conjugation (35 points)
- ☐ Brochure presentation (15 points)

APPENDIX B

Ensayo		
<p>Teresa Martinez. Houston Tx. 19 years old</p> 	<p>Chichén Itzá México</p> 	<p>México y España La cultura</p> 
<p>Escribe mi nombre de dónde soy y dónde vivo. Mis rasgos físicos 8 oraciones. (40 puntos)</p>	<p>Escribe un párrafo. 8 oraciones. Combine days of the week and different verbs learned throughout the semester to create 8 sentences. Imagine that you will be taking a trip to Chichén Itzá México. All 7 days of the week must be included and 6 different verb forms must be included. One sentence to need to desire must be included in the paragraph.</p>	<p>Escribe total de cinco oraciones. Escribe una semejanza y una diferencia. (20 points)</p>

APPENDIX C

Digital Project-based Assessment Rubric

Criteria	Ratings	Points
Uses Greetings appropriately (1. Converse in Spanish at Phrase Level)	This are will be used by the assessor to leave comments related to this criterion.	10 pts
Introduction- Self and video (3. Produce appropriate responses to Spanish aural input in highly predictable situations)	This are will be used by the assessor to leave comments related to this criterion.	10 pts
Applies Grammatical concepts (2. Write Simple Strings of Related Sentences). Ser & Estar, Ir + A, Saber o Conocer, La Familia	This are will be used by the assessor to leave comments related to this criterion.	20 pts
Compares similarity and or differences in culture **Ir+A+infinitive & Verbo Desear Latin American Country would you like to go or visit? (5. Compares a similarity or difference from his or her culture.)	This are will be used by the assessor to leave comments related to this criterion.	10 pts
Uses vocabulary from the chapters. 4. Simple written material applied from previous chapters.	This are will be used by the assessor to leave comments related to this criterion.	10 pts
Preterit Form of the verb- Uses verb in the pretérito AR, ER & IR y Irregular	This are will be used by the assessor to leave comments related to this criterion.	5 pts
Creativity	This are will be used by the assessor to leave comments related to this criterion.	10 pts
1.Converse in Spanish at Phrase Level	This are will be used by the assessor to leave comments related to this criterion.	5 pts
2.Write simple strings of related sentences in Spanish on familiar topics.	This are will be used by the assessor to leave comments related to this criterion.	5 pts
3. Produce appropriate responses to Spanish aural input in highly predictable situations	This are will be used by the assessor to leave comments related to this criterion.	5 pts
4.Comprehension of Simple Written Materials and expressions	This are will be used by the assessor to leave comments related to this criterion.	5 pts
5. Compare & Contrast Spanish Culture with Own Cultures in Spanish	This are will be used by the assessor to leave comments related to this criterion.	5 pts
100 Total Points		

APPENDIX D

<i>Los Saludos</i>	<i>30 puntos</i>	Greetings	30 points
<i>Introducción incluye la persona</i>		(Introduction, includes the person)	
<i>--Tu Nombre, apellido, de donde eres</i>		(Your name, last name where you are from)	
<i>Menciona La fecha (mes, día y año)</i>		{Name the date (month, day and year)}	
<i>Un Adiós</i>		(A Farewell)	
<i>Gramática</i>	<i>45 puntos</i>	Grammar	45 points
<i>Ser y Estar</i>		(The verb <To Be>)	
<i>**Ir+ A+ infinitivo & Verbo Desear</i>		(**Expressing what you will do in the future)	
<i>Saber y conocer</i>		(The Verb <To Know>)	
<i>Menciona tu familia o algún miembro de tu Familia</i>		(Mention family or a family member vocabulary)	
<i>Verbo en el Pretérito - (1) Verbo AR o (1) Verbo ER o IR & 1 verbo irregular</i>		(Preterit Tense of a regular AR Verb & 1 ER o IR Verb & 1 irregular verb)	

****What Latin American Country would you like to go or visit? Compare a similarity or difference from Your culture (Total 15 points)**

<i>Vocabulario</i>	<i>15 puntos</i>	Vocabulary	15 points
<i>Solamente usa el vocabulario de la lección preliminar y capítulos 1 al 4.</i>		(Only use vocabulary from preliminary chapters and chapters 1-4.)	
<i>Creatividad</i>	<i>10 puntos</i>	Creativity	10 points
<i>La imaginación es importante o otras aplicaciones para tu presentación. ¡Quiero que disfrutes creando tu proyecto final para la clase de español!</i>		(Imagination is important or other applications for your presentation. Most importantly I want you to enjoy completing your final project for Spanish!)	

1. Use greetings and subheading from each row within the XX into your monologue. (Where you are from, first & last name etc...)
2. Ensure that you narrate a trip stating date, month year of a Latin American Country you will be visiting y (un adiós). This country is in addition to a vacation that did not take place in 2020 due to the COVID-19 pandemic. (Use the past tense)
3. When creating your monologue ascertain that all grammatical concepts from the list given. (i.e. Ser y Estar) are included in your recording.
4. Use vocabulary from textbook chapters.
5. Apply Creativity and Enthusiasm into your monologue with a minimum of 4 slides
6. With Permission, VoiceThread Monologue can be shared with recipient.

Project Submission through VoiceThread

1. Login to <https://voicethread.com>
2. Create a VoiceThread account.
3. Watch the tutorials
4. Submit your VoiceThread- Project
5. Email your link to XXX@XXX.edu

Developing Educational Websites to Supplement Clinical Fieldwork

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In response to the disruption of the COVID-19 pandemic, the author designed an assignment to have teacher candidates create educational websites to replace disrupted clinical field placements. The author surveyed two classes of candidates who are now in their first year of teaching to understand what, if any, value candidates found in their future teaching. The responses reflect that candidates built websites for their own classrooms for a variety of purposes and found them useful. The implications for teacher educators are that incorporating educational website design into courses is valuable but should be supported with strong social cohesion among the candidates along with instruction on literacy development and differentiation.

HISTORICAL REVIEW

In March of 2020, the Loyola University Chicago ended all education course practicum experiences due to the COVID19 pandemic. As part of a field-based teacher preparation program, a secondary social studies methods course had four remaining weeks, entailing another 28 hours of time working in high school classrooms. These clinical experiences are essential to the preparation of successful teachers (Sturmer et al., 2015; Zeichner, 2010). It was an uncertain moment that caused many teacher candidates frustrated with technological challenges and lacking course content (Türkan et al., 2020). Instructors needed to quickly reimagine how they might continue to engage students and teachers while rapidly moving to online instruction (Kahn & Williams, 2021; Mollenkopf & Gaskill, 2020) in social studies, a subject area that has typically been resistant to website integration (Gregario, 2022).

The instructor for the course hit upon the idea of building a website for teachers and students that would provide historical information about pandemics across the world, current information on the COVID-19 pandemic, and learning activities. “Pandemics: Past & Present” (www.pandemics.education) was further expanded by an elementary education methods instructor at a different university (Tocci et. al., 2020). This class of candidates added primary-grades-level reading lists that addressed pandemic relevant issues for children. The website appeared to be a success with over 1,600 visits in the first month and several supportive comments sent in by teachers. At the time, the teacher candidates also expressed appreciation for the learning that came through the project.

In light of this positive experience, the original instructor transferred the website development project to a new course taught during the following summer semester. Whereas the spring 2020 course was for undergraduate juniors three years into their field-based program, the summer course was an introductory-level leaning theory course for candidates just starting a masters in education program. In small groups the candidates developed content for a website on culturally responsive social emotional learning (Cressey, 2020), which was also content in the course itself. This project fell flat as candidates struggled to develop material for the site and present it in ways that might be useful to teachers (e.g., discussing classroom practices or challenges in implementation). Candidates submitted their work by the end of the course, but the instructor did not publish the website feeling that it was not of sufficient quality.

The divergent short-term results between the two courses informed the research questions, did the projects contribute useful pedagogical knowledge (Guerriero, 2014) for candidates as they moved forward in their careers? What aspects of educational website development were implemented into their teaching practice?

There is scant literature on teacher candidates developing websites as part of their preparation. Burgess (2009) incorporated it into a reading pedagogy course and Lindsey-North (2000) had candidates develop message boards for classroom use. Kelly and Breault (2007) held focus groups with teachers, students, and museum educators to identify the qualities of good educational websites, including that websites should: look good, contain concise content, contain a glossary, have well-developed curriculum links, and be easy to navigate. Ikpeze and Arndt (2020) found that pairing

newer digital tools with longer standing website designs, such as using Voice Thread with discussion boards, improved the quality of student work while Lowenthal et. al. (2020) found strong student engagement with video-recorded content.

Websites were a common and valuable part of classroom instruction (Dunn & Peet, 2010) and communication with students' families (Piper, 2012; Unal, 2008) prior to the pandemic-induced shift to online schooling for millions of students. Dunn described class websites as "a dynamic and growing knowledge repository" for classrooms (Dunn, 2013, p.24). Websites can also serve as a productive space for projects and assessments (Quezada et. al., 2020). Yet, "[c]ontrary to our expectations, early career teachers' status as belonging to the generation of 'digital natives'...does not guarantee that they have developed sophisticated digital skills in general" (Konig et. al., 2020, p.618) or had instructive models from their own educational experiences. To realize the value of educational websites, the teacher education field needs to provide opportunities to develop teacher candidates' capacity to effectively incorporate technology into their instruction (Brinia & Psoni, 2022).

METHODS

To assess how, if at all, developing websites contributed to teacher candidate's development, completers of both classes ($N=18$) were surveyed with one identifying question (which course the candidate completed) and four open-ended questions:

- Looking back, what was the most valuable take away from building the pandemics website?
- How, if at all, have you employed things you learned from building the website in your teaching since then (student teacher or this past year)?
- If you could redesign that project, what would we do differently?
- Please add anything else you'd like about the pandemics website or teaching using websites.

Nine responses were collected. All the respondents completed student teaching during the 2020-2021 school year, which was almost entirely held online in local school districts. The respondents' first year of teaching was during 2021-2022, when school was intermittently moved online. Data were coded by question in NVIVO using an axial method (Vollstedt & Rezat, 2019) that sorted responses into addressing pedagogical knowledge or classroom practices and then employing a grounded method to develop codes. The codes were then organized into thematic nodes using a constant comparative method (Creswell, 2022). Finally, the responses were crosstabled by course taken to explore any differences.

RESULTS

In general, respondents across both courses reported that having experience developing educational websites was valuable for pedagogical knowledge and practical implementation because online schooling created a significant need for educational websites. All respondents indicated that they implemented educational websites as part of their student teaching and first year teaching experiences. Former candidates published websites to post information about themselves, class rules and procedures, assignments and deadlines, and specific projects. The most common purpose of these sites was to communicate primarily with students, but secondarily with parents and guardians about class activities. In this way the websites largely served to broadcast information, which was valuable given the high number of student absences and the general challenges of remote teaching. This is in keeping with older examples published by Burgess (2009), Lindsey-North (2000), and Dunn and Peet (2010).

There were no examples of respondents using their own websites for assessment or interactive engagement of students. For these purposes, the teachers would link to websites developed by education organizations and textbook publishers or use popular platforms designed, at least in part, for educational use. While Quezada et al. (2020) outlined the many great possibility for websites to deepen assessment and project-based learning, the candidates surveyed here did not have the web development skills necessary to build sites for these functions. Instead, they relied on existing options to do this.

In terms of contributing pedagogical knowledge, respondents indicated that maintaining updated and relevant course material presented both a challenge and an opportunity. On the one hand, the websites needed regular revision, especially if they addressed current events, to remain timely and accurate. One respondent wrote, “the pandemics website gave a powerful takeaway-- materials made for students need updates *often*...This has helped me significantly this year-- many of the lessons I created for student teaching were very re-usable but need constant updates to make sure students have the most recent materials available.” Yet, this also offered the opportunity to reflect new information with multiple ways to engage students. Another respondent wrote “having a website like this, specifically one that you can alter regularly, you can constantly update it with newer information as well as frame it for certain age groups so it’s accessible to all.”

Another pedagogical knowledge issue was the accessibility of information for students. Respondents indicated trying to use a variety of media—text, images, videos—to provide multiple ways to engage students. Websites and platforms that were simple in design and whose functionality was familiar worked best. As one reply noted, “I have been able to use similar formats (such as Padlet) to create interactive pages where students can access resources, make comments, and “like” posts.” Still, the text provided on the site needed to be differentiated for students’ reading levels. One respondent suggested more preparation work on differentiating for reading levels would be valuable. They wrote, “[i]f I could go back, I would implement different reading levels throughout the website to ensure that it was accessible to all students.”

Another respondent indicated that the project would have developed greater pedagogical knowledge if it were more teaching-facing as opposed to student-facing. The implication was that this focus would require candidates to generate more classroom materials as opposed to standalone website content. They replied, “I think we would make a significant portion of the website geared towards teachers-- while the website is very accessible to students, I would love to provide classroom resources that teachers could use to compliment the website.”

IMPLICATIONS

The respondents offered that learning how to develop educational websites as part of their preparation coursework was valuable to them during student teaching and their first year of teaching, both of which entailed remote teaching. In practice, the websites served a variety of communication functions and required continual updating to stay current. In the future, implementation of websites as a regular part of teaching practice could grow from having candidates work with widely used platforms that are familiar to navigate and simple to design in order to support more interactive functions (e.g., assessment) without having to learn sophisticated web development skills. Pedagogical knowledge about how to make website’s information accessible to students was a central concern and challenge, but this could be partially addressed in the future by reviewing Kelly and Breault’s (2007) qualities of educational websites and reviewing several exemplar sites with those criteria before commencing work on a class project. As Cullen and Ottenbreit-Leftwich (2020) suggest, candidates’ own online experiences during the pandemic might serve as an additional touchstone for this work. Finally, incorporating more literacy development materials and Universal Design for Learning (Novak & Rose, 2021) techniques into the project may help in this regard, including the intentional pairing of expressive modes (e.g., audio narration and text; Ikpeze & Arndt, 2020).

The responses between the social studies methods candidates and the learning theory candidates were largely similar; they responded that the preparation work developing a website was beneficial to them in their classroom teaching. This is despite the divergent outcomes of the two projects. Carillo and Flores (2020) provide a helpful clue here when they note when teaching online, “social cohesiveness was a prerequisite for a knowledge building discourse.” The social studies methods candidates had spent more than half the semester in person together as a class and, three years into the education program, built up knowledge and skills to apply to this project. The learning theory candidates had neither of these assets to draw on. Building a website was too much, too soon for them as a course project, yet these candidates could still find value in the experience during the extraordinary circumstances of remote teaching during the pandemic. A lesson to take from this is that the candidates need to have strong working relationships with each other and the instructor in addition to developed content and pedagogical knowledge foundation to facilitate a complex, collaborative project like this. In short, collaboratively building educational websites is an assignment best undertaken in the later stages of a teacher preparation program.

To follow Brinia and Psoni (2022), dedicating time to such practice is necessary if we want future teachers to incorporate websites innovatively and effectively into their teaching repertoire. Instructors must build the space for this to happen.

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Using Twitter for Engagement and Student-Centered Design in Online Teacher Preparation Courses

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During the pandemic, instructors implemented course design revisions continuing to reflect and support students during times of potential stress and trauma. The use of social media, in particular, Twitter, was initially focused on developing personal learning networks and digital citizenship. However, within the context of the pandemic, Twitter was used more for enhancing interactions with peers and instructors within our courses which supported our design framework of building community but with an increased focus on student-centered learning design. The research question was, “What are the teaching and learning outcomes for using social media, in this case, Twitter, to increase student-centered design in online educational technology (EDT) courses?” The context includes online EDT courses in the teacher preparation department for students who range from undergraduate preservice to graduate-level inservice K12 teachers, to educators from various backgrounds and instructional designers. We used a qualitative collaborative autoethnographic research approach. The key themes that arose were the importance of providing opportunities for different types of engagement with learning activities using Twitter including, 1) sharing of learning artifacts, 2) engaging in creative pedagogical practice, 3) the concept of fun, and 4) collaboration and teamwork. Implications from this research include 1) confirmation of the importance of student-centered design, 2) the continued use and adoption of relevant technology tools and skills, and 3) building community with the frameworks of Community of Inquiry (CoI) and the modes of interaction model.

Keywords: educational technology courses, K12 teaching, online teaching, online learning community, social media, student-centered teaching, Twitter

HISTORICAL REVIEW

During the pandemic in 2020, the university shifted to almost all online learning. Though proponents of online learning, we are aware of the regular challenges that teachers and students face, including technology access, needed technology skill development, accessibility, feelings of isolation, and the complexity of building community online (Beaunoyer et al., 2020; Brenneman & Karpman, 2020; Chametzky, 2021; Ferri et al., 2020; Vesely et al., 2007). These challenges were amplified by the pandemic.

We, as teacher educators, realized the need to revise the design of our educational technology (EDT) course to support our students, who were preservice teachers as they were experiencing stress, isolation, and illness. The design revisions we reported in 2020 highlighted a particular innovation focused on the increased role of Twitter (Chatterjee & Parra, 2020). The instruction for the use of social media in our courses was initially focused on concepts of digital citizenship and students developing their personal learning networks (PLNs). This was done with an activity titled, The Twitter Top 5 (Chatterjee & Parra, 2022). With the pandemic scenario, the instructions in our courses for using social media evolved to include an increased focus on student-centered design with strategies and activities that provided rich opportunities for active learning (Cherney, 2008).

In our first pandemic era iteration of courses, we modified the existing end-of-module reflection to include increased use of Twitter. Students used class and topic hashtags and interacted with the others through Twitter posts (Tweets) and

replies, and for grading, they reported back in the online discussion (Chatterjee & Parra, 2020). We noted some of the students were hesitant to get involved with social media. We adopted a variety of strategies for engaging students to be comfortable with social media use. We encouraged students to discuss challenges, and concerns about using social media during the class webinars, discussion boards, and end-of-module reflections. Engaging students in critical conversations about social media use, their level of comfort, and what they would recommend provided them time to reflect and use social media. With the continuance of the pandemic and the success of our use of Twitter, we have continued to modify our courses with increased use of Twitter. The purpose of this study is to share our evolving use of Twitter, as a student-centered design strategy in our online EDT courses, and our perceived outcomes from those teaching and learning experiences.

METHODS

The context for this research includes the EDT courses we teach in a teacher preparation department wherein we provide practice-based learning opportunities using technology tools, especially online and blended learning tools, for students who range from undergraduate preservice to graduate-level inservice K12 teachers, to educators from various backgrounds as well as learning/instructional designers. As teachers of teachers and learning/instructional designers, a key focus for these courses is providing practice-based experiences that are student-centered and support the students both as learners and as teachers and learning/instructional designers themselves. Using student-centered learning strategies means understanding what students need in-the-moment by interacting with and listening to them and revising coursework accordingly. In this case, it meant the evolution of the use of social media platforms, particularly Twitter, beyond learning about digital citizenship and building PLNs (Chatterjee & Parra, 2020) to a more focused intention on student-centered learning design and engagement (Duraisingh, 2020; Lee & McLoughlin, 2008).

The following research question guided the study: What are the teaching and learning outcomes for using social media, in this case, Twitter, to increase student-centered design in online EDT courses? For this study, we used a qualitative collaborative autoethnographic (CAE) research approach (Chang et al., 2016). Autoethnography provides a qualitative autobiographical approach that supports critical self-reflection as a form of research (Chang, 2013). CAE has emerged as a “dynamic research approach” (Chang et al., 2016, p. 137) that aligns with our use of critical self-reflections and with how we design our courses from a collaborative, community-based perspective.

Data were identified, collected, and analyzed from three sources, (1) archived EDT courses from Spring 2020 through Spring 2022 focusing on the Twitter-related activities and assessments, (2) researchers’ journals including their reflections regarding implementation, evaluation, and outcomes of the activities, and (3) recorded and transcribed reflective conversations in Zoom between the researchers who are instructors for EDT courses. After individually reviewing the data holistically and coding, we collaboratively categorized and found the themes (Chang, 2013). Our conversations in Zoom provided the venue for collaborative data analysis and the opportunity for data interpretation with reduced bias and that is increasingly trustworthy (Satiechayakorn & Sanpatchayapong, 2021). With this CAE approach, we challenge each other and ourselves to be authentic and accountable; and we have found this to be a critical and powerful research, design, and teaching process.

RESULTS

The key themes that arose as outcomes were the importance of providing opportunities for different types of engagement with learning activities using Twitter including, 1) sharing of learning artifacts, 2) creative pedagogical practice, 3) the concept of fun, and 4) fostering collaboration and teamwork.

- 1) Sharing learning artifacts: Instructors encouraged students to share their learning artifacts of choice and final projects; as this is a form of “knowledge sharing” that “supports online learning effectively” (Bolliger & Martin, 2018, p. 571). For example, in one of the EDT courses for preservice teachers, students posted annotated images of their makerspaces projects, games they developed, an infographic, and a poster imagining their future classroom. Ninety percent of the students in that course voluntarily posted their products and replied to peers though no points were associated with posting and replies (Chatterjee & Parra, 2022). This indicated a high level of student participation and interaction which supported each other’s learning. Also, it created an opportunity for

others in students' networks such as parents and friends to see and comment, which generated conversations about their learning with people outside the classroom. Students enthusiastically explained their activities and showed a sense of accomplishment when others commented on their final products (Chatterjee & Parra, 2022).

- 2) **Creative Pedagogical Practice:** According to Cochrane and Antonczak (2015), facilitating creativity, as demonstrated by the student shared artifacts, and modeling "creative pedagogical practice" are both integral components of creative learning environment design (p. 142). This was evidenced as we continued with a student-centered design focus where we valued student feedback and collaborated with them to meet their needs. In the process, we became more creative in our design of the activities. In one course, the instructor incorporated a new strategy for an activity that integrated Twitter based on interacting with students frustrated with the online discussion format of creating a post and replying to three classmates; the strategy was titled, Posts or Tweets for New Learning. Students then created an additional element for this that we next called Tweetouts of New Learning, based on student shoutouts to their peers as part of their new learning (see Appendix A). Cochrane and Antonczak (2015) describe this outcome perfectly, as a framework created "by designing an ecology of resources" which supports authentic learning (p. 142). Additionally, it stimulates learners to smoothly advance from a primary state of creativity toward generating and sharing innovation and design, manifesting "creativity as reinitiation" (p. 142).
- 3) **Fun:** Whitton and Langan (2018) describe fun as a fluid state that allows learners to take risks (Ungar, 2007) and feel good (Koster, 2005) when engaging with learning. This encourages them to participate, where they might fail yet still feel safe (Okada & Sheehy, 2020a). Feldberg (2011) noted that fun reduces stress and relaxes learners which positively impacts cognitive functioning. Csikszentmihalyi (2015) connected the concepts of fun and flow, referring to it as incorporating joy, creativity, involvement, and excitement with the learning experience. Okada and Sheehy (2020b) referred to emancipatory fun which they grounded in Freire's pedagogy of autonomy, whereby learners' have hope and confidence as they act, reflect, and learn. In this study, fun was identified as one of the factors for engaging learners and instructors using Twitter. For our courses, Twitter became increasingly important for establishing affective relationships, that is having fun and humor in the learning environment by expressing emotions, feelings, and moods (Swan et al., 2009). For example, Twitter includes the feature of being able to add fun with still and animated images called "gifs" to Tweets, and in one course the instructor and students engaged in Gif wars as part of their reflections (see Appendix B).
- 4) **Fostering collaboration and teamwork:** One major challenge in online teaching and learning is fostering collaboration and teamwork in the online environment; key characteristics of an online learning community (OLC) as noted by Palloff and Pratt (2010). The use of Twitter for sharing learning artifacts, participating in creative pedagogical practice, and having fun as previously described, all culminated in the fostering and development of a robust OLC. Additionally, these interactions among the students via tweets and replies supported the 3Cs, community, communication, and casual learning, (Reed, 2013) and helped students project themselves socially in their learning community (Swan et al., 2009). These interactions facilitated the development of team projects which fostered a knowledge-building community (Clarke & Nelson, 2012; Friess & Lam, 2018).

IMPLICATIONS

With this study certain implications included, 1) confirmation of the importance of student-centered design, 2) the continued use and adoption of relevant technology tools and skills, and 3) building community with the frameworks of Community of Inquiry (CoI) and the modes of interaction model.

Student-Centered Design

As practitioners, we continue to confirm the importance of student-centered learning design and especially in this case, as related to teacher education as this population will in turn take their learning and apply it in their educational environments. Lee and McLoughlin (2008) discussed that in relation to providing student-centered learning, educators are challenged to empower learners as self-directed and autonomous agents in the process of learning by offering flexibility, choice, structure, scaffolding, and enrichment to the learning process. About social networking technologies, they

believed that these tools serve best for providing a meaningful learning experience by contextualizing real-world connections. We noted that by leveraging social media formats, such as Twitter, and student-centered learning, practitioners can develop innovative curricula for fostering OLC (Duraisingh, 2020). Such learning experiences can support curiosity, engagement, and nuanced understanding among learners, along with developing critical awareness of their own positions, perspectives, and knowledge construction process (Duraisingh, 2020). Furthermore, students and instructors building upon each other's work as is evidenced in a student-centered learning space add creativity and versatility to an educational climate.

Use and Adoption of Relevant Technology Tools and Skills

In 2008, Cherney emphasized instructors' role in considering educational tools, techniques, and technologies as they strive to provide students authentic learning experience. Technology tool adoption has implications for both educators and learners as it influences necessary skill development to interact with the tool and with time grow proficiency and a better understanding of relevance, which will model adoption behavior. Based on this study and the methods we used for design, teaching and learning, and research, educators should continue to create, test, and adopt strategies and tools which engage learners in online courses as active participants generating knowledge, demonstrating creativity, and building community (see Appendices A and B). As educators put into practice the strategies, they can modify them based on what students need and want. Based on which technology works or not they can come up with the best practices for certain groups of students under certain scenarios.

Building Community with Existing Frameworks

We came full circle back to one of our foundational design strategies, that of building community. Building community in an online course is fundamental for us in online course design and we perceived it was even more critical during pandemic-induced social isolation. The purposeful scaffolding of activities using Twitter in the EDT courses encouraged instructors and students to connect and share together as a class-based community thereby limiting their exposure to the global community. We called this "building our community bubble of safety."

As researchers and practitioners, we also recognized the Community of Inquiry (CoI) framework and the modes of interaction model as foundational theories for building community in online courses. The community in our classes are dynamic and creative spaces, built on each other, where the three key elements in the model, cognitive presence, social presence, and teaching presence interact to produce the educational experience for those who participate (Garrison et al., 2000). Teaching presence is defined in terms of methods, design, organization, and facilitation that instructors use to develop, support, encourage and sustain the productivity of communities of inquiry (Bangert, 2008). During the pandemic as instructors, we desired to enhance our teaching presence so that our students know we are there to support them. We facilitated learning environments for students where they can comfortably interact. Using Twitter, students projected their personal characteristics and perspectives as real persons interacting in the community bubble, creating a social presence. Cognitive presence was evident in the courses as participants constructed meaning through active engagement in continuous communication (Garrison et al., 2000). This implies that providing engagement opportunities to learners using authentic context and articulating the three presences can support community building.

Designing online courses considering the modes of interaction framework (Anderson & Garrison, 1998) will be important. Students tweeted about a topic and their ideas on Twitter which stimulated interests, mutually influenced, and continued the conversation which highlighted student-content and student-student interaction. Instructors provided directions, guidance, feedback, and responses to students and facilitated student-instructor interaction. Therefore, designing online courses reconsidering modes of interaction when using different technology can make a significant difference in sustaining student-centered learning environments.

Next Steps

The conversations that we are currently having with our students who are preservice teachers, practicing teachers, and various types of educators (practitioners) is the importance of acknowledging that the world we live in and need to

help our learners navigate is rapidly changing; the jobs of the near future are evolving rapidly. Thus, it is imperative that practitioners stay on top of the relevant pedagogical and technological innovations and provide such opportunities as part of preservice and continuing teacher education and further. The instructors continue to incorporate changes in the course design and instruction based on what is most critical for supporting students at a given time. This support could be based on a pandemic but further applies to the ever-changing technological landscape that is the reality of our experiences in education and beyond. For example, in our next course iterations, we will continue using existing strategies including student-centered design but add on investigating and incorporating XR - extended reality that encompasses virtual, augmented, mixed, and blended reality technologies.

Further, in relation to the implications for researchers, relevant research is integral to maintaining accountability and integrity in learning design and teaching. We recommend taking a step back and assessing the seminal frameworks, for example, and looking to engagement as an overarching concept as well as the full model of online teaching and learning, as delineated by Anderson (2004) in the chapter *Towards a Theory of Online Learning*, to generate innovative/refined design principles. Then continue to break down and emphasize the areas identified as impactful for student success that can be applied in teacher education. As researchers, one area that we are interested in next is learner-content interaction and cognitive presence (Sadaf et al., 2021) as we are identifying this type of impactful interaction in our research. According to Bolliger and Martin, 2018, “Xiao (2017) highlights the lack of research on learner-content interaction” (p. 571) suggesting a need for deeper exploration of the assumptions on how learners interact with content which will help to develop a comprehensive understanding of learner-content interaction and respond to the evolving needs of teacher education.

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APPENDIX A

PLN Activity Including the shift to Tweetouts of New Learning

Your PLN

For this Module, we bring with us our prior knowledge and learning including digital citizenship, informal and lifelong learning, TPack, some social media tools, etc. and we add a potentially new concept, Personal (and Professional) Learning Networks. At first I thought, to have you all create a concept map to demonstrate your PLNs, I still think that is a good option as an artifact and evidence of your learning. However, this is also an opportunity to model different types of choices. You can still do a concept map, but you can also use anything that makes sense to you. Maybe you are tired and just want to write an essay-based type of response, maybe on your blog. Maybe you want to be more expert with infographics. There are other tools too - a comic strip (Canva has one), a voice over PowerPoint, a video. There is a great tool called Storybird (<https://storybird.com>) that is popular and learning can be demonstrated with a poem or story. I've had students write poems, songs, and once a short play. And maybe there is a tool you already use with your students that you want to share with us. You could create and share a learning plan for how you would teach the concept of PLN to your audience. You can brainstorm with your team or a study buddy. You can create something together. The key here is to open your mind to the opportunities of digital learning AND make sure you got the PLN concept in your schema :)

Instructions

1. Create an artifact of learning regarding the concept of PLN. Post by Sunday evening. **The due date is set for this.**
 - Include your understanding of what is PLN and/or what is YOUR PLN.
 - Include ideas for PLN in your life - personal, academic, professional/educational or focus on how you might use with your own students, just remember your context can always be a part of the goal.
2. Post to Twitter. Note that Instagram and Pinterest are also great for sharing infographics as these are image-based social media tools.
3. Provide the link to at least one posting.
4. Alternatively, you can just post here. Remember that not everyone will be as comfortable in social media and that is ok. If this is you, live vicariously through some of the rest of us.
5. Read your colleagues' posts and try to learn something new! Take notes as you read. Share a post or tweet of new community learning. This class has created the Shoutout Tweet (Tweetout? Tweetprops?) of New Learning, I LOVE IT! Your post of new learning should refer to concepts discussed by your classmates and at least three of their names. **The available until date is set for this.**

APPENDIX B

AHA Twitter Reflection with Gif War

What's an AHA moment? And what's a Gif War?

LOL, by now, you know what an AHA moment is. Now, let's have some fun and have a Gif War. With this week's AHA, add a gif; responses to each others' AHA's must include a gif. The way to technically win a Gif War is to receive the most likes. Our gif war is simply for fun and finding the best gifs! Consider starting a Gif War with your teams, here are the instructions - <https://www.girlspring.com/gif-wars-the-perfect-virtual-group-game-to-play-right-now/>.

Instructions

- Reflect on your fourth week in EDLT 561. Post your reflection as a tweet using class hashtag **#classhashtag** and tagging @instructor, you have a maximum of 280 characters. I recommend doing this by Friday at 10am, the due date is set for this.
- Use the Twitter search feature and search for **#classhashtag** to find your classmates' Tweets.
- Reply to your classmates' Twitter reflections. This builds community and helps you continue to get to know your classmates. Note that you may need to come back to the replies on this as reflection can take time. I recommend doing this over the weekend and/or on Monday, the Available Until date is set for this part of the activity.
- **Copy** your tweet or **post** the link to your tweet to this assignment in the submission box below and note how many classmates you replied to, I will randomly check on this. Note that you may need to come back to the replies on this as reflection can take time and I will always update progress points as needed.
- Note: a gif about gif wars was added here.

Equity Issues

Building Teacher Communities through Trauma-Informed Teaching Practices: Teaching for Social Justice in STEM

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Modeling trauma-informed teaching practices for pre-and in-service teachers by teacher educators remains critically important. This retrospective article details how the implementation of trauma-informed teaching practices in an online pre-service instructional technology course at the beginning of the COVID-19 pandemic evolved quickly into supporting induction educators. A cohort of secondary STEM teachers requested help in summer 2020 given the difficulties they encountered with student engagement during emergency remote teaching. The first iteration of professional development (PD) revealed that teachers needed support as much as their students given the uncertainty of the pandemic within schools. This problem was addressed by identifying where STEM teachers felt hesitancy in enacting the tenets of trauma-informed teaching practices, which encompassed social justice. A second round of PD transpired in summer 2021, where teachers received ongoing community support within an online PD context focused on teaching for social justice in STEM. Induction teachers benefited from the online community by sharing their successes, lesson ideas, and challenges; however, the enactment of teaching for social justice at the school level was hindered by buy-in at the school or department level. Teacher educators should continue to provide support to induction teachers through online communities of practice, given the ongoing need for trauma-informed teaching practices in schools and communities.

Keywords: trauma-informed, instructional technology, communities of practice, student engagement, STEM, science education, mathematics education

HISTORICAL REVIEW

As teacher educators in the instructional technology field, the abrupt transition to emergency remote teaching (see Hodges et al., 2020) at the onset of the pandemic in March 2020 prompted an immediate and pressing need to provide support to pre-service teachers. Guided by the recommendations of Carello and Butler (2015) and the Substance Abuse and Mental Health Services Administration (SAMHSA, 2014), checking-in with preservice teachers to see how they were doing mentally, physically, and emotionally became critically important. To address this need, a professor at one large regional university in the southeast U.S., supported pre-service teachers in an instructional technology course

using online formative assessment tools. The tools were used at the beginning of online synchronous class sessions to assess the mental well-being of undergraduate pre-service teachers from March 2020 to May 2020. Follow-up appointments with students who needed more individualized support also transpired. In the 2020 *JTATE* special issue (Roman, 2020), the ways in which formative assessment tools were used to authentically support preservice teachers in their mental health needs during synchronous class sessions were detailed. A key argument in the article was to encourage other teacher educators to consider similar trauma-informed teaching practices (see Table 1), not only with pre-service teachers, but induction teachers as well. Below, the researchers detail how the work of trauma-informed instructional support shifted from pre-service teacher participants to a small cohort of middle and high school STEM induction teachers in June 2020.

Table 1
Principles of Trauma-Informed Teaching and Learning

<i>Principle</i>	<i>Descriptor</i>
<i>Physical, Emotional, Social and Academic Safety</i>	<i>Efforts are made to create an atmosphere that is respectful of the need for safety, respect, and acceptance for both individual and group interactions, including feeling safe to make and learn from mistakes.</i>
<i>Trustworthiness and Transparency</i>	<i>Trust and transparency are enhanced by making expectations clear, ensuring consistency in practice, maintaining appropriate boundaries, and minimizing disappointment.</i>
<i>Support and Connection</i>	<i>Individuals and groups are connected with appropriate peer and professional resources to help them succeed academically, personally, and professionally.</i>
<i>Collaboration and Mutuality</i>	<i>Opportunities exist to provide input, share power, and make decisions. Individuals and groups act as allies rather than as adversaries to reach common goals.</i>
<i>Empowerment, Voice and Choice</i>	<i>Individuals and groups are empowered to make choices and to develop confidence and competence.</i>
<i>Social Justice</i>	<i>Individuals and groups strive to be aware of and responsive to forms of privilege and oppression in order to respect one another's diverse experiences and identities.</i>
<i>Resilience, Growth and Change</i>	<i>Strengths and resilience are emphasized over deficiencies and pathology. Feedback is provided to convey optimism and to facilitate growth and change.</i>

(Adapted from Carello, 2020 *Trauma-Informed Teaching & Learning Principles* handout)

PROCESS/METHODS

At the onset of June 2020, a cohort of induction-phase STEM teachers expressed a desire for summer support, given the myriad of problems that surfaced during emergency remote teaching. Four faculty members spanning the disciplines of math education, science education, and instructional technology designed and delivered professional development (PD) to 11 induction STEM secondary teachers, all of whom received funding for their degree program from the Institute for Citizens & Scholars (Roman et al., 2022). The Institute for Citizens and Scholars engages people and organizations in

response to urgent educational challenges, such as the need for STEM teacher education and support (Institute for Citizens & Scholars, 2020).

Rather than dictate what the teachers needed, the researchers conducted a needs analysis to assess the desired learning targets of the teachers (Roman et al., 2022; Roman et al., 2021). The cohort collectively sought more strategies for engaging students during online teaching. Feedback from the teachers informed the development of a five-week online PD workshop offered in summer 2020. The workshop focused on preparing teacher participants to effectively design online and blended learning activities that promote learner engagement and supported trauma-informed teaching principles (Bond, 2020; Bond & Bedenlier, 2019; Carello, 2020). It should be noted that one principle of trauma-informed teaching (Carello, 2020) is social justice, which had heightened relevance during summer 2020 as George Floyd was killed in May of that year and all the teacher participants in this study worked in schools primarily serving minority students.

The purpose of the research was to examine how secondary STEM teachers engaged their students in online/blended learning environments during the COVID-19 pandemic. Thus, the researchers used a longitudinal single case study design to garner an in-depth understanding of the situation, the process, and the context associated with teaching STEM during this unusual time (Merriam, 1998).

The following research questions guided the study:

1. How did STEM induction teachers engage their students in online and blended learning environments during the COVID-19 pandemic during Spring 2020 and Fall 2020?
2. How do STEM induction teachers enact trauma-informed lessons with a social justice focus during the 2021-2022 school year?

During Summer 2020, the researchers examined how 11 STEM teachers engaged students in online/blended learning environments during emergency remote teaching and how they designed lessons to better support student engagement during fall 2020 (Roman et al., 2022). In the following academic year, a purposeful sample of teachers (seven) were enlisted to look more closely at how they engaged students in science and mathematics using trauma-informed practices and social justice teaching (Roman et al., 2021). Data collection (Yin, 2018) included a survey to identify needs and previous experiences with student engagement, workshop artifacts (e.g., project plans, presentations, reflections) to identify dimensions of student engagement and principles of trauma-informed teaching, and two interviews (PD exit interview and follow-up interview after the social justice lesson implementation) to determine the how and why of participants' lesson plans and implementation.

Using Atlas.ti Cloud, the research team created a codebook containing theoretical and data-driven codes (Boyatzis, 1998; DeCuir-Gunby et al., 2011) and collaboratively analyzed the data using a thematic approach (Cornish et al., 2014). Codes were derived from Bond et al. (2020) indicators of engagement and disengagement in three domains: affective, behavioral, cognitive. Indicators of social engagement (e.g., peer support, productive interactions) are foundational to teaching and learning in the sociocultural and constructivist models that frame teacher-development work (Table 2). In agreement with Fredricks et al. (2016), who suggested that social engagement might serve as a separate engagement dimension, seven indicators of social engagement were generated by re-categorizing dimensions previously published in the three traditional domains. Thus, the theoretical framework and coding process described here reflect a view of student engagement as the energy and effort exerted by learners, observable by an array of affective, behavioral, cognitive, and social indicators, and shaped by the learning context. Carello's seven principles of trauma-informed teaching were also included. Open-coding generated codes related to social justice, pedagogical approaches, and implementation successes and barriers. Analysis included reliability checking, data triangulation, member checking and identifying disconfirming evidence as verification techniques to increase trustworthiness (Merriam, 1998; Yin, 2018).

Table 2
Indicators of Student Engagement

<i>Cognitive Engagement</i>	<i>Behavioral Engagement</i>	<i>Affective Engagement</i>	<i>Social Engagement</i>
<i>Purposeful</i>	<i>Effort</i>	<i>Enthusiasm</i>	<i>Trying to understand other's ideas</i>
<i>Critical thinking</i>	<i>Attendance</i>	<i>Interest</i>	<i>Teaching self & peers</i>
<i>Self-Regulation</i>	<i>Positive conduct</i>	<i>Enjoyment</i>	<i>Learning from peers</i>
<i>Integrating ideas</i>	<i>Study habits</i>	<i>Sense of belonging</i>	<i>Asking teacher or peers for help</i>
<i>Setting learning goals</i>	<i>Attempting</i>	<i>Sense of well-being</i>	
<i>Operational Reasoning</i>	<i>Action/initiation</i>	<i>Pride</i>	<i>Supporting & encouraging peers</i>
<i>Doing extra to learn more</i>	<i>Developing agency</i>	<i>Satisfaction</i>	<i>Interactions (peers, teacher, content, technology)</i>
<i>Follow through/ care/ thoughtfulness</i>	<i>Homework completion</i>	<i>Vitality/Zest</i>	
<i>Reflection</i>	<i>Confidence</i>	<i>Excitement</i>	<i>Positive interactions with peers & teachers</i>
<i>Positive self-perceptions & self-efficacy</i>	<i>Participation/involvement</i>	<i>Curiosity</i>	
	<i>Assuming responsibility</i>	<i>Feeling appreciated</i>	
<i>Concentration/focus</i>	<i>Developing multidisciplinary skills</i>	<i>Confidence</i>	
<i>Preference for challenging task</i>	<i>Attention/focus</i>	<i>Sense of connectedness to school/university</i>	
<i>Deep learning</i>	<i>Time on task/ staying on task/ persistence</i>	<i>Positive attitude about learning/ values learning</i>	
<i>Use of sophisticated learning strategies</i>	<i>Accessing course material</i>		
<i>Justifying decisions</i>	<i>Identifying opportunities & challenges</i>		
<i>Positive perceptions of teacher support</i>			

RESULTS

Mathematical practices and the science and engineering practices of influential reform documents (National Council of Teachers of Mathematics, 2014; NGSS Lead States, 2013) are aligned (Mayes & Koballa, 2012), supporting a consensus view that effective STEM teaching practices require student engagement in productive discourse and social construction of knowledge. Amid these norms of research-based STEM pedagogy, emergency-remote teaching (Hodges et al., 2020) necessitated by COVID-19 forced the teacher-participants to implement teaching strategies for which they had no prior experience. During the 2020 academic year, induction-support of these STEM teachers included an investigation of their online and blended teaching practices related to dimensions of student engagement and trauma-informed teaching principles (Roman et al., 2022).

Q1: How do STEM induction teachers engage their students in online and blended learning environments during the COVID-19 pandemic during Spring 2020 and Fall 2020?

Survey data indicated that while participants were confident in using technology to engage students in learning during face-to-face instruction, they experienced challenges associated with students' lack of access to technology and the absence of a centralized learning platform to support student interactions. Initial reflection data indicated that participants primarily emphasized cognitive dimensions of student engagement before COVID-19, followed by attention to behavioral and social indicators. During spring 2020 COVID-19 teaching, participants prioritized behavioral engagement, and to a lesser extent social engagement, when facilitating and supporting learning activities. Analysis of engagement indicators evident in instructional designs prepared in summer for the upcoming fall 2020 semester showed a general balance across the cognitive, affective, behavioral, and social engagement domains (Roman et al., 2022). Within this representation across the four engagement domains, the noteworthy pattern in the data was the prominence of social engagement indicators (*interaction, learning from peers*) and affective indicators (*sense of connectedness to school, sense of belonging*). When coding for indicators of affective engagement, the participating teachers' post-PD project presentation and exit interview comments indicated a dramatic increase in references to students' *sense of connectedness to school* and *sense of belonging*. Data analysis indicated that participants made intentional plans to infuse trauma-informed teaching principles (Carello, 2020) into their instruction and learning contexts. The most notable were *Support and Connection, Physical, Emotional, Social and Academic Safety; Empowerment, Voice and Choice; and Trustworthiness and Transparency*.

Q2: How do STEM induction teachers enact trauma-informed lessons with a social justice focus during the 2021-2022 school year?

Of the seven who participated, four teachers were able to enact the social justice STEM lessons, which are described in more detail Roman et al. (2021). Implementation of these social justice-oriented STEM lessons demonstrate the capacity of these teachers to adapt plans to the demands of their context. Three of the seven participating teachers enacted social justice lessons of greater number and depth, and in these cases, teachers enjoyed more autonomy, academic freedom, and perceived more support and solidarity from district school leaders for integrating social justice issues in the STEM curriculum. Integrating social justice topics into specific STEM lessons was challenging for some participants. They cited a lack of time, resources, or lesson examples. However, they were able to have informal social justice discourse with students whether in homeroom before school, during class discussions about current events, or in afterschool club meetings.

IMPLICATIONS

Implications from the longitudinal study encompass recommendation for both theory and practice in the areas of trauma-informed teaching, student engagement, and teaching for social justice.

Trauma-Informed Teaching and Student Engagement

This study has theoretical implications that offer potential avenues for future research. Indicators of social engagement based on the work of Bond et al. (2020) and informed by Fredricks et al. (2016) have been presented. These social indicators are a first iteration that can be refined by other scholars interested in using student engagement indicators for coding purposes. Additionally, analysis of these data using student engagement indicators (Bond et al., 2020) and trauma-informed teaching practices (Carello, 2020) indicated an overlap between these two constructs. Assuming some consensus in the professional education community as to the value of all four engagement domains for supporting student learning, these data may support the claim that trauma-informed teaching supports student engagement (Rumsey & Milsom, 2019), particularly in the affective dimension of engagement during times of trauma.

During the COVID-19 pandemic with limited training in online teaching strategies, many teachers were faced with the challenges of engaging students in learning in an online environment during a time of crisis and trauma. As a result,

practicing teachers sought support to enhance their pedagogical strategies for engaging students during online learning, including learning strategies to support students' emotional needs. In many ways, the pandemic created opportunities for teachers and administrators to reimagine the processes and policies of educating students. According to the 2016 National Survey of Children's Health, 45% of all school-age students have experienced a traumatic event. Experiencing a traumatic experience can impact students' mental health, behavior, school attendance, and academic achievement (RB-Banks & Meyer, 2017). As teachers resume pre-COVID educational practices, they should be encouraged to continue to use online tools to enhance teaching as well as engage trauma-informed pedagogy in support of student learning. Teacher educators have an opportunity to provide Professional Develop (PD) for practicing and prospective teachers who have limited knowledge of implementing trauma-informed best practices in an online or face-to-face classroom.

Teaching for Social Justice

Whether teaching in-person or online, students benefit academically when teachers incorporate principles from trauma-informed pedagogy into their practice. This involves considering how events outside of the classroom impact student engagement with learning STEM content inside the classroom (RB-Banks & Meyer, 2017). The tenets of trauma-informed pedagogy are like those of social justice teaching as its approach (a) addresses inequities that exist in education, (b) attends to academic gaps in students' experiences, and (c) creates a learning environment that supports student engagement in learning STEM content that promotes not only understanding inequities in their school, community, or society but also helps students to advocate for change. There is evidence to suggest that teaching for social justice presents challenges for novice teachers (Cochran-Smith et al., 2009; Grossman et al., 2009). To overcome challenges, STEM teachers need frequent opportunities to engage in PD and to build collaborative relationships that can foster connecting trauma-informed and social justice pedagogy across content areas (Kelley et al., 2020). This can be accomplished through communities of practice that emerge from planned PD. Wenger (2011) defined communities of practice as "groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly" (p. 1). Mathematics and science teacher educators can facilitate communities of practice by collaborating with instructional technology teacher educators on using technology to support in-service STEM teachers who encounter difficulties engaging social justice teaching practice in their classrooms due to shifting education environments or political climate. Crompton et al. (2021) argued that "teacher communities can rapidly respond to a shifting professional landscape when teachers engage, share, and critically reflect on their professional practices" (p.12).

The seven STEM teachers involved in this social justice project worked in six different schools in five different districts. While the participants formed a productive community with a shared vision during the summer PD and follow-up support, each teacher nonetheless had unique school and district-level contexts in which to enact their planned social justice instruction. The summer 2021 workshop marked the end of grant-funded induction support, intensifying the challenge of individual participants applying summer plans to their specific teaching contexts. Enactment of STEM teaching for social justice progressed more in schools where STEM faculty recognized that social justice issues might serve STEM learning, and the reciprocal capacity of STEM curricular concepts to deepen students' understanding and response to social justice issues.

CONCLUSION

Key recommendations from this longitudinal study apply to teacher educators as well as in-service and preservice teachers. Since trauma-informed teaching supports student engagement (Rumsey & Milsom, 2019), *all* educators should be more intentional about modeling and integrating trauma-informed teaching into their instruction. Facilitating trauma-informed teaching is dependent on (a) access to resources; (b) support from colleagues and administrators; (c) school and district cultures; and (d) mentoring and induction (Thomas et al., 2019). Assuming one has support for trauma-informed instruction, teaching with this lens enables the growth of trust and safety within the learning environment, enabling issues of social justice to be more readily addressed in one's classroom and curriculum. Challenges in teaching for social justice may involve buy-in at the school or department level. As such, teacher educators in instructional technology and STEM fields should consider facilitating online or blended communities of practice that support preservice and in-service teacher efforts to engage in trauma-informed and social justice teaching, given the ongoing need for trauma-informed care in schools and the ever-changing political climate.

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Successes and Challenges with Anti-Racist Community Building in Online Environments: Dual Pandemic Intersection

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This paper reports on a collective case study that examined a community of inquiry designed to help teachers address the challenges of enacting anti-racist pedagogy using virtual teaching practices in the wake of the dual pandemics of COVID-19 and systemic racism. The following research questions guided this study: 1) What successes and challenges do teachers report when enacting anti-racist community building with students in online environments? 2) How does participation in an online professional learning community that cuts across the racial divide in St. Louis impact teachers? We used descriptive statistics along with open and a priori coding to analyze data from 29 participants, including pre and post surveys, focus group interviews, learning circle recordings, and participant-generated artifacts. Results are reported in relation to five themes: trust, vulnerability, awareness, accountability, and connection. We end by sharing implications of this study for supporting educators who work at all levels of education.

HISTORICAL REVIEW

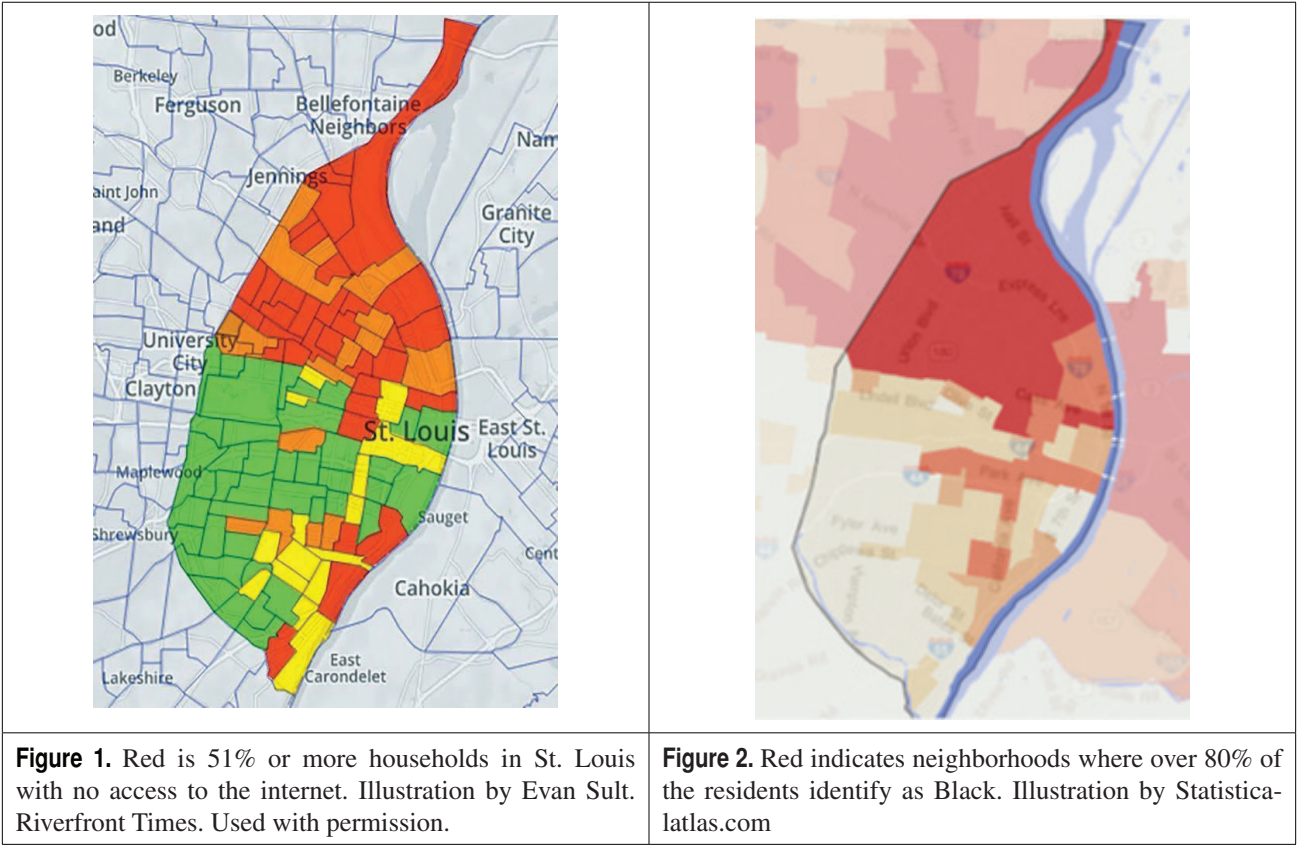
The spring of 2020 ushered in what has been referred to as dual pandemics (e.g., Jones, 2021). There was the global pandemic of COVID-19, which disproportionately impacted people of color. Then, the murder of George Floyd further highlighted a pandemic that has been festering for centuries - that of systemic racism (Silverstein, 2021). Our work before 2020 included multiple teacher inquiry communities focused on antiracism. When the COVID-19 pandemic first hit, we built a community of inquiry around global solidarity to help combat the racist undertones of xenophobia that were associated with COVID-19 (see Kerkhoff, 2020). Then, the racial health disparities of COVID-19 and the murder of George Floyd underscored the need to focus on systemic racism in our local communities to help teachers address the challenges of enacting antiracist pedagogy using virtual teaching practices.

Although the end of the 2019-2020 school year can be characterized as “emergency teaching,” during the summer, educators began planning in earnest for virtual teaching to start the 2020-21 school year. In the St. Louis, Missouri area, districts moved to adopt various online learning management systems and trained teachers on their use. Some districts developed and distributed online curricular modules that teachers were required to use. However, even in the most prepared school districts, online platforms and pre-loaded learning modules could not alleviate two primary concerns of teachers returning to a changed classroom: 1) How will I build relationships and community with my students in a virtual

setting; and 2) How can I demonstrate my commitment to antiracist pedagogy and open up brave spaces (Aroa & Clemens, 2013) for critical conversations in a virtual setting? These concerns were exacerbated in communities marginalized by the digital and racial divides in St. Louis (see Figure 1).

In an effort to center the needs of historically marginalized people and prioritize educational equity, colleagues at the University of Missouri - St. Louis designed and implemented a free virtual professional learning series rooted in antiracism for teachers in our region whose schools could not afford to provide professional development (PD) or whose PD experiences were not from a framework of social justice. This project brought together STEM, literacy, and special education researchers to utilize both quantitative and qualitative methods to investigate building community in online learning. Our work was guided by the following research questions:

1. What successes and challenges do teachers report when enacting anti-racist community building with students in online environments?
2. How does participation in an online professional learning community that cuts across the racial divide in St. Louis impact teachers?



METHODS

This study is a collective case study (Stake, 2000) with teachers from diverse schools in the greater St. Louis area who participated in virtual professional learning. The PD began in September 2020 with four, 90-minute workshops focused on building community in online spaces. The PD included whole-group interactive sessions, discipline-focused breakout sessions, and design time where participants could engage in applying their learning to instructional design. From there, interested teachers were invited to engage in continued inquiry circles in which participants attended ten weekly, 60-minute synchronous Zoom sessions from October-December, 2020. The session titles for each week show the progression of topics and are listed in Table 1.

Table 1
Session Topics and Progression

Session	Topic
Session 1	Start with the basics: Getting to know your students
Session 2	Redefining participation: Getting each student involved and engaged
Session 3	Vulnerability: Leading difficult discussions
Session 4	Using student interests to guide our teaching
Session 5	Teaching Accountability: Understanding the impact of our actions and word choices
Session 6	Honor the Healing
Session 7	Building Cultural Awareness: Exposing students to perspectives and experiences different from their own
Session 8	Practicing self-care in a culture that expects teachers to self-sacrifice
Session 9	Positioning students as experts
Session 10	Let's Celebrate: Creating meaningful celebrations in online environments

Participants

The initial professional learning series drew over 75 area teachers. Twenty-nine of those teachers continued with the inquiry circles that focused on an explicitly anti-racist stance to building community in online spaces, allowing teachers to (1) build supportive professional networks and (2) build community with their own students. These teachers were invited to be study participants. As shown in Table 2, participant demographics largely mirrored the demographics of the national teaching force with the largest percentage being white teachers who identify as female; however, there was representation across race, gender and role.

Table 2
Participants' Demographic Data

Characteristics		Frequency	Percentages
Race	Asian	1	4%
	Black	5	16%
	Hispanic	1	4%
	White	22	76%
Gender	Female	25	86%
	Male	4	14%
Role	Administrator	1	4%
	Teachers	18	62%
	University Faculty	6	21%
	University Students	5	17%

Data Collection & Analysis

Data sources included pre and post surveys, focus group interviews, learning circle recordings, and participant-generated artifacts. The pre survey included questions about participants demographics, items from the Online Teaching Self-Efficacy Scale with Likert response (Gosselin, 2009), and open-response questions about participants' knowledge of online teaching practices and goals for their professional learning. Post surveys were collected in order to measure the effectiveness of the series and included Likert Scale items as well as open-response questions to help answer the research questions.

Likert scale items on the pre and post surveys were analyzed with descriptive statistics. Sessions were transcribed and analyzed first through direct interpretation in each individual instance and then through aggregation of instances across sessions and participants (Stake, 2000). We analyzed data using open and a priori coding (Saldaña, 2021) looking for patterns to develop themes of teachers' perspectives on building community online with their peers and classes in ways that are specific to their context. Artifacts were coded based on themes developed from the other data sources.

RESULTS

What successes and challenges do teachers report when enacting anti-racist community building with K-12 students in online environments during COVID-19?

Understandably so, teachers seemed to find it challenging to transfer what they understood to be good and equitable teaching to an online environment. Though they all reported various levels of success with each of the major categories this study addresses (i.e., trust, vulnerability, awareness, accountability, and connection), they were also seeking ideas and resources for cultivating these in an online environment with students.

Most of the teachers' big questions in the pre-survey revolved around how to foster environments in which students could build and engage in community with their classmates in an online space that was representative of and accessible to all students. Teachers wondered about how to structure time online for students to get to know one another, how to model vulnerability to gain trust, and how to help students and themselves remain their authentic selves and have important (even if controversial) conversations in an environment that easily lends itself to being recorded and shared, and has been increasingly legislated (Ladson-Billings, 2021).

In the post-survey, teachers shared successes in building trust, cultural awareness, and accountability for learning among students through sharing vulnerability and forging students' connections with the teacher, other students, and the curriculum. Teachers shared that they had success in implementing technical tools and resources that they learned in the program to help build relationships with students and help attend to students' emotional and social needs. Data is displayed in Table 3.

How does participation in an online professional learning community that cuts across the racial divide in St. Louis impact teachers during COVID-19?

Teachers who participated in this study hoped to build and be part of a community of teachers who were working to learn how to teach in inclusive ways in a digital environment during an especially challenging cultural moment. Teachers reported enjoying the opportunity to build community with one another while learning practical tools and approaches to help students build supportive communities in their classrooms.

Post survey data indicates that, after being in online discussion spaces where they could participate in instruction modeled as an example of how they could do this work in their own classrooms, teachers were much more confident in their abilities to create engaging online classrooms that were reflective and inclusive of diverse identities as well as to engage students in engaging and meaningful discussions around difficult topics.

On the overlapping items from the two surveys, participants reported a confidence increase of up to two points on the scale. Table 4 displays comparisons of pre and post survey results, though our design does not allow for causation explanations of the data.

Table 3
Participant Data on Successes

Theme	Quotes from Participants
Trust	This helped me to realize I can rely on my kids to be experts too. I do not have to be in control of every single moment or action to allow my students to learn what I hoped they would. Sharing control gives kids true ownership of their learning.
Awareness	Specifically the school gave us a pile of texts to choose from for our homerooms and told us to choose three. The goal I had was to choose the texts that the students could relate to of course. Yet I found one particular text (on the hijab) that just one student could relate to. At first glance I bypassed it because not all or majority of students could relate. Then I thought about the one student and thought that she would be so ecstatic to see herself in the curriculum and remembering that representation is not just about the majority. It is not just a student can see themselves but also so that other students can see them too.
Accountability	Making sure to start discussions with group norms. I was able to give students roles - moderator, chat monitor, expert, novice, etc. and it really made a difference for some kids and the engagement in class.
Vulnerability	I notice the vulnerability of the group members and the facilitators. It led to powerful and engaging discussions. I carried that into the online class. I check whether students are emotionally ok before moving into academics. This is new for me. I learned about the importance of following up with a student individually after a difficult conversation or microaggression.
Connection	Finding ways to help understand students in these unusual times and to help them understand each other. Connecting during discussions and helping students to be willing to share out. I can't say that all of my students are comfortable taking risks, but I have had more students willing here recently to open up during conversation when they haven't been confident. I learned so much about creating a community when I am further than 6 feet apart as well as tools/techniques/ in order to create more discussions and sharing ideas in my classroom.
Implementing digital tools and opening virtual spaces for relational and social learning.	I have learned so much from you all and I have been able to apply what we have discussed to both my work with teachers as well as to my own online classes. I learned about really practical technical tools (such as whiteboardfi.com) and organizing tips (group roles in discussions and setting group norms). But I have also been inspired to consider how I open up to my students and invite them to open up to me in ways that will lead to more meaningful learning and relationships. What an amazing experience. Using Padlet in an anonymous way after the election for students to share thoughts across classes, is not something I had ever considered doing before. It ended up being a great outlet for some students who just had a thought that needed to get into the world before the election was called. I shared this with one of our district's facilitators who has shared this with several teachers in the district. Here is a quote from our district newsletter. "Whiteboard.fi is amazing!" Designating students as chat monitors has helped me. I've also tried using (with some success) FlipGrid and Padlet. I implemented a discussion board in my online class and it was successful. It grew our classroom community and it was fun to see students begin to respond to each other's posts.

Table 4

Pre-test Items	Pre Mean (<i>N</i> = 29)	Pre <i>SD</i>	Post Mean (<i>N</i> = 15)	Post <i>SD</i>
Ensure students from a variety of cultural backgrounds feel represented in online courses.	2.93	0.92	4.20	0.56
Get students to work together in online courses.	2.48	0.95	4.00	0.53
Promote student participation in my online classroom.	2.90	0.98	4.20	0.41
Create a sense of community in my online classroom through activities that help my students get to know each other more.	2.93	1.07	4.27	0.70
Create meaningful class discussions in an online environment.	2.72	0.80	4.20	0.68

The themes of *trust*, *vulnerability*, *awareness*, *accountability*, and *connection* were revealed to be salient in regards to this research question also.

Table 5

Theme	Quotes from Participants
Trust	I have enjoyed hearing other stories, disagreeing over personal philosophy, and building a community based on shared experience and trust especially in this time when teaching feels like an island.
Awareness	It was helpful to hear from other educators with a variety of backgrounds and experience to provide multiple examples and perspectives with ideas and support. I look at student representation with a different lens. Representation is not just about catering to the masses in the classroom. I tend to group students as a whole when looking at resources to implement in lessons. However, it is alright to use resources that just one student can connect or relate to.
Accountability	I tried new strategies that encouraged students to work together effectively and respectfully
Vulnerability	It was beautiful to experience the group becoming more open and vulnerable over the course of the program.
Connection	We are so focused on building communities for our students that we sometimes forget the importance of having our own communities. From the very first session, I've loved the collaborative nature of working with other teachers to find out what's working and what isn't when it comes to learning online. Discussions about sharing and empowering students' perspectives have helped shape an entire unit plan on Culture. I also liked sharing a virtual space with people in the same boat as me- especially as a first-year teacher with no background/training in education- it's been very impactful to hear and see how the pros do it!

IMPLICATIONS

The move to virtual teaching left many teachers underprepared and unmoored. Indeed, the ongoing staff shortages and increasing teacher burnout have over 55% of teachers considering leaving the field earlier than planned (Dabrowski, 2021; Walker, 2022) and few who are looking to join the field (Maxouris & Zdanowicz, 2022; Partelow, 2019). Although

the reasons for the growing teacher shortage are complex, there are implications of this study for supporting educators who work at all levels of education.

While most schools returned to in-person, face-to-face instruction at some point in 2021, we know that some of the pivots made during virtual teaching are here to stay. For example, educators report being able to communicate more easily with parents via Zoom, and there is opportunity to prevent disruptions to learning using digital platforms for virtual tutoring and instruction during emergency days (e.g. snow days). To better support teachers before they ever enter the field, teacher preparation programs need to work with preservice teachers to consider beneficial uses of technology for creating supportive classroom communities in equitable ways. These findings push teacher education to prepare teachers to use technology beyond community of inquiry (Garrison et al., 2010) to consider race, culture, and equity when teachers design ways for students to connect to the instructor, other students, and the content and beyond TPACK (Koehler & Mishra, 2009) to include pedagogical knowledge of digital platforms, tools, and methods for building a community of learners both locally and globally. In addition, our findings suggest that teachers need practice with virtual methods for social and emotional learning and culturally relevant teaching during their coursework and field experiences.

Regardless of the format for instruction, teachers are being thrust onto the frontlines of the culture wars. They need anti-racist, social justice-focused networks to help them navigate this tricky terrain. For in-service teachers, our findings suggest the need to create more professional networking spaces (either online or in-person) where teachers feel connected to each other, learn from each other, and realize they are not alone in the challenges they are facing. Given the exodus from the field of teaching, connections are needed more than ever, especially among teachers of color and those who work in schools with historically marginalized populations.

Although the conversations that took place during the learning circles were a clear source of support for our participants, these conversations must move beyond our localized virtual setting and into the realm of policymaking more widely. Further research is needed to point to solutions for policy makers who are willing to address the stark realities of inequity that were laid bare during the COVID-19 pandemic and continue to fester as part of the systemic racism pandemic.

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Inhibitors of Teacher Research Engagement in Isolated Settings

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The global COVID-19 pandemic found teachers and teacher educators unprepared for the challenges they confronted. Many of these challenges are comparable to those faced by teachers in remote areas around the world, one of which includes the limited options for professional development. As a result, many of them do not have access to proper professional development during their whole teaching career. Educational research has the potential to assist teachers in remote settings and therefore it can support teachers who are in isolation due to COVID-19. Educational research holds the potential to support teachers so that they can take more initiatives for their practice and conduct a critical assessment of their situation. This study aims to investigate the factors that inhibit teachers in remote settings from research engagement. The sample of the study included 302 teachers, serving in mountainous and island areas of Greece. The daily workload, lack of motivation, and family obligations were found to be the most important issues preventing remote teachers to engage themselves in educational research.

HISTORICAL REVIEW

During the COVID-19 period, teachers needed guidance on how to resolve many online teaching challenges and stood unprepared for the issues they confronted (Hodges et al., 2020). For years, scholars have argued that teachers and teacher educators should have been prepared for online and hybrid education (Ferdig & Kennedy, 2014). However these warnings have mostly gone unheeded (Kennedy & Ferdig, 2018).

The challenges faced by teachers as a result of their isolation are similar to those faced by teachers in remote areas around the world (Trikoilis & Papanastasiou, 2020). Teachers serving in isolated settings have limited options for professional development. This is because it is more expensive to train teachers in remote places (OECD, 2010). Thus, rural teachers who wish to attend a workshop held in a metropolitan area must travel a significant distance, remain away from home overnight, and frequently provide a substitute teacher (Timar & Carter, 2017). As a result, many of them do not have access to proper professional development during their entire teaching careers.

Educational research has the potential to assist teachers in remote settings and therefore it can also support teachers who are in isolation due to COVID-19 (Trikoilis & Papanastasiou, 2020). Educational research supports teachers so that they can take responsibility for themselves and their actions (Stenhouse, 1975). In this way, they can conduct a critical assessment of their situations. They can participate in substantial professional development and learn to function independently, as they make their own decisions about their practice (Stremmel, 2015). Finally, teachers with a research attitude can help their students research their questions, empowering them to engage in a discovery process. For all these reasons teachers should be able to embed and integrate relevant educational research findings and scientific theories into their professional actions.

Prior research on rural teachers indicates that teachers who feel more isolated are more active in engaging in research-related activities in an attempt to develop themselves professionally (Trikoilis & Papanastasiou, 2021). In the same way, during the pandemic period of self-isolation, research involvement could help teachers develop professionally (Trikoilis & Papanastasiou, 2020). Although there is a growing body of literature about the factors affecting teacher re-

search engagement (Baoguo, 2017; Gomez & Catan, 2021; Hussien et al., 2019), little is known about the factors inhibiting teachers from research engagement in remote areas.

Rural and remote areas of developing countries are home to more than 2.5 billion people (about 40% of the world's population). An examination of the research literature has identified several inequalities between remote and urban areas which eventually lead to educational gaps which are especially troubling (Opoku-Asare & Siaw, 2015; Sullivan et al., 2018; Sumi et al., 2021). These gaps include inequalities in students' achievements, high school graduation rates, and educational opportunities (Sullivan et al., 2014). However, research has consistently shown that effective professional development is strongly linked to improved student outcomes (Hattie, 2009) and that it plays a major role in the success of high-performing, high-needs remote schools (Barley, 2018). Therefore this research initiative aims to provide some insights into this direction, investigating the factors inhibiting teachers from research engagement in remote areas. The main research question of this study is: "*Which factors inhibit teachers the most from research engagement in remote areas*". The results of this study could enrich the knowledge in the field and provide useful evidence-based information for educational stakeholders. This information could also enhance teachers' professional development, whether they are isolated due to geographical or pandemic conditions.

PROCESS/METHODS

To examine the factors that inhibit teachers from engaging in educational research in remote areas, an empirical study took place in remote areas of Greece. This study examined alternative explanations beyond those identified in the international literature. As it has already been established remote schools confront poor financial resources (Marré, 2020), poor school infrastructure and facilities (Zhang et al., 2018), and consequently face various technical issues such as frequent electricity outages, low internet connectivity, low-speed Wi-Fi, and broadband connections (Gurung, 2021). Therefore this study aimed to investigate other factors such as facets related to teachers' time management, motivation, and research knowledge.

The research was planned to take place during the spring semester of 2020. Due to the adverse conditions of the pandemic, there was a problem with communication with both the school principals and the teachers themselves. For this reason, the research was postponed and carried out at the beginning of the winter semester in 2021.

The participants answered a brief online questionnaire constructed in Google Forms by the researchers. The data were automatically gathered and stored in a linked spreadsheet. After that, the data were filtered and transferred to IBM SPSS 23.0 for statistical analysis, where mainly descriptive statistics were used.

Participants

A sample of 302 teachers participated in serving in mountainous and island remote schools in Greece. Overall, 66.6% of the sample was female, 30.1% of the participants were teaching in Primary Education whereas 69.9% were teaching in Secondary Education. Their average years of teaching were 15.4 years ($SD = 8.2$). In terms of the highest academic degree, 53% of the participants only earned a Bachelor's Degree, 43.4% had a Master's degree, and 3.6% had earned a Ph.D. in Education.

Instrument

The 302 participants responded to a brief online questionnaire constructed by the researchers. The questionnaire was created and administered online (via Google Forms) and was forwarded to the emails of the 556 Primary and Secondary remote schools in Greece. It consisted of 10 items on a 7-point Likert scale (1 - strongly disagree, to 7 - strongly agree). Items 2 and 3 examined the extent that lack of motivation affects teacher research engagement. Item 1, 4, 5, 6, 7, 8 measure facets related to time such as the daily workload, the program schedule, family obligations and the curriculum to be taught. Finally, items 9 and 10 refer to the knowledge about research procedures and data analysis. The Cronbach's alpha value for the overall instrument is $\alpha = 0.75$. Table 1 illustrates the wording as well as the supporting literature for each item.

Table 1
Wording and References of the Items

	To what extent do the following factors prevent you from conducting educational research?	Reference
1	The daily workload	(Eroglu & Kaya, 2021)
2	The lack of staff motivation on part of the Ministry of Education	(Jenkins et al., 2011)
3	The lack of staff motivation on part of the school Principal	(Jenkins et al., 2011) (OECD, 2009)
4	The tight school schedule	(OECD, 2009)
5	Family obligations	(Eroglu & Kaya, 2021) (OECD, 2009)
6	The curriculum to be taught	(OECD, 2020)
7	Extracurricular school obligations	(Kyaw, 2021)
8	Teaching in more than one school	(Elacqua & Marotta, 2019)
9	Lack of knowledge about research procedures	(Hussien et al., 2019) (Yen et al., 2017)
10	Lack of knowledge about data analysis procedures	(Hussien et al., 2019) (Yen et al., 2017)

RESULTS

The data that were obtained by the 302 teacher participants from remote schools in Greece, were analyzed through descriptive statistics, which included means, standard deviations, skewness, and kurtosis statistics. As presented in Table 2, the item values for skewness and kurtosis ranged from -2 to +2 and were therefore considered acceptable regarding the normal univariate distribution (George & Mallery, 2010). The average means ranged from 4.01 to 5.70, indicating that their responses tended to fall between neutral opinions, to opinions to which the respondents tended to agree.

Table 2
Descriptive Statistics of the Factors that have Prevented Teachers from Engaging in Educational Research

Item no	Factors that prevented teachers from engaging in research	Mean Statistic	Std. Deviation Statistic	Skewness Statistic	Kurtosis Statistic
1	The daily workload	5.70	1.331	-1.236	1.405
2	The lack of staff motivation on part of the Ministry of Education	5.43	1.694	-1.177	.555
5	Family obligations	5.17	1.934	-.851	-.474
6	The curriculum to be taught	5.11	1.703	-.845	-.034
4	The tight school schedule	5.06	1.788	-.738	-.409
7	Extracurricular school obligations	4.93	1.870	-.695	-.558
3	The lack of staff motivation on part of the school Principal	4.16	2.102	-.112	-1.283
10	Lack of knowledge about data analysis procedures	4.07	1.977	-.102	-1.207
8	Teaching in more than one school	4.07	2.517	-.110	-1.702
9	Lack of knowledge about research procedures	4.01	1.987	-.090	-1.229

According to the magnitude of the mean scores, the factors that prevent teachers from conducting educational research can be categorized into two groups. The first group contains factors with the greater mean values ranging from 4.93 to 5.70, indicating that the teachers tended to agree with these statements. These factors with descending mean value order are a. The daily workload ($M = 5.70$, $SD = 1.331$), b. The lack of staff motivation on part of the Ministry of Education ($M = 5.43$, $SD = 1.694$), c. Family obligations ($M = 5.17$, $SD = 1.934$), d. The curriculum to be taught ($M = 5.11$, $SD = 1.703$), e. The tight school schedule ($M = 5.06$, $SD = 1.788$), and f. Extracurricular school obligations ($M = 4.93$, $SD = 1.870$). The second group consists of factors with mean values lower than 4.16 and therefore indicated that the teachers tended to have quite neutral opinions as 4 was the middle point of the Likert scale. These items were “The lack of staff motivation on part of the school Principal”, “Lack of knowledge about data analysis procedures”, “Teaching in more than one school”, and “Lack of knowledge about research procedures”.

In conclusion, according to the participants of this study, there are time-related factors and motivational factors preventing teachers in remote areas to engage in research. Amongst them, the daily workload, the lack of staff motivation on part of the Ministry of Education, and family obligations are the factors with the greater mean values.

IMPLICATIONS

Teachers serving in remote areas have a lot in common with teachers isolated due to a pandemic crisis. Both of them confront the issue of professional isolation that hinders their professional development. This study proposes the model of the teacher-researcher (Stenhouse, 1975), as a means of overcoming this challenge and aims to investigate the factors that have a negative impact on remote teachers’ research engagement. The research focused on factors other than those related to poor infrastructure and facilities which have already been identified in prior studies.

According to the results of this study, the daily workload was found to be the factor with the greatest negative effect on remote teachers’ intention to engage in educational research. Teachers have a heavy daily workload that consumes valuable time and energy. This workload includes paperwork even during their off-time, and the preparation of their daily

lesson plans according to the demands of the curriculum. They also have to grade papers and tests, calculate grades, and undertake actions in developing students' well-being (Gomez & Catan, 2021). Moreover, to assist student development, teachers also spend time forming partnerships with parents (Graham-Clay, 2005), which is a time-consuming task.

The tight school schedule is another important issue negatively related to efforts in research engagement. It can prevent teachers from communicating and collaborating with their colleagues (VanWeelden, 2021). Thus, it deprives the proper space and time for teachers to reflect on their practice and engage in research. Apart from the extracurricular school obligations which are also time-consuming (Whiteley & Richard, 2012), teachers have to fulfill their obligations and responsibilities to their families (Sorenson et al., 2017). However, conflicts between work and family have negative effects on job satisfaction as well as on family satisfaction (Hu et al., 2016).

Teachers' motivation is another critical factor related to teachers' intention to utilize educational research. The international literature has pointed out that teachers' motivation has been linked to a variety of outcomes, including well-being, work satisfaction, dedication to the profession, and participation in professional development (Bardach et al., 2021; Lauermaun, 2017).

To overcome the factors that have a negative impact on remote teachers' research engagement some recommendations are presented. First of all principals and teachers should be informed about the benefits of educational research to understand its value and potential. Subsequently, a national network of teacher training in educational research could be developed. Teachers could learn about the research methodologies, the stages of research, research ethics, data coding, and statistical analysis so that they can become both producers and consumers of research (Papanastasiou & Karagiorgi, 2019).

At the school level, incentives can be given for teachers to participate in research groups. These incentives may refer to reduced working hours or exemption from extracurricular school obligations. This would reduce the workload and encourage teachers to engage in educational research. Besides, it will save time and reduce conflicts between work and family obligations. In addition, a points system can be created where teachers involved in research groups and conducting research may be rewarded for certain extra points for promotion purposes.

At the regional level, a research consultant could be appointed to coordinate the school research teams and act as a facilitator. Such a consultant could organize research presentations for teachers to present the research they have carried out and encourage them to attend conferences and publish their research. This would boost teachers' confidence and their professional development and act as an incentive for others to engage in educational research. Moreover, this would also improve the quality of education in these settings overall. Developing a research community in every school holds the potential to foster great change and improvement both at the individual and the organizational level.

In conclusion, teacher training in educational research, the creation of research teams, coordination by a research consultant, and even conducting research can be accomplished remotely. The development of technology and digital tools has allowed this. For example, teachers can create online questionnaires and share them via email. Data can be easily stored on worksheets without the need for human contact and intervention. Therefore, whether teachers are in a remote location or isolated due to a pandemic, they can develop professionally through educational research.

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