



The impact of COVID-19 on the delivery of preservice teacher education: a scoping review

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Abstract

The COVID-19 pandemic and the ensuing lockdowns have transformed the mode of delivering preservice teacher education from face-to-face to online, causing unexpected challenges and difficulties. This scoping review aims to synthesize the empirical evidence to explore the reported effects of COVID-19 on preservice early-childhood teacher education programs. The search identified 17 studies in international peer-reviewed journals between February 2020 and February 2022. Four themes of concern emerged: program preparation, program delivery, teaching practicum, and psychological well-being. This study also identified literature gaps in online preservice teacher education and highlighted the need to conduct cross-country comparisons with large sample sizes.

Keywords COVID-19 · Preservice teacher education · Early childhood education · Online education · Psychological well-being

The COVID-19 pandemic forced schools and higher-education institutions worldwide to implement lockdowns and move from face-to-face to online mode of delivery (Watermeyer et al., 2021). By April 15, 2020, about 1.5 billion students in 195 countries, from preschool to higher education, have been affected by repeated lockdowns (UNESCO, 2020). Although the number of confirmed cases has since dropped in many countries because of increased vaccination rates and improved medical treatment, an estimated 1.3 billion learners in 186 countries have remained unable to access face-to-face education in 2020 (UNESCO, 2020). Nevertheless, the closure of schools, colleges, and universities did not lead to a cessation of teaching and learning because of the implementation of contingency plans to continue them online via the digital interface (Bashir et al., 2021; Rapanta et al., 2020). However, such a paradigm shift has emerged as a particular challenge to preservice teacher education programs, which require classroom observation, field-based coursework, and face-to-face practicum (Timmons et al., 2021; Yamamura

& Tsustsui, 2021). Thus, it would be crucial to conduct a synthesis or at least a scoping review to understand what has been explored and reported about the impact of COVID-19. This scoping review aims to examine a focused scope of research resources during the period February 2020–February 2022 to provide synthesized evidence of such an impact.

Preservice early-childhood teacher education during the COVID-19 pandemic

Preservice early childhood teachers develop their qualifications and professional abilities to meet the considerable demands of the teaching profession through both coursework learning and practicum training in face-to-face settings. However, from 2020 to the present, both coursework and practicum needed to transform from face-to-face to online learning because of the pandemic lockdowns. Although no longer a novel concept in education, synchronous, face-to-face online education remains challenging for the delivery of preservice teacher education for teaching in early-childhood education settings, among other fields. Preservice teacher education courses are largely based on face-to-face interactions between teachers and young children, which requires the integration of teaching into real classrooms. According to

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a cross-country survey of more than 3,500 teacher participants in schools across Australia and New Zealand in April 2020, 38% of Australian and 42% of New Zealand teachers and other educators were likely to be less confident in meeting students' learning needs as a result of the switch to online teaching and learning (Flack et al., 2020).

Moreover, practicums have been designed as field-work-based training. Therefore, preservice teachers who cannot instruct children in classrooms because of the COVID-19 lockdowns will be deprived of opportunities to fulfill their practicum requirements and the experience of interacting with young children, which develops their integrative skills, or to observe interactions between an experienced teacher and young children, which provide examples of managed learning. There are, therefore, some concerns about the quality of online education for preservice teachers and the challenges they face in fostering social learning and engagement in the early-childhood education setting. Furthermore, online education presents additional difficulties for preservice teachers because they are still in the process of learning and training to teach.

Only a few studies have discussed the dilemma of online education for preservice teacher education in early-childhood education (Kim, 2020; Kinkead-Clark, 2021; Mohebi & Meda, 2021). Most have focused on the issue in relation to elementary and junior secondary levels, where K–12 students show more self-control and are more aware of the need to follow preservice teachers' online instructions than children in early-childhood education (Cirillo et al., 2020; Clark & Newberry, 2019; König et al., 2020; Miller & Flint-Stipp, 2019). This scoping review aims to highlight and complement this research gap by presenting an overview of the literature on preservice education delivery for early-childhood education in the age of COVID-19.

The Present Study

This study was a broad survey of existing sources to identify research evidence that could explain how preservice teacher education is delivered during the COVID-19 pandemic for student-teachers aiming to teach in early-childhood education settings as this was an area that seems inadequately researched. Therefore, this scoping review was conducted with two purposes: First, it thematically categorizes and summarizes themes associated with the influences of COVID-19 on preservice early-childhood teacher education programs. Second, this research seeks to reveal research gaps in the preparation, delivery, and practicum of preservice teacher education and the psychological well-being of preservice teachers in the early-childhood education field during the COVID-19 pandemic. Furthermore, this review hopes to offer teacher-educators and preservice teachers (student-teachers) new insights into online education for early-childhood education settings and suggest future directions for integrating technology into the coursework and practicum of preservice teacher education programs. This study also considers preservice teachers' psychological well-being where material could be found.

Method

The scoping review process was underpinned by the five-stage framework of Arksey and O'Malley (2005) as described in Table 1: (1) identifying the initial research questions, (2) extracting relevant studies, (3) studying the selection, (4) charting the data, and (5) collating, summarizing, and reporting the results (see Table 1). This five-stage framework ensures research transparency because it allows other researchers to replicate the literature search strategies, which can therefore guarantee the reliability of research results. Arksey and O'Malley (2005) proposed an

Table 1 Arksey and O'Malley's (2005) five-stage framework

Stage	Description
1. Identifying the research questions	Circling a range of questions to be answered and identifying the essential part of the research questions. This process provides the roadmap for subsequent stages
2. Identifying relevant studies	Identifying the "search term," "the period," "the databases," and "search strategies" to explore the relevant journal articles
3. Selecting the studies	Listing the inclusion and exclusion criteria for the study selection. The detailed selection process should be provided in the PRISMA diagram
4. Charting the data	Extracting data from each study via narrative review or descriptive-analyze to meet the research aim
5. Collating, summarizing, and reporting the results	Categorizing and summarizing the result thematically
6. Consultation (optional)	Conducting consumer and stakeholder consultations to suggest additional references and provide insights beyond those in the literature

optional sixth phase, a “consultation exercise,” which was not undertaken because the purpose of that exercise was to provide consumers and stakeholders the opportunity to suggest additional references and offer insights beyond those found in the literature (Levac et al., 2010). Therefore, it was not considered necessary for this scholarly literature review although future research may include it.

Identifying the research question

The scoping review focuses on early-childhood preservice teacher education programs that have been affected by the COVID-19 pandemic. To ensure that a substantial body of literature relevant to this topic is captured, two preliminary research questions were developed to guide the search:

1. What has been the impact of COVID-19 on the delivery of preservice teacher education in early-childhood education settings?
2. What are the literature gaps on this topic?

Identifying relevant studies

The identification of relevant studies followed three search strategies: a database search, a manual journal search, and a manual reference search (Table 2). The aim was to thoroughly identify all empirical research articles that discuss “COVID-19 and preservice early-childhood teacher education” published between February 2020 (just before the World Health Organization declared COVID-19 as a pandemic) and February 2022.

Electronic resources were searched and identified from three databases: ProQuest, Scopus, and Google Scholar. The authors searched and extracted relevant literature from these databases using three different term sets and two Boolean operators (and/or): set 1 included “COVID-19” or “SARS-COV-2” or “the COVID-19 pandemic,” set 2 included “preservice teacher” or “teacher-preparation” or “teacher-training” or “trainee teachers” or “student-teachers” or “prospective preschool teachers,” and set 3 included “early childhood” or “preschool” or “pre-k-2” or “kindergarten.” These searches generated 36 scholarly journal articles from

Google Scholar, 93 from ProQuest, and 40 from Scopus, for a total of 169 candidate studies. The first author then performed a manual search of prominent early-childhood education journals using “early years” or “early childhood” or “young child” in *SCimago*. Afterward, the first author manually screened peer-reviewed empirical articles published between 2020 and 2022 in 20 selected journals via the *SCimago* search and identified eight journal articles that met the criteria. Finally, a manual reference search yielded one related journal article. A total of 178 potential articles were identified: 169 from the three databases, eight from the manual journal search, and one from the manual reference investigation. After removing 37 duplicate items, 141 articles remained after this search stage (Fig. 1).

Selecting studies

Next, the authors reviewed the 141 identified articles using several inclusion criteria (Table 3):

1. The articles were based on empirical research.
2. The articles were peer-reviewed.
3. The articles were written in English.
4. The published journal articles focused on COVID-19 and the delivery of preservice teacher education in early-childhood settings.
5. The articles were published between February 2020 and February 2022.

Two reasons explain why this scoping review only explored and analyzed English journal articles (the third criterion). First, English is the academic language widely adopted by global scholars, and most research works are preferably published in English. Second, while choosing two or three non-English languages is not inclusive, it is also not economically efficient for the authors to choose all of them. This is one of the limitations of this study.

After the first and third authors screened the 141 papers and excluded 111 after title and abstract screening, 30 articles remained. The two screeners agreed on 135 of 141 articles after paper screening and disagreed on the other six.

Table 2 Literature search strategy

Search period	February 2020–February 2022
Search strategies	1 Database strategy (Google Scholar, ProQuest, Scopus) 2 Manually prominent early-childhood education journal search 3 Manually reference search
Search terms	(COVID-19 or SARS-COV-2 or 2019 coronavirus disease or the COVID-19 virus) and (preservice teacher or teacher-preparation or teacher-training or trainee teachers or student-teachers or prospective preschool teachers) and (early-childhood or preschool or pre-K-2 or kindergarten)

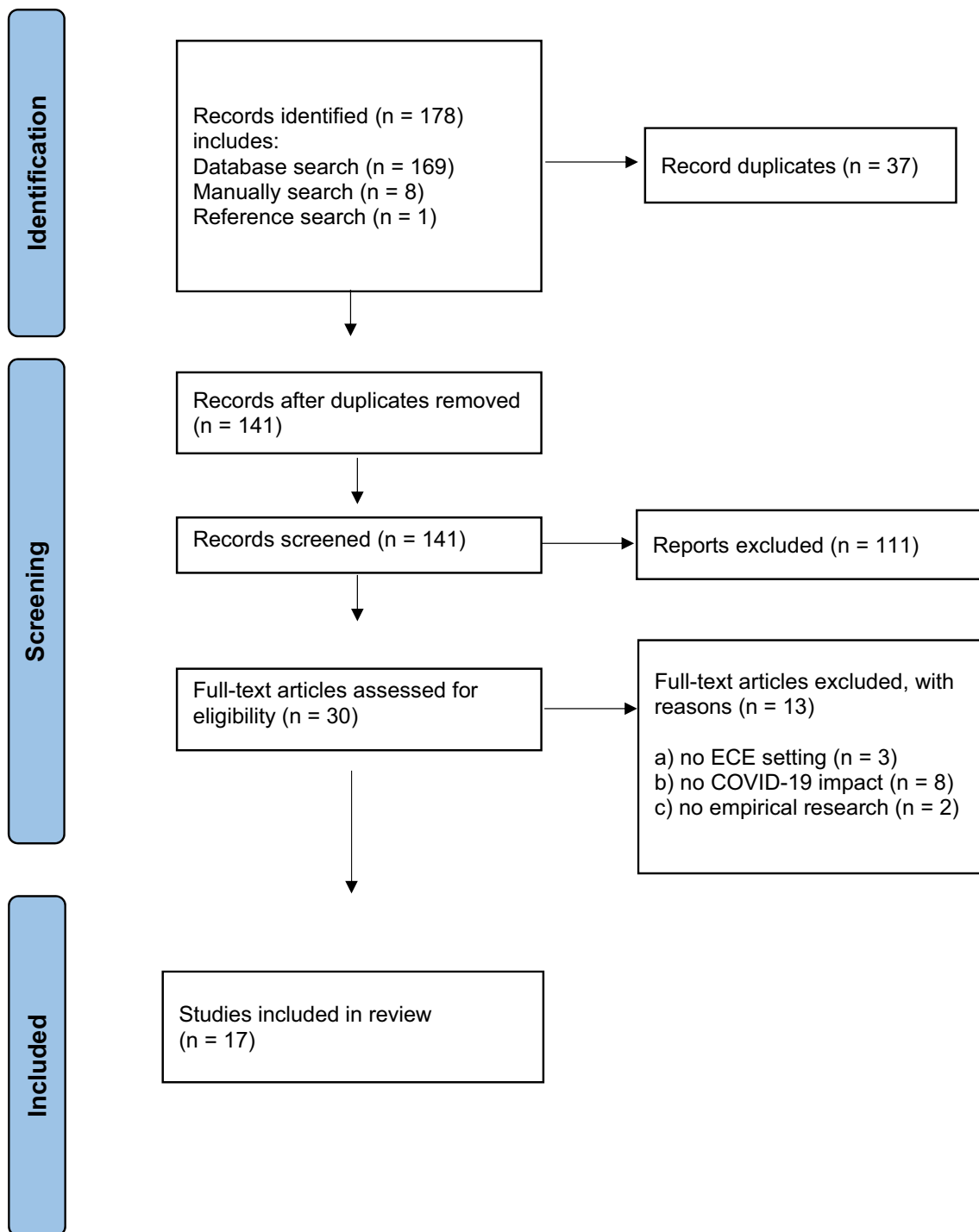


Fig. 1 PRISMA flow diagram of literature search and data charting

Therefore, the reliability of this paper screening was 95.74% (135/141) with Cohen's kappa $k=0.83$, which corresponds to a near-perfect agreement on the screening result.

After this step, the remaining 30 articles were evaluated for eligibility. The three authors independently

screened the full text and resolved disagreements via Zoom meetings. As a result, 17 articles were finalized for review. The PRISMA flow diagram in Fig. 1 details the entire selection process of relevant studies.

Table 3 Inclusion/exclusion criteria

Criterion	Inclusion	Exclusion
Research scope	Empirical studies	Not empirical studies
Document type	Peer-reviewed scholarly journal articles	Not peer-reviewed scholarly journal articles
Language	English	Languages other than English
Educational level	Early-childhood education	Not focused on early-childhood education
Period	February 2020–February 2022	Prior to 2020 and after 2022
Research topic	COVID-19 and the delivery of preservice teacher education at early-childhood education settings	Articles that did not focus on COVID-19 and the delivery of preservice teacher education at early-childhood education settings

Charting the data

Data charting was divided into two processes. First, the demographic and methodological characteristics of the 17 selected articles were summarized. Specifically, the following information were collected: author(s), title, journal, country, participant sample, school settings, research design, and data collection method(s). Second, the themes of the chosen articles on the delivery of preservice early-childhood teacher education during the pandemic were analyzed and summarized. The first author initially extracted the listed information and passed it on to the two other authors. They then held regular Zoom discussions to share their opinions on the data extraction, resolve any conflicts, and agree on the results. Table 4 provides details of the finalized studies.

Collating, summarizing, and reporting the results

An analytic framework or thematic construction is essential for mapping the strategies and themes found in studies identified for scoping review (Arksey & O'Malley, 2005). The thematic analysis identified four themes of concern in the 17 articles in this scoping study: (1) the preparation of preservice teacher education, (2) the delivery of preservice teacher education, (3) the practicum for preservice teacher education, and (4) the psychological well-being of preservice teachers. Most of the articles reported on only one of these topics, but a few of them covered two topics in the same article; in the latter case, only the main point was extracted from the articles and categorized as their theme. Any conflicts over theme classification were resolved through a group discussion and agreement among the authors of this review. Table 5 lists the detailed themes or topics.

Results

Demographic and methodological summary of the included studies

This section discusses the specific research methods, countries of origin, sample sizes, categorized themes, and school settings found in the selected articles. Regarding research methods, 58.82% of the sample ($n = 10$) were qualitative studies, 23.53% ($n = 4$) were quantitative analyses, while 17.65% ($n = 3$) were mixed-method studies (Fig. 2). Of the qualitative articles ($n = 10$), 50% ($n = 5$) were case studies, 30% ($n = 3$) involved phenomenological approaches, and 20% ($n = 2$) performed narrative research. To collect data, this qualitative research used (1) open-ended questions, (2) observations (Zoom), (3) reflective papers/class notes/journals/field notes/narratives, (4) documents/e-books, (5) interviews (via Zoom), (6) reviews of online lessons, (7) written responses (via course assessments, course assignments, and online views on WhatsApp), and (8) audio and video recordings of teaching. These data were summarized using thematic analysis, content analysis, and discourse analysis.

Among the quantitative research articles ($n = 4$), 50% ($n = 2$) performed correlational research, 25% ($n = 1$) conducted descriptive research, and the remaining 25% ($n = 1$) adopted a quasi-experimental approach. Surveys were used to gather quantitative data, which were analyzed via numeric assessment and descriptive reflection. Meanwhile, among the mixed-method studies ($n = 3$), 66.67% ($n = 2$) were a mix of descriptive quantitative analysis and phenomenological qualitative research, while the remaining 33.33% ($n = 1$) combined quasi-experimental quantitative research and qualitative case studies. Descriptive statistical analysis was

Table 4 Included articles: demographics and methodological characteristics

Author/s	Country	Sample Size	School Setting	Research Design	Data Collection Method/s
1 Gozum, A. I. C., & Demir, Ö. (2021)	Turkey	280	Preschool	Quantitative: quasi-experimental research	Survey
2 Ogbonnaya, U. I., Awoniyi, F. C., & Matabane, M. E (2020)	Ghana	147	K–12 including early childhood	Mixed method	1) Survey 2) Open-ended question
3 Pourdavood, R. G., & Song, X. (2021)	USA	48	1) 32 participants in the early-childhood program 2) 16 participants in the special-education program	Qualitative: phenomenological research	1) Zoom observation 2) Participants' verbal responses 3) Participants' written responses 4) Participants' reflective paper 5) Researchers' field notes
4 Lo, W. Y. (2021)	South Korea	45	Early-childhood education	Qualitative: phenomenological research	Reflective writing task from an online course
5 Mphahlele, R., & Jikpamu, B. T. (2021)	South Africa; Canada	2	Early-childhood education	Qualitative: narrative research	Authors' reflective journals
6 Loose, C. C., & Ryan, M. G (2020)	USA	2	K–12 including early childhood	Qualitative: narrative research	1) Reflective narratives 2) Online lesson review 3) Reflective journal 4) Documentation of class sessions 5) Reflective virtual meeting 6) Written reflective interview
7 Scull, J., Phillips, M., Sharma, U., & Garnier, K (2020)	Australia	4	K–12 including early childhood	Qualitative: case study research	Semi-structured Zoom interview
8 Yilmaz, A. (2021)	Turkey	144	1) Early-childhood education: 48 2) Classroom education: 48 3) Science education: 48	Mixed methods	Survey
9 Galindo-Domínguez, H., & Bezanilla, M. J. (2021)	Spain	200	1) 46 early-childhood education students 2) 154 primary education students	Quantitative: descriptive research	Survey
10 Callaway-Cole, L., & Kimble, A. (2021)	USA	26	Early-childhood education	Mixed methods	1) Course assignments 2) Reflections 3) Instructor- and self-assessments
11 Mohebi, L., & Meda, L Trainee (2021)	United Arab Emirates	17	Early childhood	Qualitative: case study research	1) Observation notes 2) Open-ended questionnaire
12 Fuertes, M. T., Dul-sat, C., & Canovas, I. A. (2021)	Spain	107	K–12 including early childhood	Quantitative: correlational research	Survey
13 Kinkead-Clark, Z. (2021)	Belize and Jamaica	5	Early-childhood education	Qualitative: case study research	Unstructured Zoom interviews
14 Moyo, N. (2020)	Zimbabwe	Not provided	K–12 including early childhood	Qualitative: phenomenological research	Online views on WhatsApp

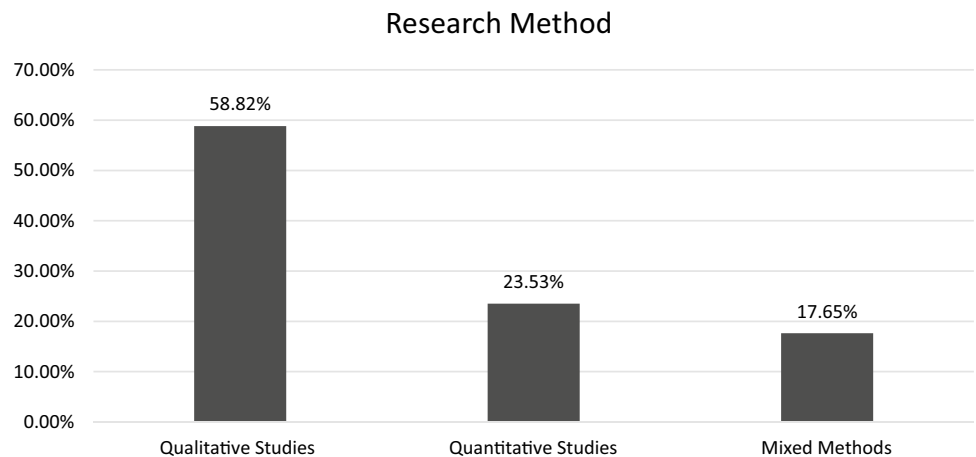
Table 4 (continued)

Author/s	Country	Sample Size	School Setting	Research Design	Data Collection Method/s
15 Kim, J. (2020)	USA	Not specified	Early-childhood education	Qualitative: case study research	Reflective notes
16 Jin, M. (2022)	USA	3	Early childhood	Qualitative: case study research	1) family interview reflection papers 2) lesson reflection papers 3) video records of teaching 4) e-books 5) teaching movies
17 Kong, S. H., & Wong, W. K. (2021)	Hong Kong, China	198	Kindergarten	Quantitative: correlational research	Survey

Table 5 Categorizing themes

Theme	Article count	Articles
Preparation for online learning and teaching	3	1) Gozum, A. I. C., & Demir, Ö. (2021) 2) Ogbonnaya, U. I., Awoniyi, F. C., & Matabane, M. E. (2020) 3) Pourdavood, R. G., & Song, X. (2021)
Delivery of preservice education	7	1) Lo, W. Y. (2021) 2) Mphahlele, R., & Jikpamu, B. T. (2021) 3) Loose, C. C., & Ryan, M. G. (2020) 4) Scull, J., Phillips, M., Sharma, U., & Garnier, K. (2020) 5) Yilmaz, A. (2021) 6) Galindo-Domínguez, H., & Bezanilla, M. J. (2021) 7) Fuertes, M. T., Dulsat, C., & Canovas, I. A. (2021)
Online practicum	6	1) Kinkead-Clark, Z. (2021) 2) Moyo, N. (2020) 3) Kim, J. (2020) 4) Jin, M. (2022) 5) Callaway-Cole & L., Kimble (2021) 6) Mohebi, L., & Meda, L. (2021)
Psychological well-being of preservice teachers	1	1) Kong, S. H., & Wong, W. K. (2021)

Fig. 2 Research methods



conducted for the quantitative data, while thematic analysis was used for the qualitative data.

With regard to country of origin, most of the studies ($n=5$) were from the United States, while the remaining articles were from Spain ($n=2$), Turkey ($n=2$), Australia ($n=1$), China (Hong Kong) ($n=1$), South Korea ($n=1$), Canada ($n=1$), South Africa ($n=1$), Ghana ($n=1$), the United Arab Emirates ($n=1$), Zimbabwe ($n=1$), Belize ($n=1$), and Jamaica ($n=1$). Two of the 17 studies were cross-national where data were collected in two countries for the same research. One study gathered data from Belize and Jamaica, while the other collected data from South Africa and Canada (Fig. 3).

Regarding sample size, 52.94% ($n=9$) of the articles had sample sizes between 1 and 100, 29.41% ($n=5$) between 101 and 200, 5.89% ($n=1$) between 201 and 300, and 11.76% ($n=2$) unspecified (Fig. 4), describing the participant as the preservice teacher in one online class. Preservice teacher participants accounted for 70.59% of the identified articles, while teacher-educators were the primary participants in 29.41%.

As for the research theme, 41.18% of the articles presented findings about the online delivery of preservice teacher education, 35.29% discussed the online practicum of preservice teachers, 17.65% focused on the preparation of online education for preservice teachers, and 5.88% highlighted the psychological well-being of preservice teachers. With regard to school setting, the authors found that nine of the 17 articles focused on early-childhood education students or teacher-educators, while the remaining eight discussed the situation for K-12 educational contexts but did not focus on early-childhood education settings despite including them.

Regarding the authorship and readership of the 17 chosen studies, most of the reviewed articles had two authors (47.06%) from the same intuitions (76.47%) within the same country (88.24%) (Table 6). Moreover, the articles were predominantly authored by scholars from English-speaking countries; as previously discussed, these articles are expected to reach a broad audience given that English is the language widely adopted by global academics. Because of the dominance of English-language publications,

Fig. 3 Origin countries

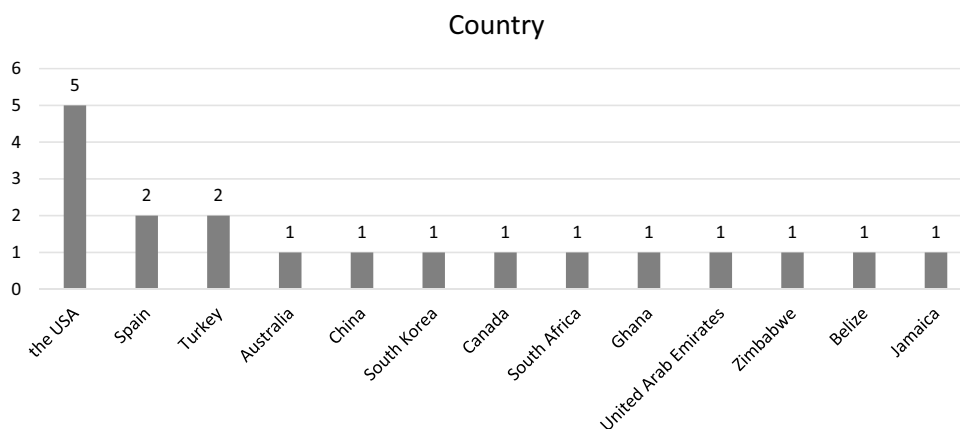


Fig. 4 Sample sizes

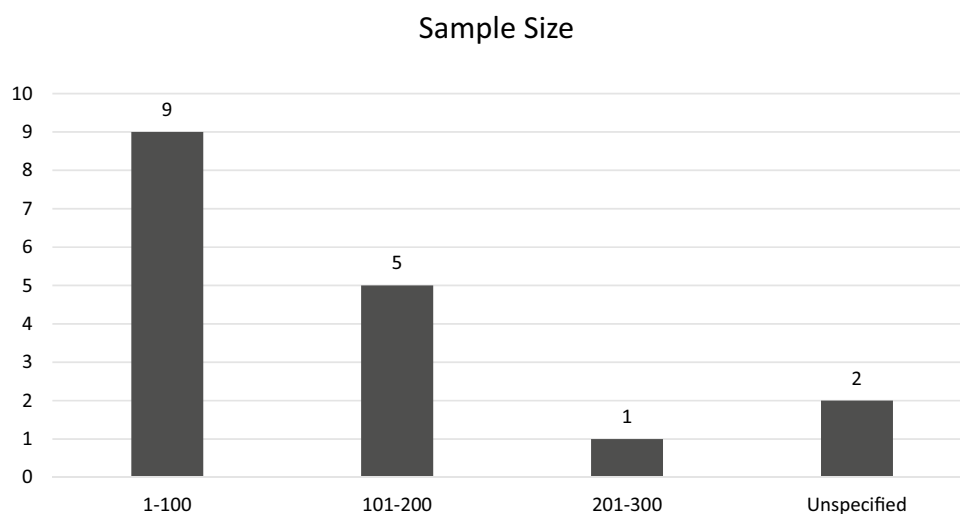


Table 6 Demographic characteristics of authors

Authorship	Number of reviewed articles (n = 17)	Percentage frequency
Number of authors		
One	6	35.29%
Two	8	47.06%
Three	2	11.76%
Four	1	5.89%
Number of institutions		
One	13	76.47%
Two	3	17.65%
Three	1	5.88%
Number of countries		
One	15	88.24%
Two	2	11.76%

non-English-speaking countries that may benefit from the evidence in these studies may be excluded.

Mapping the impact of COVID-19 on the delivery of preservice teacher education for early-childhood education settings

The following paragraphs map the four themes extracted from the 17 selected journal articles in more detail regarding the impact of COVID-19 on the delivery of preservice teacher education for early-childhood education settings.

Theme one: preparation for online education

The global pandemic has necessitated online education training programs for the preparation and training of teachers, especially those who intend to teach in early-childhood education settings. The reviewed articles produced two themes for online education preparation in the age of COVID-19: (1) techno-pedagogical preparation and (2) virtual classroom management preparation.

With regard to techno-pedagogical preparation, several studies pointed out that technology must be integrated into early-childhood education on the assumption that today's children are already digital natives (Cao et al., 2021; Dong et al., 2020). Therefore, preservice teacher education programs must train preservice teachers on how to do this. While the COVID-19 pandemic has undoubtedly accelerated the integration process, technology integration in education is multifaceted, which includes pedagogical content knowledge, content knowledge, and technological knowledge (Gozum & Demir, 2021; Roddy et al., 2017) and requires a framework for the development of such programs. In 2006, Mishra and Koehler (2006) devised a conceptual framework called "technological pedagogical content knowledge"

(TPACK), which is used to demonstrate the process of integrating technology into education instruction (Gozum & Demir, 2021). Drawing on examples from three different master's courses, Mishra and Koehler further differentiated three types of variables: *pedagogical content* knowledge variables (TPACK), *pedagogical* knowledge variables (TPK), and *technological content* knowledge variables. The authors showed a positive correlation among all three variables (Gozum & Demir, 2021). Based on this work, Gozum and Demir argued that the pedagogy, content, and technology elements included in Mishra and Koehler's framework must be examined as a whole rather than as separate parts since the latter affect each other in complex ways. Similarly, Roddy et al. (2017) asserted that technology must be embedded in content delivery and pedagogical education since digital devices and technology were only a basis for preservice teachers' online learning. Both Gozum and Demir (2021) and Roddy et al. (2017), as well as other authors such as Pourdavood and Song (2021) and Ogbonnaya et al. (2020), all pointed out that preservice preschool teachers must learn and practice integrating their digital skills and competencies with pedagogical content knowledge for the early-childhood education setting to meet young children's play- and inquiry-based educational needs.

Meanwhile, three articles addressed virtual classroom management preparation, which refers to teachers' actions and strategies to sustain children's development during online education. Pourdavood and Song (2021) argued that teaching and learning in early-childhood education need ongoing interactions and communications with young children and their parents (Pourdavood & Song, 2021). To efficiently deliver online classes, therefore, preservice teachers must be trained to be as competent in virtual classroom management as they would be in real classroom management. Effective classroom management is especially preferred since physical contact is absent in a virtual classroom. In the selected articles on preservice teacher education preparation, Gozum and Demir (2021), Ogbonnaya et al. (2020), and Pourdavood and Song (2020) suggested three enabling factors to improve virtual classroom management. First, preservice teachers must be familiar with the children's cultural background and social and emotional development (Pourdavood & Song, 2021). To achieve this knowledge, preservice teachers must learn and improve their communication and classroom management skills for online education (Pourdavood & Song, 2021). Second, preservice teachers should also find ways to enhance their interactions with parents since online teaching and learning in early-childhood education settings require parental involvement (Ogbonnaya et al., 2020; Pourdavood & Song, 2021). Strategies must also be taught to preservice teachers to understand how to achieve this. Third, preservice teachers need support and mentorship from their peers and mentors to develop the necessary online

education skills (Ogbonnaya et al., 2020; Orland-Barak & Wang, 2021).

Theme two: delivery of online preservice teacher education

Research in this area was grouped into three subthemes: (1) delivery of content, (2) delivery of instruction, and (3) delivery of assessment. Some studies also identified some positive and negative aspects of online delivery.

First, content delivery must be innovative and flexible to meet students' needs in the age of COVID-19. Remote learning could offer significant opportunities for teacher-educators as well as preservice teachers to demonstrate innovativeness in their curriculum content. For example, Scull et al. (2020) mentioned that teacher-educators redesigned their courses to meet the special needs of online teaching. For example, considering the accessibility challenges of some preservice teachers, the course content was not too comprehensive; the long duration of a normal class was divided into smaller, discrete online activities such as combining pre-work, interactive sessions and Moodle reflective activities; a team-teaching approach was adopted considering staff–student ratios for online classes to better facilitate access to online activities; midway surveys were administered to preservice teachers to provide individual feedback on course delivery and personalized teaching as some preservice teachers were asking others regarding different approaches (Scull et al., 2020). Likewise, Loose and Ryan (2020) indicated that student educators used multiple platforms to deliver online classes to decrease transactional distance. For example, they used Zoom breakout rooms, Google Docs, and other tools to promote collaboration with peers or preservice teachers. Moreover, student-teachers were more flexible about the types of classes they could prepare for their students and were freed from standardized tests as well. In addition, Lo (2021) suggested that preservice teachers from non-health backgrounds had the opportunity to be trained in public health education, including personal hygiene and physical distancing in kindergarten (Lo, 2021), not just for the course of the pandemic but also because such training would lay a solid foundation for young children to learn good health behaviors and know simple public health interventions to prevent the spread of infectious diseases. Nevertheless, all the above studies mentioned that the curriculum of preservice teacher programs must be more creative and flexible so that they could respond better to online delivery in the face of crises such as pandemics.

Second, instruction delivery was addressed. Remote learning required a shift toward synchronous or hybrid instruction. This required preservice teacher education programs to focus on instructional skills and practices that could motivate students and meet their needs in online learning environments (Gregory & Salmon, 2013).

However, the studies found that preservice teachers themselves must also develop their digital literacy skills, critical and creative thinking skills, and multidimensional skills to meet the demands of online education during pandemics and other crises (Mphahlele & Jikpamu, 2021; Yilmaz, 2021), indicating a pressing need for teacher-educators to include these skills in the preservice teaching curricula (Galindo-Domínguez & Bezanilla, 2021). Specifically, online education access, participation, and collaboration were discussed in relation to the delivery of instruction (Scull et al., 2020).

Regarding online access, teacher-educators must design teaching materials and adopt responsive approaches to ensure preservice teachers' equal access to online education. To achieve this goal, teacher-educators should understand preservice teachers' digital competencies and willingness or ability to access online education. Teacher-educators must also understand the difficulties some preservice teachers were likely to experience in their online classes because of their low socioeconomic status (Mphahlele & Jikpamu, 2021). For example, they might be unable to afford data, digital devices, and electronic power fees. With respect to online participation, the repertoire of teacher-educator strategies must be expanded (Mohebi & Meda, 2021) to encourage preservice teachers to participate in online classes (Loose & Ryan, 2020; Scull et al., 2020). Teacher-educators should creatively build flexible spaces where preservice teachers could share and discuss their learning and teaching online. For online collaboration, teacher-educator identity must move away from that of a supervisor and toward that of a collaborator with their preservice teacher students (Loose & Ryan, 2020). Equalizing the position between teacher-educators and preservice teachers was more likely to promote productive, authentic, dialog-driven autonomy in the student–teacher concerning their immediate needs in online teaching. Ultimately, this process would demonstrate that creating a learning community online and focusing on content delivery are not only possible (Kim, 2020) but would also provide a model for classroom delivery in the future.

Third, concerning the delivery of assessment for preservice teacher education, Fuertes-Camacho et al. (2021) highlighted reflective practice as an efficient method to assess online preservice teacher education. However, the authors also argued that reflective practice must be accompanied by communication and supervision between teacher-educators and preservice teachers. Furthermore, training future teachers in reflective practice should be a differentiating element in achieving quality teacher education, as it could enable future teachers to adapt to current and future adverse situations (Fuertes-Camacho et al., 2021).

Theme three: online practicum of preservice teachers

A practicum in education and training is a field-based internship that provides preservice students with background knowledge in child development principles and effective teaching and training practices (Jin, 2022; Kim, 2020). In teaching practicums, preservice teachers work with qualified and experienced classroom teachers who direct and supervise their activities, providing feedback along the way. The main objective of the teaching practicum is thus to provide student-teachers with authentic, hands-on experience in the classroom (Jin, 2022; Kim, 2020). The COVID-19 outbreak, however, meant that preservice teachers are now required to work with children and families remotely to gain this practicum experience.

Mohebi and Meda (2021) argued that despite the drawbacks of this online experience in other respects, online practicums have been proven as an achievement milestone for preservice teachers in terms of integrating technology into the teacher preparation program. Nevertheless, the drawbacks can be considerable. Six of the articles discussed the challenges as well as the opportunities of online practicums for preservice teachers during the pandemic. For example, Kinkead-Clark (2021) found that, in an online practicum, preservice teachers failed to acquire valuable experience and perform adequate preparation normally attained from their face-to-face practicums with young children. They also struggled with online classroom management tasks (Mohebi & Meda, 2021), such as maintaining children's active engagement and identifying appropriate times to support their learning, since they could not fully observe these children's learning processes on camera (Jin, 2022). Furthermore, preservice teachers appeared to find it difficult to cooperate reasonably with children's families even though online delivery to young children particularly requires parental involvement, making the online practicum even more challenging (Kinkead-Clark, 2021). An additional concern expressed by Callaway-Cole and Kimble (Callaway-Cole & Kimble, 2021) was that preservice teachers had difficulty remaining flexible and responsive in their online practicums and therefore failed to create inclusive and individualized experiences for the children in the class.

These challenges did, however, bring some opportunities. These studies also indicated that preservice teachers often overcame the above mentioned challenges by employing strategies such as modeling, child-centered approaches, and patience, which reflected their pedagogical resilience (Jin, 2022). Some studies also argued that the online practicum teaching experience still provided preservice teachers with opportunities to interact with young children as well as encouraged reflection on how best to promote their development and learning with online communication tools (Kim, 2020; Mohebi & Meda, 2021; Moyo, 2020). Improvements

were often observed in preservice teachers' know-how in professional development, curriculum design, and online class implementation and their cultural and familial knowledge of young children (Callaway-Cole & Kimble, 2021). Nevertheless, challenges remain for online practicums, with Moyo (2020) expressing concern that the emerging "new normal" of online practicums should not be allowed to compromise the quality assurance mechanisms for teacher education that have been developed over time (Moyo, 2020).

Theme four: psychological well-being of preservice teachers

The COVID-19 pandemic has caused uncertainty, which was detrimental to the psychological well-being of preservice teachers. Nevertheless, within the date range of the scoping study, only one article examined preservice teachers' psychological health during the pandemic. Clearly, the issue has not attracted much research attention despite the recognized impact of stress on learning (Kong & Wong, 2021). Kong and Wong (2021) aimed to validate a model that offered a strategy to cope with psychological distress by examining the efficacy of listening to music in moderating and lessening the impact of stressors on psychological well-being. Studies have often claimed that listening to music plays a prominent moderating role in the relation between stressors and psychological distress, but Kong and Wong found that this was not universally the case. Counter intuitively, music with lyrics that had a positive meaning could reduce the moderating effect of listening to music, so although the study suggested that music listening had a generally significant moderating impact on psychological well-being, the implicit or explicit meaning of the music, as perceived by the listener, determined its moderating effect (Kong & Wong, 2021).

Discussion and conclusion

This scoping review provided a preliminary summary of the impact of COVID-19 on the delivery of preservice teacher education for early-childhood education settings, drawn from 17 journal articles identified as meeting the research criteria. This summary sought to help universities involved in teacher education to better understand the challenges facing preservice teachers as their training and education shifted to online delivery as well as those of their prospective students so that better and more appropriate training and support could be offered to trainee teachers in this field.

Four themes of concern emerged in the scoping study in relation to preservice teacher training, specifically in the early-childhood education sector: the preparation of preservice teacher training, its delivery, practicums, and

the trainees' psychological well-being. Only three of the 17 selected journal articles discussed the delivery of preservice teacher education for the early-childhood education sector and how this has been affected by the COVID-19 pandemic. From these three articles, two themes were extracted: techno-pedagogical preparation and virtual classroom management preparation. The three articles also emphasized the importance of integrating technology into preservice education and the need for preservice teachers to be adept at online classroom management. However, the articles did not indicate how preservice teachers could improve their digital skills, competencies, and practices to meet their own or their future students' needs.

Seven articles discussed the delivery of preservice teacher education for the early-childhood education field, accounting for the highest percentage in the selected journal reports. Three subthemes were extracted from these seven articles: delivery of (1) content, (2) instruction, and (3) assessment. These subthemes covered the entire process of online delivery to preservice teacher students. The seven articles were mainly authored by preservice teachers and their teacher-educators but rarely discussed their interactions and mutual evaluations. All focused on the delivery of education to the preservice teachers by teacher-educators rather than by the prospective teacher to young children in a class. However, this aspect of delivery is complicated by the need to include parental participation and consider parents' views on online education. Also, no studies attempted to gather parents' opinions on online preservice teacher programs in relation to added requirements for both parents and teachers.

Six articles discussed the online delivery of what was once fieldwork-based practicum in preservice teacher education programs for early-childhood education settings. These covered both the challenges and opportunities presented by online practicums, which were apparently a new requirement for the early-childhood education field. Until the outbreak of COVID-19, face-to-face interaction was the normal requirement for practicums. Overall, the studies found that the challenges of an online practicum outweighed any opportunities it presented under contemporary teacher-training models and that this area needs more assessment and evaluation. Appropriate standards for online practicums must also be developed for teacher qualification in the post pandemic era.

Only one article discussed preservice teachers' psychological well-being, indicating that this issue has yet to attract scholarly attention. Nevertheless, the evidence of stress uncovered in the article indicates the need for more studies to find ways to strengthen the psychological well-being of preservice teachers, including the provision of psychological counseling services to these student-teachers.

Gaps in the literature

This scoping review identified several literature gaps that must be addressed to effectively deliver preservice teacher education in the field of early-childhood education not just for the duration of the COVID-19 pandemic but for the future as well. First, more research must be conducted in higher-education institutions and at an organizational level, such as leadership, management, and policymaking, specifically on the delivery of online education to preservice student-teachers who aim to practice teaching in early-childhood education settings. Second, further study is critically needed on both interaction and collaboration possibilities between online teachers and parents, as well as with young children, because young children's education is a comprehensive and systematic project that requires the joint efforts of all three parties. Third, no longitudinal comparative research specifically addressed the delivery of preservice teacher education for early-childhood education before or after the COVID-19 pandemic. Despite online education being an established practice, the COVID-19 pandemic has simply accelerated its process and implementation. In fact, no article has discussed this gap between face-to-face and online teaching before the pandemic or since. Last but not least, most of the selected studies lacked conceptual or theoretical frameworks. Hence, more research articles in this field are needed to provide clarity and content focus and encourage more comprehensive and convincing research in the future.

In any case, the 17 reviewed articles discussed many opportunities and challenges encountered by preservice teachers when their teaching and learning moved online during the pandemic. In addition, all the studies argued for targeted teaching and training support since online education was likely to remain the new normal for preservice teacher education for early-childhood education even in the post pandemic era.

Limitations and further directions

Two limitations affect the potential impact of this scoping review. First, the literature sample size was small; out of 178 journal articles located through the different search processes outlined in the methodology section, only 17 focused on the delivery of preservice teacher education during the pandemic and were therefore analyzed. Second, the data extraction process could be regarded as subjective as the three authors were experts in different areas within the field of education, which may have biased the extraction of data, especially on the dominant theme. For example, the research background of the first author was K-12, while that of the second and third authors was education issues in early

childhood. When classification was not apparent in an article, the three authors, from different academic backgrounds, had to choose among multiple categories, which may have resulted in subjective theme bias (Martin et al., 2020).

Limited as it is, the scoping review has nevertheless highlighted the need for further research directions in this field of preservice teacher education for those who wish to teach in early-childhood education settings. More cross-country comparisons should be undertaken in both developing and developed countries. Because digital education largely depends on government support, developing and developed countries will provide different kinds of digital support based on their financial capacities. Additionally, most studies in the review were based on qualitative research designs using small sample sizes. While they offer detailed descriptions of online education for preservice teachers through reflective strategies, they did not provide generalizable information on the effectiveness of online education for preservice teachers in early-childhood settings (Shoffner, 2009). This highlights the need for further larger-scale cross-cultural comparisons to develop evidence-based strategies for improving preservice teachers' education as online delivery expands to all education sectors.

Author contributions LK collected and analyzed the literature and wrote the first draft; SD and HL gave feedback on the data analysis and reviewed and refined the manuscript.

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Data availability ProQuest, Google Scholar, and Scopus are open to academics for a secondary search. In addition, the identified literature data for this scoping review is available from the corresponding author, Li Kan, upon reasonable request.

Declarations

Ethical approval This is a part of a large research project (ID: 10921) that has been reviewed and approved by the Arts Subcommittee of Macquarie University (Reference No: 520221092136090).

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