

**Teacher Preparation Programs and Teacher Training in Online Learning Environments:
A Review of Literature**

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Traditionally, teacher preparation programs have been designed to prepare teacher candidates to teach in face-to-face learning environments. Due to the heightened demand for online learning, amplified by the emergency shift to remote teaching during the novel coronavirus (COVID-19) pandemic and continuous technological advancements, teacher preparation programs now face the responsibility of adequately preparing their students to excel in teaching within online learning environments. To better understand teacher candidates' access to training for teaching in online environments, we conducted an extensive literature review from 2003 to 2022. The following themes were identified within the literature and are discussed: 1) Expectations for teacher candidates to have competencies in online teaching are increasing, 2) Teacher candidates need more engagement in online learning in their teacher preparation programs, 3) Teacher candidates experience unique difficulties in online environments in their teacher preparation programs, 4) Teacher candidates who receive purposeful instruction and support in online learning environments perceive greater professional preparedness, and 5) Teacher candidates' educational experiences vary among diverse learning environments. Throughout this literature review, we share pedagogical approaches and ideas for future research that may have utility for teacher educators to support teacher candidates in developing their knowledge and skills as future professional educators in online environments.

Keywords: Blended learning; Hybrid learning; Literature review; Online teaching; Teacher candidates; Teacher preparation programs

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Prior to the 2019-2020 novel coronavirus (COVID-19) global pandemic, there were calls for more research for evidence-based PK-12 online teaching practices (Arnesen et al., 2018). Research topics included a focus on using blended learning, hybrid learning, and online instructional strategies, as well as the benefits and challenges these strategies offer, for PK-12 teachers, educational leaders, administrators, and students (e.g., Balentyne & Varga, 2016; Beckem & Watkins, 2012; Smith & Brame, 2018). Despite the identified needs of blended, hybrid, and online learning methods, many in-service teachers consider teaching and learning in online environments as a choice and do not prioritize *online* instructional strategies as a skill (Choate et al., 2021; Quezada et al., 2020). Furthermore, legislation and policies are often written with an assumption that all or most PK-12 teachers will teach in a building, and thus create rules that are measured by time (e.g., 90 minutes of uninterrupted English Language Arts [ELA] focus). This type of rule may not be appropriate for a school that offers only online instruction. Therefore, teacher preparation courses that focus on preparing candidates to teach in buildings may not ensure teacher candidates are prepared to deliver instruction effectively online or via a hybrid approach.

When schools shifted instruction to an online and remote format during the COVID-19 pandemic, many educators found themselves unprepared for the shift, underscoring gaps in knowledge and skills not afforded to them via teacher preparation programs or previous professional learning opportunities (Choate et al., 2021; VanLone et al., 2022). According to Hodges et al. (2020), “in contrast to experiences that are planned from the beginning and designed to be online, emergency remote teaching (ERT) is a temporary shift of instructional delivery to an alternate delivery mode due to crisis circumstances” (para. 13). This temporary

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mode of delivery led schools to continue to offer online instruction, shifting to a more permanent option now and for the future. As some educators adapt to the increasing trend of delivering instruction in online environments, the development of specific online pedagogical skills and strategies within the profession is needed.

This emergency shift to online teaching during COVID-19 further highlighted gaps within teacher preparation programs' expectations of knowledge, expertise, and skillsets to train prospective educators to teach in blended, hybrid, and online learning environments (Cooper et al., 2020; Jin, 2022; Luo et al., 2017). Since the onset of the COVID-19 pandemic, some scholarship contributions have focused on in-service teachers' needs, roles, and competencies required to teach in online venues. Researchers (e.g., Grammens et al., 2022; Park et al., 2023) continue to describe how evidence-based online instructional practices continue to inform teaching regardless of format (e.g., in a building or using a digital platform from a distance).

The rapidly evolving landscape of teacher preparation underscores the necessity of a comprehensive analysis of scholarship spanning the past 20 years. Through this review, we seek insights into the training and development of PK-12 teacher candidates to employ blended, hybrid, or online instructional strategies. The subsequent section provides background on teacher preparation, defines common online learning terms, and explores research trends in teacher preparation and field experiences within blended, hybrid, and online learning environments.

Background

The call to prepare teacher candidates for teaching in online environments is not new. As virtual schools expanded throughout the United States in the early 2000s, Davis and Roblyer (2005) shared the critical need for teacher preparation programs to offer teacher candidates experiences and skill development related to delivering digital and online instruction. In 2012,

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Kennedy and Archambault (2012) identified limited opportunities to enroll in coursework that prepares future teachers by learning virtual teaching methods and participating in virtual field experiences with an aim to effectively instruct K-12 students in online contexts. After the abrupt shift to online instruction in 2020 due to the COVID-19 pandemic, many states (e.g., Georgia) called for, or mandated, teacher preparation programs to add specific learning outcomes and experiences to ensure teacher candidates have foundational knowledge and skills, as well as self-efficacy when teaching and learning in online contexts (Cooper et al., 2020; Keefe, 2020).

Acknowledging the impact of state policy changes and the global ramifications of the COVID-19 pandemic on education, leaders and faculty members of teacher preparation programs recognize the need to equip teacher candidates with specialized skills for online teaching while fostering equity and inclusive practices within online learning environments (Johnson et al., 2022; Quezada et al., 2020; VanLone et al., 2022). Furthermore, the United States Department of Education recently called for all teachers to develop and prepare to teach in blended learning environments, which includes the ability to teach online or in digital spaces (Short et al., 2021).

Blended, Hybrid, and Online Learning

With the sudden and exponential growth of online platforms and services since the onset of the COVID-19 global pandemic, teaching and learning in digital spaces is more prevalent now. Online learning indicates access to the internet is necessary to engage with the instructional delivery from an instructor or a digital program. Blended learning infuses digital devices across the curriculum in traditional, face-to-face classroom instruction, which may or may not be online. This format combines the benefits of traditional pedagogical strategies employed in face-to-face settings with the utilization of digital devices to enhance engagement or monitor

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participation. Like blended learning, hybrid learning adopts digital devices to deliver instruction to different audiences simultaneously and synchronously, in-person and from a distance, utilizing online learning methods. This format can be a demanding use of instructor time as asynchronous and synchronous teaching modes are both employed (Jnr, 2022).

A difference between blended and hybrid learning is that while blended learning relies on digital media or online engagement as a supplement to in-person instruction, the hybrid instructional approach is delivered from a distance, simultaneously while teaching an audience in person (Imran et al., 2023). To avoid misconceptions about the varying pedagogical approaches, we define five learning formats, as referenced herein, to clarify the similarities and nuances that differentiate each format. These learning formats include:

1. Blended learning: Blended learning integrates digital technology within the traditional, face-to-face classroom as an additional instructional approach utilizing online learning and offline digital learning opportunities (Halverson et al., 2017);
2. Digital learning: Digital learning is defined as “any instructional practice that effectively uses technology to strengthen a student’s learning experience and encompasses a wide spectrum of tools and practices” (Every Student Succeeds Act, 2015, p. 169);
3. Hybrid teaching and learning: The hybrid modality allows for a wider reach and flexibility to instruct students in person and from a distance via a synchronous online classroom. Hybrid learning is defined as an approach in which students “participate in some learning tasks via rich computer-mediated communication technologies even when they cannot physically be in classes” (Özüdoğru, 2021, p. 35). There are many distinct types or styles of hybrid teaching and learning, which include: parallel hybrid,

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alternating hybrid, blended hybrid, and a combination of models (e.g., hybrid flexible [HyFlex]) (Bartlett et al., 2022; Beatty, 2020).

4. HyFlex learning: HyFlex teaching strategies make it possible for students to choose whether to attend class face-to-face or online, synchronously or asynchronously, depending on the needs and preferences (Beatty, 2007).
5. Online learning: Online learning includes learning experiences that take place digitally and may be led by students or instructors. Online learning can be broadly defined as the use of the internet in some way to enhance the interaction between teacher and student. Online delivery covers both asynchronous forms of interaction (e.g., assessment tools and the provision of web-based course materials) and synchronous interaction through email, newsgroups, and conferencing tools (e.g., chat groups) (Curtain, 2002).

In addition to these pedagogical approaches, schools and teachers may also have a broader reach to students and families beyond brick-and-mortar walls or inadvertently create barriers to building relationships. For these reasons, it is crucial that teacher preparation programs are deliberately designed with field experiences and ways to allocate space and time to practice and develop skills to design and deliver instruction employing blended, hybrid, and online approaches. This enables teacher candidates to practice and enhance their abilities to effectively teach in school buildings or from a digital platform in an online context using strategies and approaches that are best for either or both (e.g., online and in-person) learning environments.

Understanding Research Trends

Between 2000 and 2019, the literature concerning the training and development of online teaching skills was limited. Most research during this period focused on studying the

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instructional delivery modality of teacher preparation coursework (e.g., online courses), but this emphasis did not adequately prepare students for teaching in online or hybrid learning environments. A positive shift in online teaching focus began from 2016 to 2020, and this momentum significantly increased during and after the global COVID-19 pandemic.

During this more recent period, there has been a noticeable expansion in scholarship, particularly in relation to teacher candidates' practical application of instructional technology within online or hybrid field experiences (Martin et al., 2023). This notable shift indicates a growing recognition of the importance of addressing the specific skills required for effective online teaching. The literature is still limited as it pertains to teacher preparation programs, however, especially beyond the integration of technology in physical settings versus digital environments.

Thus, the purpose of this review of literature is to better understand how teacher preparation programs equip PK-12 teacher candidates to implement blended, hybrid, or online instructional approaches, including their online experiences around the time of the COVID-19 pandemic. In this review, we examine a selected body of literature to determine how and in what ways, if any, teacher candidates are learning and practicing online instructional approaches. Our intent is not to judge the types of scholarship or research approaches that have been employed through more than 20 years of scholarly contributions to education fields (e.g., education technology, instructional technology, teacher preparation). Alternatively, we seek to identify in what ways the peer-reviewed, scholarly articles describe support for the development of instructional technology teaching strategies and how those strategies may benefit teacher candidates' ability to teach in blended, hybrid, and online learning environments.

To focus our review of the literature, we referred to the following research questions:

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1. In what ways, if any, do teacher candidates experience learning how to teach with instructional technology as part of their teacher preparation programs in the past 20 years?
2. Based on the literature, in what ways, if any, do PK-12 teacher candidates learn to teach in online learning environments?

Methodology

The synthesis and analysis of literature for literature reviews can be complex for both novice and experienced researchers; oftentimes focusing on collecting and organizing literature with no deeper understanding (Matteson & Warren, 2020). Matteson and Warren (2020) proposed a tool to organize and analyze literature to illuminate trends across the studies and critically examine the literature related to a specific topic. We referenced Matteson and Warren's (2020) literature crosswalk framework to guide and organize this extensive literature review by synthesizing trends across multiple studies regarding theories, research methods, findings, and future implications of the researchers' topics of interest.

Search Methods

To identify relevant literature related to teacher candidates' knowledge and application of blended, hybrid, or online instructional strategies, we navigated the following four action steps (adapted by the work of Matteson and Warren [2020]) to create the literature crosswalk.

Step 1: Gathering Articles and Deciding What Aspects of the Topic are Important to Analyze and Synthesize Through the Crosswalk

We systematically searched for peer-reviewed academic research publications from 2003 to 2022 to add to a matrix of all relevant articles identified. We utilized Google Scholar and EBSCOhost to aggregate articles of interest. The aggregated list of articles selected for our

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analysis is provided in Table 1. These articles include topics related to online teacher preparation and preparing teacher candidates to teach in online learning environments.

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Table 1

Summary of Study: Aggregated List of 30 Research Publications Selected for Analysis

Author, Year	Topic	Sample	Findings
Bicen et al., 2014	Blended learning, multimedia design, online learning	62 teacher candidates	A blended learning approach was more effective than the online learning approach in higher education and could be used to overcome the negative effects of e-learning. Teacher candidates studying in a blended approach had more positive perceptions of e-learning than the online group.
Caliskan & Bicen, 2016	Blended learning, online learning	120 volunteer teachers	Using video in Moodle attracts more attention to the content. Teachers reported that Moodle is effective and makes knowledge easily accessible. Teachers reported that they do not experience problems while watching lecture videos.
Carr, 2020	Asynchronous, online discussion boards	77 teacher candidates	Teacher candidates' preference for AODB (asynchronous online discussion boards) platforms include: Flipgrid, Video-response, and Book Snap. Faculty should consider implementing carried formats of AODBs. Effective AODBs are creative, easy, fun, quick, and understanding.
Compton & Davis, 2010	Field experiences, virtual schooling	2 teacher candidates, 1 graduate student, one virtual school educator	Teacher candidates address their preconceptions/misconceptions about virtual school, minimizing their concerns about virtual school. Virtual school field experience helped teacher candidates understand virtual school, key teaching skills/responsibilities, and the role of technology in virtual school.
Cooper et al., 2020	Online teacher preparation, virtual schooling	N/A	Teacher candidates were able to gain knowledge of technology tools and online learning, including basic technology concepts, how to use these tools to teach, and how to build a simple online class. Teacher candidates exited the program using a wider variety of instructional technology integration strategies.
Davis & Roblyer, 2005	Program evaluation, virtual schooling	N/A	There is a need for qualified teachers, counselors, and other support personnel who are prepared to teach at a distance (competence in new medium), and this program hopes to prepare them adequately.
Duhaney, 2012	Blended learning, literature review	N/A	Blended learning can be used to fulfill teacher candidates' field experience requirements while reducing the number of hours in the physical classroom. Information and communications technology (ICT) should be a pivotal part of teacher preparation programs.
Faulk & King, 2014	Online teacher preparation	255 early childhood education teachers	Early childhood teachers had mixed opinions and did not completely agree that online programs would fully prepare teachers. Specific areas (e.g., classroom management, student diversity, special needs issues) were not viewed as positive in online preparation.

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He, 2014	Online learning	24 teacher candidates	Participants reported enhanced confidence and self-efficacy in both learning and teaching online after taking the course. Participants believed that benefits include ongoing opportunities to interact with content, ability to be self-paced, and the opportunities to use various technological tools.
Hursen & Beyoğlu, 2020	Online learning, virtual reality	27 teacher candidates	The virtual reality (VR) geography curriculum had moderate effects on the academic achievement levels of teacher candidates and high influence on affective/cognitive interests for the course.
Juarez & Critchfield, 2021	Field experiences, virtual classroom observations	108 teacher candidates, 2 teacher educators	Teacher candidates perceived benefits from the presence of teacher educators during virtual field experiences in five key areas: guided support, comfortability, new ideas, best practices, and feedback.
Keefe, 2020	Virtual coaching, virtual teaching	Teacher candidates unknown; 1 teacher educator	Teacher candidates had six weeks of virtual practice, which increased their confidence as they developed new digital skills. Also, the teacher educator and teacher candidates' perceptions of improved practice increased.
Kennedy et al., 2013	Virtual field experiences, virtual schools	3 teacher candidates	Preservice teachers recommended that mentors should be required to do a mentor training program, and they should receive compensation to increase their investment. Field placements should not be rushed, as they are recommended to span 16 weeks to allow for proper immersion in the online environment.
Lenkaitis, 2020	Virtual exchange	15 teacher candidates	Virtual exchange programs are valuable for teacher candidates prior to practicum or student teaching experiences. The teacher candidates could bridge theory into practice more effectively using the virtual exchange.
Lenkaitis et al., 2020	Virtual exchange	12 teacher candidates	The utilization of a virtual exchange program is valuable for teacher candidates prior to practicum or student teaching experiences. Through the virtual exchange, the teacher candidates formed a greater recognition of learners' errors and developed their corrective feedback strategies.
Lewis & Jones, 2019	Virtual coaching	36 principal candidates; teacher candidates unknown	Principal candidates reported increased confidence in providing instructional feedback after completing the video capture and annotation technology (VCAT) project and, therefore, increased self-efficacy.
Liu, 2008	Online discussions	39 teacher candidates	Participants found that the online discussion was successful in reducing some aspects of their anxiety towards teaching mathematics (ATTM). This could be the result of increased understanding, engagement in personal reflection, or the healing act of disclosure.
Luo et al., 2017	Online learning, virtual field experiences	141 teacher candidates	Teacher candidates' perceptions of online learning shifted after increased exposure to virtual field experiences. Teacher candidates believed the experiences could be equivalent to traditional learning and reported being more knowledgeable and interested in online learning environments.

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Mollenkopf et al., 2017	Online learning, program evaluation	123 teacher candidates	The online course was as effective as face-to-face, and students could retain information when technology was infused into their lesson plan. Learning outcomes can be equivalent in online and face-to-face settings.
Mullen et al., 2007	Online gaming, virtual field experiences, virtual worlds	N/A	Based on case studies of teacher preparation programs that use gaming and virtual worlds, preservice teachers may find simulation environments as a “safe space” to adopt alternate identities.
Özüdoğru, 2021	Hybrid learning	129 teacher candidates	Instructors should encourage learners (ask questions, personal interaction) to increase their passion for engagement in the course. Higher teacher candidate participation (online and in person) equals higher grades. The more teacher candidates preferred surface learning approaches, the lower their overall achievement.
Saine & West, 2017	Online coaching	36 teacher candidates	Teacher candidates benefitted from virtual writing experiences and their self-efficacy beliefs were influenced by giving/receiving feedback, gaining knowledge and confidence, increasing awareness of their emotions, and increasing insight into student writing.
Sardone & Delvin-Scherer, 2008	Online learning, virtual teaching,	18 teacher candidates	Participants noted that students were more actively engaged with learning and developing technology skills using an application. Participants had differing opinions about the multi-user virtual environment’s purpose/function, and its applicability to educational settings
Sarıtaş, 2015	Virtual reality	29 teacher candidates	Teacher candidates have acknowledged the potential benefits of virtual reality in chemistry teaching, yet their intention does not always mean they will use it. Teacher candidates believe that virtual reality could be used as a means of "facilitating, motivating, and encouraging" the learning of chemistry for students (Sarıtaş, 2015, p. 2754).
Sepulveda-Escobar & Morrison, 2020	Virtual teaching	27 teacher candidates	Challenges outweighed the benefits of this program. Teacher candidates struggled with the lack of interactions with students and the sudden change of setting. However, they adapted to unexpected situations, learned new technological platforms, and designed creative strategies to connect with students.
Stapleton et al., 2017	Virtual coaching	39 principal candidates, 41 teacher candidates	Both candidates felt that the virtual coaching model was mutually beneficial and provided practical experience. Candidates indicated there was increased accountability through virtual coaching. Selecting the appropriate technology to conduct the virtual coaching sessions was vital.
Sunal & Sunal, 2003	Online learning	245 teacher candidates	“The results of this study indicate that web-assisted participation involving an online module with a subsequent face-to-face discussion of each phase of the module has a positive influence on teacher candidates' conceptualization of a model of guided inquiry” (Sunal & Sunal, 2003, p. 262).

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Tambunan et al., 2021	Blended learning	84 participants	Different modalities of learning (e.g., percent face-to-face, percent in-person) are significant in determining learning outcomes. Learning groups should be evaluated ahead of time and formed based on learning style to maximize achievement.
Wake et al., 2017	Virtual coaching	16 teacher candidates	Teacher candidates affirmed that this virtual coaching model is effective, convenient, comfortable, non-evasive, facilitates connection with supervisor, and provides immediate feedback. Teacher candidates reported the negatives of this model include balancing multiple devices and a desire for more feedback.
Williams & Casale, 2015	Online learning	1 teacher candidate	The participants believed their program should have better prepared them in creation/implementation of online-based resources and assessments, developing relationships with online students, and enactment of teacher dispositions in an online environment.

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We used several keywords and phrases to search for relevant articles, which included “teacher preparation,” “online field experiences,” “teacher candidate training,” “teacher preparation programs,” “pre-service teacher training,” “hybrid,” “blended,” “online,” and “teacher candidate perceptions.” These keywords and phrases were used interchangeably to yield the highest number of relevant research articles. We reviewed articles published between January 2003 and May 2022. These search criteria yielded 30 scholarly, peer-reviewed articles (see Table 2). These articles are organized in four five-year time spans to better identify trends in the literature of key strategies throughout these different periods of time. Step 1 of this crosswalk framework, and subsequent steps, do not include our judgments of the level of rigor of methodological approaches used in the selected articles.

Table 2

Key Strategies Identified in 30 Articles from 2003-2022

Key Strategies	<u>2003-2007</u>	<u>2008-2012</u>	<u>2013-2017</u>	<u>2018-2022</u>
	2 Articles	4 Articles	13 Articles	11 Articles
Blended learning	1	2	2	3
Face-to-face instruction comparison		1	1	1
Hybrid learning				1
Online learning teacher preparation	1	2	5	2
Online teacher preparation programs	1		1	1
Teacher candidate perceptions	2	1	3	5
Virtual coaching/mentoring		1	3	3
Virtual/Online exchanges				3
Virtual/Online field experiences		1	3	1
Virtual/Online instruction tools	1	2	5	3
Virtual/Online schooling	1	1	1	3

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Step 2: Creating a Spreadsheet that Includes the Information for Each Category for Each Article or Study

We designed a matrix within Microsoft Excel with elements of each article or study, such as the research participant demographics, research questions, and recommendations for future studies. We also included topic categories covered by each article or study that suggested the type of learning experiences the teacher candidates were engaged in (e.g., virtual coaching and mentoring, virtual exchanges, virtual field experiences) (see Table 1).

Step 3: Updating the Spreadsheet from Time to Time to Ensure the Literature Review Information Remains Current

We read the 30 identified articles and noted elements of each article to fill in the matrix categories. We documented the findings and added new columns as needed for unexpected information for each article.

Step 4: Analyzing and Synthesizing the Information in the Literature Crosswalk

Once we, as a research team, read all the articles and agreed upon elements within the matrix, we began analyzing and synthesizing the information through axial coding (Saldaña, 2009). In the following section, we describe the analysis of the identified literature.

Analysis

Matteson and Warren's (2020) literature crosswalk includes six steps for analyzing information aggregated from the matrix. We aligned our research analysis by following the six steps provided by Matteson and Warren (2020). These steps are further described in the following subsections.

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Step 1: Creating a Second Copy of the File for Analysis

To maintain the integrity and completeness of the initial literature crosswalk, we subsequently created a second copy of the Microsoft Excel spreadsheet to sort, filter, and reorganize information. Both files were shared with the research team.

Step 2: Sorting the Columns of Information

With the sorting capabilities of Microsoft Excel, we could sort the columns and rows of information collected in the literature crosswalk to understand the content and area of focus better. The sorting function allowed us to review data in multiple ways.

Step 3: Looking for Patterns Among the Various Studies

Articles we opted to include in the literature crosswalk were grouped, so articles with matching keywords and phrases were aligned within the matrix. We also reviewed the data to identify trends and patterns regarding topics and types of articles and studies.

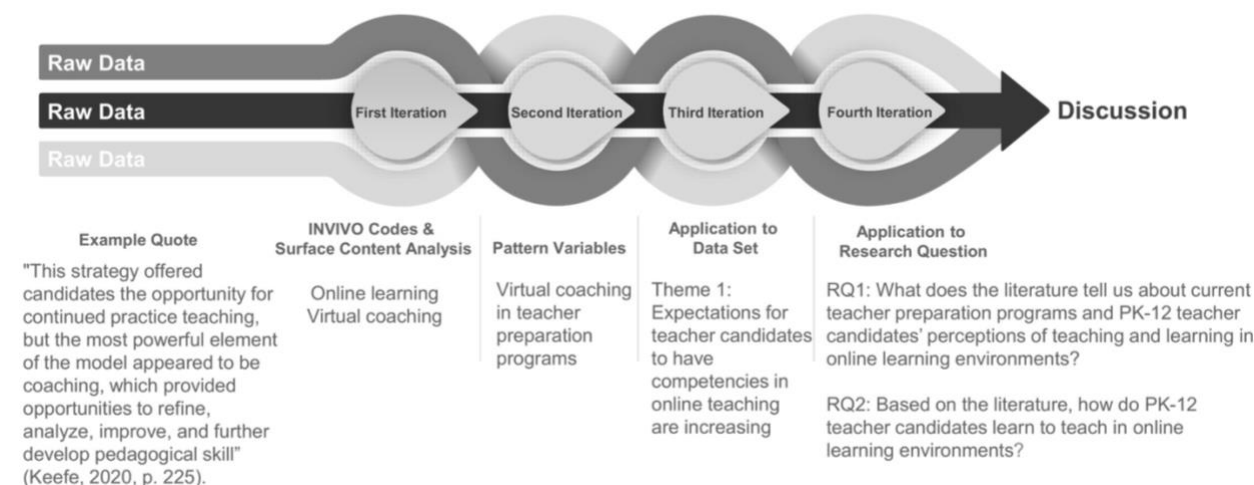
Step 4: Comparing Various Aspects of Studies by Looking at Each Column Individually and then Across the Columns

With key elements of the articles assembled side by side, we used open-ended or initial coding to identify similarities and differences in research questions, timelines, participant demographics, and conclusions from the 30 studies over a 20-year period. For organizational purposes, we adopted Anfara et al.'s (2016) code-mapping processes. Research team members individually reviewed data across columns in the Microsoft Excel spreadsheet. Then, we met as a team to identify emergent themes. We agreed upon five emergent themes. Figure 1 includes an example of the code mapping process.

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Figure 1

Example of Code Mapping Methodology Used by the Researchers



Step 5: Creating a Literature Review from the Crosswalk

We located content within the articles from the five identified emergent themes to build the literature review. We grouped direct quotes from the articles that provided evidence to support the themes within the research questions.

Step 6: Viewing Your Own Research Study with a Critical Eye

We appreciated the structured approach of the literature crosswalk framework constructed by Matteson and Warren (2020). However, our navigation of the crosswalk differed as we opted to support a more open-ended understanding of the literature. Table 3 includes an example of one author's reflections on the research study.

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Table 3

Example of Author's Reflection on the Literature

Author	Author Statement
Stith	<i>"In the last ten years, I have witnessed an explosion of PK-16 instructional technology integration apps, software, learning management systems, certifications, and trainings for in-service educators. This is not a surprising phenomenon considering that we, as educators, teach in a technologically driven society. As a teacher educator and an older millennial, I have been interested in better understanding the pedagogical approaches used in teacher preparation programs regarding adopting technology integration from a historical lens, particularly with events such as COVID-19. In what ways, if any, are we preparing the next generation of teachers to be impactful in creating modules for e-learning days, assessing PK-12 students on their digital literacy in a social studies class, or coordinating an online field trip via Zoom? With this study, we were able to identify trends, but I do not think we will be able to truly grasp what has evolved in the last twenty years. In searching for instances of online learning environments, a notable shortcoming is the ambiguity of verbiage related to online learning, blended learning, hybrid learning, and more. I feel that the lack of consistency in language of instructional technology in online teacher experiences limited our capacity for exhaustive research. Additionally, while I appreciated the crosswalk approach, the number of researchers working on this project complicated the analysis. Therefore, we opted to delineate from Matteson and Warren's (2020) analysis approach, which, we felt, worked well with one or two researchers. Since our study included a larger cohort of researchers, the linear analysis process of Anfara et al., (2016) provided a good fit to organize the raw data and identify emergent themes."</i>

By drawing on the literature crosswalk framework for the methodology of this review, we were able to organize and analyze data spanning 20 years with a focus on how teacher preparation programs may equip teacher candidates to integrate instructional technology in blended, hybrid, and/or online learning environments. Next, we identify and synthesize the trends, relationships, research questions, and key strategies across the body of literature chosen for this review. In the next section, we unpack the five themes that emerged through our analysis.

Findings

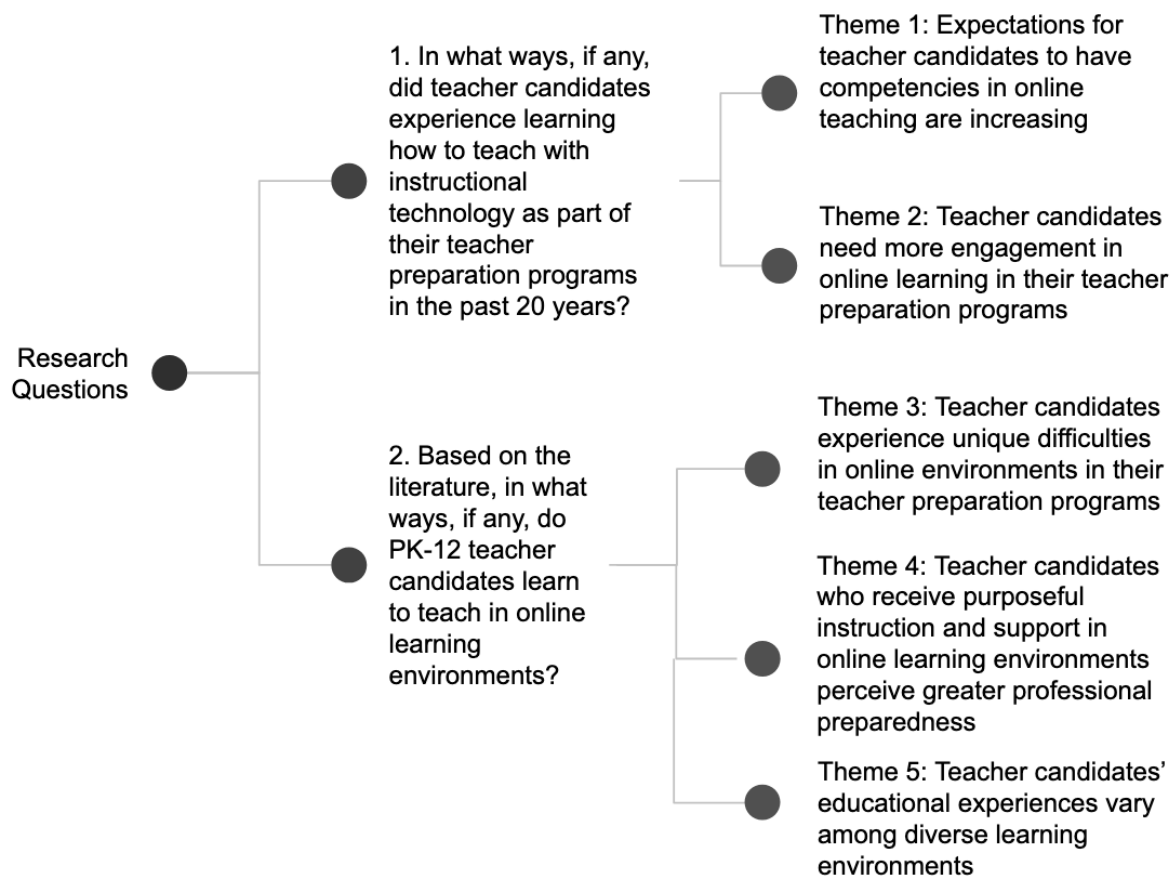
Throughout this literature review, we examined teacher candidates' experiences in learning how to teach with instructional technology as part of their teacher preparation programs, as well as the ways, if any, teacher candidates learn to teach in online learning environments. From our analysis, we identified five themes: 1) Expectations for teacher candidates to have competencies in online teaching are increasing, 2) Teacher candidates need more engagement in online learning in their teacher preparation programs, 3) Teacher candidates experience unique

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difficulties in online environments in their teacher preparation programs, 4) Teacher candidates who receive purposeful instruction and support in online learning environments perceive greater professional preparedness, and 5) Teacher candidates' educational experiences vary among diverse learning environments. The alignment of research questions with the aforementioned themes is included in Figure 2.

Figure 2

Themes tied to Research Questions 1 and 2



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Next, we describe the first two themes to answer research question 1: In what ways, if any, do teacher candidates experience learning how to teach with instructional technology as part of their teacher preparation programs in the past 20 years?

Theme 1: Expectations for teacher candidates to have competencies in online teaching are increasing

While research related to teacher candidate training for teaching in online environments appears limited in our search between 2003 and 2017, there were significantly more studies published between 2018 and 2022. Multiple articles indicated that strong pedagogical knowledge and skills in traditional classroom settings of teacher preparation programs are not necessarily analogous to strong pedagogical knowledge and skills in online classroom settings. Additionally, teacher candidates should have purposeful training to be well-positioned for teaching online as professionals (e.g., Compton & Davis, 2010; Davis & Roblyer, 2005; Lewis & Jones, 2019; Tambunan et al., 2021).

Notably, there are growing expectations for teacher candidates to have knowledge and skills beyond sitting in front of a computer and teaching a lesson. Five years into the twenty-first century, Davis and Roblyer (2005) describe skills for online teaching requires similar skills as teaching in person, but slightly different when teaching from a distance, such as 1) course planning and organization, 2) verbal and nonverbal presentation skills, 3) questioning strategies and 4) coordinating student activities among several sites. Fifteen years later, Lenkaitis et al. (2020) posit that teacher candidates need to be able to communicate, collaborate, recognize student errors, and provide timely, corrective feedback via digital technology. This argument is supported by Cooper et al. (2020),

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With public schools infusing more online course options, teacher candidates need to be equipped to provide online instruction in a variety of learning environments of which they may serve in the future, and more educator preparation programs are committing to educating pre-service teachers about online education (p. 127).

Nevertheless, after 2005 and before 2020, findings revealed that many teacher preparation programs continue to focus on preparing teachers for traditional in-person settings and teacher educators can be passive to adopt recent technologies (Kennedy et al., 2013; Williams & Casale, 2015). The effect of the global COVID-19 pandemic on teacher preparation programs further highlighted the need for highly qualified online instructors, as argued before the pandemic began. According to Keefe (2020), “teacher candidates should be supported to practice virtually during their teacher preparation programs with systems that mirror traditional strategies, such as coaching and cycles of feedback, for developing well-prepared teachers” (p. 226). With more PK-12 students engaged in online learning, teacher candidates should be prepared for impactful online delivery. Lastly, findings suggest teacher educators play critical roles towards promoting online teaching and learning praxes to prepare future professionals for a field where the demand for strong online pedagogical knowledge and skills exists.

Theme 2: Teacher candidates need more engagement in online learning in their teacher preparation programs

Asynchronous online teacher preparation without connection and engagement between teacher candidate and teacher educator may not be enough to prepare future professionals in online environments. Several respondents in a survey on online teacher education had reservations on teacher candidate capacities in navigating classroom management, student diversity, special needs issues, and social aspects when the instruction is entirely online and

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without mentoring in classroom settings (Faulk & King, 2013). Many of the findings, however, note that during their teacher preparation programs, teacher candidates engage in online and blended learning through frameworks of virtual coaching and online field placements (Keefe, 2020; Williams & Casale, 2015).

Many teacher preparation programs implement coaching to facilitate a connection between supervisors and teacher candidates (Keefe, 2020; Stapleton et al., 2017). Finding effective video platforms for virtual coaching is worth the investment of time, as faculty of teacher preparation programs should seek an efficient and reliable online platform (Stapleton et al., 2017). With video platforms, teacher candidates can record their teaching sessions, share videos with their coach, and receive feedback in an asynchronous manner (Stapleton et al., 2017). These coaching strategies should be carried out online to improve teacher candidates' overall preparation and access to feedback (Keefe, 2020). Within the findings (e.g., Stapleton et al., 2017; Wake et al., 2017), teacher candidates reported numerous benefits while engaging in virtual coaching, such as receiving timely feedback. The asynchronous coaching option improved opportunities that were efficient and convenient (Stapleton et al., 2017; Wake et al., 2017).

Wake et al. (2017) developed a virtual coaching model for teacher candidates to use during their internship. The teacher candidates did not find this intervention disruptive, and they appreciated how comfortable and non-evasive it was, provided immediate feedback, and allowed them to connect with their supervisor (Wake et al., 2017). However, teacher candidates also faced challenges balancing multiple devices and desired to receive more feedback from their supervisor (Wake et al., 2017). In a different study, Lenkaitis et al. (2020) allowed teacher candidates to engage in a virtual exchange that helped them to develop their corrective feedback

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strategies. Through a variety of ways for teacher candidates to connect, researchers found that virtual coaching, as a means of online engagement, provides teacher candidates with efficient and meaningful feedback when executed correctly (e.g., Lenkaitis et al., 2020; Stapleton et al., 2017).

Online field experiences may also provide teacher candidates with a greater understanding of online learning environments (Compton & Davis, 2010). According to Williams and Casale (2015),

it is the responsibility of teacher education programs to begin to offer *required* field experiences in K-12 online learning environments . . . such required field experiences would give teacher candidates the opportunity to learn and develop the necessary knowledge, skills, and dispositions to teach them in these schools. (p. 149)

Therefore, teacher preparation programs should strive to incorporate online field experiences into their curriculum (Kennedy et al., 2013; Williams & Casale, 2015), as “teacher certification organizations need to acknowledge and plan certification to allow practica in K-12 online and blended learning programs” (Kennedy et al., 2013, p. 66). In this model, each teacher candidate may be paired with an online field experience supervisor who provides them with support, knowledge, feedback, and insight on the best practices for online teaching (Compton & Davis, 2010; Juarez & Critchfield, 2021).

Teacher candidates who engage in online field placements report many benefits (e.g., feeling more equipped to teach in online environments) (Kennedy et al., 2013; Williams & Casale, 2015). Teacher candidates increase their understanding of online teacher roles and responsibilities while also becoming aware of the importance of communication, self-management, and learning from others (Compton & Davis, 2010; Kennedy et al., 2013). Overall,

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teacher candidates can minimize their concerns about teaching online by addressing their preconceptions through online field placements (Compton & Davis, 2010).

In the following subsection, we describe the themes that answer research question 2:

Based on the literature, in what ways, if any, do PK-12 teacher candidates learn to teach in online learning environments?

Theme 3: Teacher candidates experience unique difficulties in online environments in their teacher preparation programs

Throughout teacher preparation programs, teacher candidates may experience difficulties in online learning environments with online biases and technology issues (Compton & Davis, 2010; Juarez & Critchfield, 2021). Many teacher candidates have previous exposure to online learning environments, which can often cause candidates to develop concerns and biases toward online learning (Compton & Davis, 2010). Some common problems related to online learning environments include the cost of online learning, the ability to motivate students, and the fear that an online approach is only effective for certain courses (Compton & Davis, 2010; Luo et al., 2017).

Within the findings, the most cited concern regarding online learning was a lack of socialization and connection (Compton & Davis, 2010; Luo et al., 2017). According to Luo et al. (2017), “though they now realize how much technology could boost interactivity, almost all participants still believed that the level of interactivity in online classes is not equivalent to what learners experience in a face-to-face classroom” (p. 9). Teacher candidates were worried that online learning reduces teacher-student communication and student-student collaboration opportunities (Compton & Davis, 2010; Luo et al., 2017). Luo et al. (2017) sought to challenge these preconceptions by exposing teacher candidates to virtual field placements. After

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completing the placements, the teacher candidates were surprised by the connection opportunities that could be offered in online education, yet they still believed learners experience more interactivity in face-to-face settings (Luo et al., 2017).

Another obstacle that teacher candidates faced while working in online environments was technology and connection issues (He, 2014; Juarez & Critchfield, 2021). Virtual classes and other interactions can get delayed due to problems with the internet connection and hardware issues (Juarez & Critchfield, 2021). These technical issues are often beyond the control of teacher candidates, which is a source of frustration (He, 2014). While many teacher candidates were initially apprehensive about their personal technology skills, they eventually were more challenged and concerned with “ways to facilitate online learning for students with various technology backgrounds” (He, 2014, p. 293). Teacher candidates feared they would spend more time explaining the technological aspects of the course rather than going over course content (He, 2014).

In addition to findings from He (2014) regarding technology access and support, Hursen and Beyoğlu (2020) shared in a more recent study that “it is recommended to pay particular attention to the internet connection and take necessary precautions when designing environments where technology-supported implementations will be carried out” (p. 88). Teacher candidates need training and support regarding technology implementation, integration, and troubleshooting during instruction. Additionally, teacher candidates need to account for these technological concerns when designing and implementing online courses (Hursen & Beyoğlu, 2020).

Theme 4: Teacher candidates who receive purposeful instruction and support in online learning environments perceive greater professional preparedness

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Teacher candidates who engage in online learning environments during their teacher education programs perceive greater professional preparedness through the development of skills and enhanced knowledge (Compton & Davis, 2010; Lenkaitis, 2020; Luo et al., 2017). While traditionally prepared teachers may lack online teaching experience, candidates who increase their technical skills are prepared for a broader range of school responsibilities (Keefe, 2020). For instance, Keefe (2020) highlighted the “development of candidates’ digital literacy by preparing them to leverage technologies that promoted engaging, accessible, universally designed lessons” (p. 226). This finding was opposed to Sepulveda-Escobar and Morrison (2020), in a study with 27 Chilean teacher candidates, who concluded that lack of interaction and abrupt unplanned changes to completely online training was so problematic that students were left with negative paradigms towards online teaching.

In another study, Lenkaitis (2020) found that teacher candidates who utilized virtual exchanges and reflections were better able to connect theory and practice, which also allowed them to “develop their teaching skills through ‘an interesting way of bringing the book and course material to life’” (Lenkaitis, 2020, p. 8). Teacher candidates’ exposure to online learning environments may promote a greater understanding of online education, online teaching practices, and the role of online educators (Compton & Davis, 2010; Luo et al., 2017). Furthermore, teacher candidates with this knowledge display increased interest in participating in online environments in the future (Luo et al., 2017).

Self-efficacy beliefs of teacher candidates are also enhanced through experiences in online learning environments (He, 2014; Keefe, 2020). Teacher candidates who teach and learn in online environments report increased confidence and the perception of improvement in teaching practices (He, 2014; Keefe, 2020). According to He (2014), “this finding supports the

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need for all teacher candidates to have the opportunity to experience online learning during their teacher education program” (p. 295).

In a separate study, Saine and West (2017) allowed teacher candidates to coach high school writing students through virtual interactions. After six weeks of coaching high school students, these teacher candidates reported increased self-efficacy in teaching online because of their experiences giving feedback, working directly with students, and gaining knowledge of effective online teaching resources (Saine & West, 2017). Therefore, recent studies (e.g., He, 2014; Lenkaitis, 2020) recommend that all teacher candidates experience online learning to improve their teaching skills, knowledge, and confidence in online learning environments.

Theme 5: Teacher candidates’ educational experiences vary among diverse learning environments

Teacher candidates experienced various learning environments throughout their teacher preparation programs. Findings revealed blended learning, hybrid learning, virtual and augmented reality learning, virtual mentoring, online coaching, virtual field experiences, virtual exchanges, and educational technologies as diverse approaches to train teacher candidates to teach online. Teacher candidates experienced these different environments as students in collegiate courses, informal workshops, as well as teaching during their field placements, practicums, or student teaching experiences (Caliskan & Bicen, 2016; Duhaney, 2012; Tambunan et al., 2021). Preparing candidates to be flexible is a common argument and rationale for diversifying educational experiences in different contexts (Özüdoğru, 2021; Saine & West, 2017; Sunal & Sunal, 2003). Furthermore, teacher educators must also model flexibility and the ability to shift between approaches and be able to explain their rationale for changing instructional modes. Tambunan et al. (2021) argue that teacher educators should intentionally

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plan their mode of instruction based on what will yield the desired results. The authors explain that

The composition of online learning and face-to-face learning in blended learning needs to be considered to get maximum results in teaching prospective teachers—likewise, the placement of participants on the type of learning style they have. The combination of learning styles and the right combination of online and face-to-face meetings is quite significant in determining learning outcomes (Tambunan et al., 2021, p. 2027).

Additionally, recent studies (e.g., Caliskan & Bicen, 2016; Mollenkopf et al., 2017) indicate that online learning is an effective approach. Teacher candidates perceived online learning to be as effective as traditional settings and found benefits in having easy access to learning materials (Caliskan & Bicen, 2016; Mollenkopf et al., 2017). According to Mollenkopf et al. (2017), a hands-on instructional technology course “could be effectively offered in the online learning environment and appeared to be as effective as the face-to-face course in helping students retain this information when they infused technology into their lesson plans during student teaching” (p. 8).

Discussion

The selected literature between 2002-2022 argues that teacher preparation programs need to expand their training and teacher development as it relates to teaching in online, hybrid, and blended learning environments. This body of literature aims to identify how to expand teacher training and development as well as understand how the perceptions of PK-12 teacher candidates' knowledge and ability to teach or learn with blended, hybrid, or online instructional approaches influence their preparedness.

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Research Question 1

To answer the first research question (*i.e., In what ways, if any, do teacher candidates experience learning how to teach with instructional technology as part of their teacher preparation programs in the past 20 years?*), we refer to themes related to teacher preparation programs and teacher candidate perceptions. Due to the COVID-19 global pandemic, a sudden shift in the delivery of instruction occurred toward technologically driven and online learning environments (Ellis et al., 2020; Keefe, 2020). The design of teacher preparation programs also shifted as teacher candidates were expected to be prepared and capable of teaching in blended, hybrid, and online learning environments upon graduation, a demand that has been slowly increasing over the past decade (Cooper et al., 2020; Davis & Roblyer, 2005; Kennedy et al., 2013), but not fully appreciated until the global pandemic.

Teacher educators were encouraged to expand their practice to include online, hybrid, and blended learning experiences to address what was a slow pedagogical evolution (Kennedy et al., 2013) before the COVID-19 pandemic to a more rapid shift in demand and culture (Keefe, 2020; Lenkaitis et al., 2020). Designing and facilitating opportunities for online field experiences greatly influences teacher candidates' digital competencies, as they report increased confidence in teaching in online settings, as well as greater understandings of the teacher's role in online learning (Compton & Davis, 2010; Williams & Casale, 2015). Furthermore, some current teacher preparation programs began including virtual coaching between supervisors and teacher candidates to improve overall preparation and increase access to resourceful and meaningful feedback (Lenkaitis et al., 2020; Stapleton et al., 2017; Wake et al., 2017).

Previous experiences in online environments may lead to biases, misconceptions, and concerns for teacher candidates prior to engaging in online learning (Compton & Davis, 2010).

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In a study before the COVID-19 pandemic (e.g., Luo et al., 2017), some teacher candidates believed online education might only be effective for certain courses. Also, teacher candidates' primary concerns were the lack of communication between students and teachers and difficulties in motivating students (Luo et al., 2016). In other studies (e.g., He, 2014; Juarez & Critchfield, 2021), teacher candidates faced technology issues surrounding internet abilities and facilitating learning for students with varying technology capabilities. However, some literature (Keefe, 2020; Luo et al., 2017) indicates that incorporating purposeful online instruction into teacher preparation programs increases professional preparedness and reduces online biases. After engaging in supportive online learning environments, teacher candidates perceive increased confidence, knowledge, digital skills, and self-efficacy in teaching online (He, 2014; Keefe, 2020; Lenkaitis, 2020; Luo et al., 2017).

Research Question 2

We focused on themes related to teacher candidates' learning to answer the second research question (*Based on the literature, in what ways, if any, do PK-12 teacher candidates learn to teach in online learning environments?*). As online learning has become more prevalent, faculty in teacher preparation programs have been encouraged to adjust their pedagogical approaches to meet the new demands for teacher candidates, specifically the need for increased digital competencies (Choate et al., 2021; Sprague et al., 2022; VanLone et al., 2022). According to the literature, one of the most effective methods for learning to teach in online environments is hands-on experiences in these settings (Compton & Davis, 2010; Keefe, 2020; Kennedy et al., 2013; Williams & Casale, 2015).

Therefore, many teacher candidates perceived the blended learning approach to be the most effective for teaching and learning (Duhaney, 2012; Moore & Gilmartin, 2010; Tambunan

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et al., 2021). According to Duhaney (2012), “teacher preparation programs help teacher candidates learn how to tap into their students’ interests and familiarity with a range of information communication technology (ICT)” (p. 201). The optimal combination between online and face-to-face learning environments plays a significant role in ensuring the best learning outcomes for teacher candidates and their PK-12 students (Tambunan et al., 2021). Using blended learning, teacher candidates felt that learners had an opportunity to increase their engagement with content, achieve deep learning, reflect on discussions, and participate in various in-class activities (Duhaney, 2012; Moore & Gilmartin, 2010; Özüdoğru, 2021). Furthermore, technology resources allowed teacher candidates to tap into student interests, which increased their involvement in the course content (Duhaney, 2012).

By engaging in virtual field experiences, teacher candidates have opportunities to increase their understanding of teachers' roles, skills, and dispositions in online teaching settings (Compton & Davis, 2010; Keefe, 2020; Williams & Casale, 2015). Furthermore, they gain awareness of effective technology resources, which may cultivate engaging learning environments for students (Compton & Davis, 2010; Duhaney, 2012; Keefe, 2020). Kennedy et al. (2013) mention that field placements in virtual settings “fosters preservice teachers’ awareness of the power of communication with and learning from others...the diversity in learning opportunities...and the importance of self-management to maximize the benefits of their developmental learning experiences” (p. 62). Overall, field experiences can be a useful learning tool to promote teacher candidates' self-confidence to teach online (Keefe, 2020; Saine & West, 2017).

Faculty in teacher preparation programs have also found other strategies that support teacher candidates' development in virtual learning environments. By incorporating collegiate

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courses that focus on online learning, teacher candidates can gain knowledge on appropriate instructional strategies, online communication skills, and collaboration opportunities (Kim, 2020). Many of these courses include blended learning, which provides teacher candidates with further opportunities to engage their PK-12 students in virtual and physical classroom environments (Duhaney, 2012).

Current online educators provide many benefits and resources to teacher candidates (Juarez & Critchfield, 2021; Lenkaitis, 2020). For example, Juarez & Critchfield (2021) noted that “teacher candidates perceived to learn best pedagogical practices by observing the classroom teacher, then receiving confirmation of those practices or new ideas” (p. 240). Virtual coaching and mentoring are crucial learning tools for teaching candidates, as they can receive feedback and bridge theory into practice (Lenkaitis, 2020; Lenkaitis et al., 2020). Current studies (e.g., Sprague et al., 2022; VanLone et al., 2022) suggest that these strategies continue to be developed in order to best prepare teacher candidates to enter the field of online education.

To further understand how the scholarship describes teacher preparation programs and how teacher preparation programs can be designed to engage teacher candidates in online teaching experiences, we found that teacher candidates’ educational experiences (e.g., collegiate courses, field experiences) vary among diverse learning environments. With a rise in interest and research since 2017 (see Table 2), scholars identify and investigate topics of blended or online (synchronous or asynchronous) modes for engaging teacher candidates in opportunities to teach using various digital pedagogical strategies. In the following sections, we discuss the implications for theory and practice, limitations, recommendations for future research, and the conclusion of this literature review.

Implications for Theory and Practice

This literature review adds information to the limited scholarship related to preparing PK-12 teacher candidates to teach in online learning environments. Although the literature findings were relevant before the COVID-19 pandemic, they are now more widely acknowledged in the education community. The number of school closures due to the pandemic shifted teachers to using online learning platforms, and many PK-12 teachers had little to no experience teaching online at that time (Keefe, 2020). As a result, teacher candidates are now expected to increase their digital competencies, such as their ability to teach, manage, and carry out professional tasks in digitally infused-learning environments (Starkey, 2020).

Teacher candidates' self-efficacy in online learning platforms is increasingly valuable in today's educational landscape (Kim, 2020; VanLone et al., 2022). Research on this topic may provide insights into designing field experiences and training to teach in online learning environments to better prepare teacher candidates for various instructional opportunities. Although teacher candidates confronted many challenges in teaching throughout the height of the COVID-19 pandemic, they also gained valuable knowledge in their attempts to provide rich learning experiences through online formats (Jin, 2022). Teacher candidates should adapt their teaching strategies to their PK-12 students' needs in a new context to further display their pedagogical resilience in the face of challenges (Jin, 2022).

As online learning environments continue to grow, teacher preparation programs should also evolve. In the following subsections, we describe online instructional approaches that emerged from this literature review as highly impactful to support teacher candidates in online teaching and learning.

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Virtual Mentorships

Many mentorship programs have shifted to taking place online, where mentor-mentee relationships are connected through video conferences or digital communication tools. Virtual mentorships alleviate geographical constraints, scheduling constraints, or even connection constraints. For example, Carpenter and Morrison (2018) highlighted how pre-service teachers accessed Twitter to connect with professionals and follow the documented examples of bridging theory and practice. The Modern Classrooms Project (n.d.) matches mentors with mentees based on grade level experience and subject area specialties through the organization's online training program. Mentors provide feedback on mentee assignment submissions and offer expertise to navigate possible challenges of designing blended learning experiences (Johns Hopkins University, 2020). Virtual mentoring allows candidates to refine and retry instructional strategies to improve observation, deliver instruction, reflect, and provide feedback in online environments (Keefe, 2020).

Teacher preparation programs have established mentoring as a strategy for both teacher candidates and practicing teachers. Before the COVID-19 global pandemic, virtual mentorship programs were emerging to address limitations with time and space to cultivate mentor-mentee relationships (Greenberg et al., 2016). Most virtual mentor programs, however, focused on improving teacher well-being, limiting stress during the transition from higher education to careers, and reducing attrition in the initial stages of educators' careers (Briscoe, 2019).

Virtual Field Experiences

Field experiences provide a systematic, planned sequence of engagement with PK-12 students, educators, and school communities. Virtual field experiences occur in online spaces where teacher candidates are observed and practice online instruction to develop their teaching

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practices and classroom management skills, assess outcomes, use resources, and collaborate with others (Compton & Davis, 2010). In 2012, it was reported that only 1.3% of responding teacher preparation programs in the United States offered field experiences for online teaching in virtual schools (Kennedy & Archambault, 2012). While there is limited scholarship on virtual field experiences involving teacher candidates, available research indicates that cultivating positive learning experiences for students can be achieved through strategies such as personalized teaching activities, video interaction, and the opportunity for one-on-one meetings with PK-12 students (Gutierrez et al., 2020). Additionally, future research may include a review and analysis of current teacher preparation curricula and the integration of online teaching methodologies for teacher candidates. Reviews of course syllabi, instructional materials and resources, and pedagogical approaches to prepare teacher candidates to deliver effective online and virtual instruction may be beneficial in this analysis.

Virtual Exchanges

Virtual exchanges, also referred to as telecollaboration or collaborative online international learning (COIL), introduce cross-cultural experiences for students. Dooly (2020) refers to virtual exchanges as “. . . students in digitally supported collaborative learning processes with transnational partners from different geopolitical and sociocultural contexts through a series of sequences activities (in or outside class), usually under the guidance of teachers or trained facilitators” (p. 102). A common approach through virtual exchanges is (a) developing an international partnership among teacher trainers from two or more different countries to develop a “joint curriculum”; (b) students from different classes collaborate in a virtual environment to engage in activities, discuss issues, and create new materials; (c) trainers guide students in online engagements and experiences; and (d) students receive academic credit

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for submitting cumulative assignments with international partners (e.g., essays, portfolios, presentations) (Baroni et al., 2019). Teacher candidates should expand their knowledge and skills by increasing engagement in virtual field placements, which may provide an online context not previously prioritized in teacher preparation programs (Choate et al., 2021; VanLone et al., 2022).

Virtual Trainings, Microcredentials, and Certifications

Teacher candidates and educators of teacher candidates also have opportunities to engage in virtual trainings for professional learning that may lead to the achievement of microcredentials and professional certifications related to online, blended, and hybrid teaching and learning techniques. For example, we developed and implemented a series of virtual training opportunities with microcredentials for in-service teachers, teacher candidates, and teacher educators to learn, explore, and utilize educational frameworks and digital tools to enhance social-emotional learning in online environments (o-SEL) and educational structures for PK-12 students (Geesa et al., 2021; Geesa et al., 2022; Shively & Geesa, 2023). Additional training and microcredential opportunities were provided to support professional learning related to teaching science, technology, engineering, and mathematics (STEM) and literacy in online environments (i.e., o-STEM and o-literacy).

Another example of virtual training is a Project Lead The Way (PLTW) certification, where a Midwest university's teacher preparation program created a blended learning environment for elementary teacher candidates to receive a PLTW Launch Certification. In this training workshop, which includes how to teach in an online environment, teacher candidates navigate approximately 10 hours of online content with readings, tutorial videos, case study videos, and discussion boards. Additionally, teacher candidates also come to campus and engage

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in another two hours of hands-on learning with equipment (e.g., iPads and 3D printers) to build a skill set with the new knowledge learned online.

Furthermore, teacher candidates may benefit from online collaborations with schools, families, caregivers, co-workers, and school administrators (Kim, 2020). By providing online learning opportunities to teacher candidates in their teacher preparation programs, their digital skills can become more enriched (Keefe, 2020; Lenkaitis, 2020). These skills may allow teacher candidates to be more effective in the field, as they have experience teaching online.

Limitations

This literature review is confined to analyzing teacher candidates enrolled in teacher preparation programs instead of in-service educators receiving professional development in online, blended, and hybrid environments. A notable limitation we identify in this study is the ambiguity and confusion of online-related key terms and their operational definitions within teacher preparation programming and the education field at large. Singh and Thurman (2019), in a literature review of online learning between 1988 and 2018, collected 46 definitions from 37 resources and assert that

the significance of this work lies in highlighting the overuse of the umbrella term online learning to discuss online education. Online learning and online teaching are sub-sets of online education but the term online learning is used excessively to include many different concepts. (Singh & Thurman, 2019, p. 301)

Another limitation is the literature collection timeline, as additional studies and online tools emerged shortly after our selected article window of January 2003 to May 2022 (e.g., the public launch of ChatGPT occurred in November 2022). Much of the newer research presents exciting contributions to online learning as educators continue to explore pedagogical

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opportunities and other online tools; we appreciate that the emerging opportunities signify a high degree of continuous innovation in this field.

Also, the lack of analysis of the methodologies within the identified literature is a limitation of this study. We sought to identify literature that emerged with the keywords used to answer the research questions. While an analysis of the methodologies may be insightful in the future, this was not the focus of this study.

Recommendations for Further Research

Additional research should be conducted as more faculty in teacher preparation programs encourage and support online teaching experiences for teacher candidates. We encourage teacher educators to contribute to scholarly literature in ways that purposefully integrate teaching and learning online and examine the potential impacts of diverse pedagogical approaches in online environments. With a greater understanding of what practices lead to positive teacher candidate engagement and career readiness across multiple programs, all teacher preparation programs may be informed of appropriate measures to prepare teachers for online environments. Further research of relevant factors (e.g., dedicated time, professional standards addressed, accessibility to technologies, and virtual engagement in PK-12 students) should also be explored. Lastly, we encourage and call for longitudinal studies to capture the outcomes from programs that have ten or more years of training teacher candidates in online environments via their alumni who are currently teaching and their PK-12 students.

Conclusion

Historically, teacher preparation scholarship has incorporated blended, hybrid, and additional online instructional training strategies with teacher candidates with varying levels of impact on educator competencies (Keefe, 2020; Tambunan et al., 2021). However, more

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engagement in teaching online is needed in teacher preparation programs. When reflecting upon the reliance on online learning in schools and districts during the COVID-19 pandemic, teacher preparation programs should consider ways to continue to purposefully infuse online teaching and learning across programs of study, so all teacher candidates are well-positioned to be successful educators in online learning environments. Not only will educators be able to incorporate technology in their lessons and classroom culture, but they can also consider rigorous quality assurance methods to best inform instructional technology adoption. Appropriate teaching and learning resources, including emerging online pedagogical approaches, should be available to deliver instruction. Delivery approaches may continue to be blended, hybrid, or online models that extend beyond what is currently available and can support all educators in improving their practices in teaching, learning, and leading schools.

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