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Review Article

The use of ICT technologies in teacher training for special educational needs and disabilities (SEND): A systematic review

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ABSTRACT

The purpose of this research is to conduct a systematic review of studies on information and communication technologies (ICT), teacher education, and special education. During the initial search, a total of 3,841 articles were identified. According to the inclusion and exclusion criteria, 11 articles were selected for analysis and for the systematic review. The characteristics of the reviewed studies revealed that nearly half were conducted with preservice teachers and used quantitative, qualitative, or mixed-methods research designs. Regarding the study results in the systematic review, three themes were identified: pedagogical skills, professional development and self-efficacy, and flexibility. The findings showed that the studies focused on developing the pedagogical skills, professional development, and self-efficacy of teacher participants. In light of the results, suggestions are made regarding the use of ICT technologies in teacher training for special educational needs and disabilities.

Keywords: ICT technologies, special education, inclusive education, systematic review, special educational needs and disabilities

INTRODUCTION

Education reform documents and reports from countries around the world concerning students with special educational needs and disabilities (SEND) aim to provide inclusive, high-quality education for these

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students (Alhaif et al., 2025; Almarzouq et al., 2025; Supermaniam et al., 2025; Yazcayir & Gurgur, 2021). In this context, the primary goal of these reforms is generally to ensure that students with SEND have equal access to the general education curriculum without barriers (Almarzouq et al., 2025; Ibrahim & Ajlouni, 2024; Kougia et al., 2026; Park et al., 2023). As a common outcome of policies implemented in alignment with the United Nations sustainable development goals, countries seek to reduce educational inequalities for students with SEND (Ibrahim & Ajlouni, 2024; Ibrahim et al., 2025; Supermaniam et al., 2025; Yazcayir & Gurgur, 2021). To achieve these objectives, the increasing digitization of education, along with the use of assistive technologies such as information and communication technologies (ICT) tools in instruction, offers opportunities for personalized teaching tailored to students' individual needs (Alhaif et al., 2025; Almarzouq et al., 2025). The intended outcomes of using these technologies are to reduce communication barriers in learning environments for students with SEND, thereby encouraging their engagement in learning and supporting their social and emotional well-being (Almarzouq et al., 2025). In this way, the aim is to help students realize their potential while also promoting their academic success and integration into society (Alhaif et al., 2025)

ICT technologies are important because they help provide personalized education tailored to the individual learning paces and needs of students with special needs who, for this reason, require special education (Alhaif et al., 2025). In particular, the use of digital tools such as text-to-speech and speech recognition helps students with special needs actively participate in class, enhances their learning journeys, and boosts their motivation (Alhaif et al., 2025). Furthermore, since these technologies facilitate behavioral and social-emotional adjustment and management, they positively support students' self-confidence and interactions with their peers.

ICT enable special education teachers to flexibly adapt instructional materials to students' individual learning needs. The availability of these technologies in the form of learning and teaching platforms that can be customized for individual students or groups allows teachers to design and implement personalized educational programs. In particular, it is emphasized that teachers must possess technological knowledge and related skills within the framework of technological pedagogical content knowledge (TPACK). Research also indicates that digital tools integrated with the principles of universal design for learning (UDL) help teachers create learning environments that are accessible and equitable for all students.

Consequently, smartphones, smart boards, digital learning and teaching platforms, digital storytelling, and Web 2.0 tools position every teacher as a digital instructional designer (Ünay et al., 2025). In all these respects, the use of technology in special education plays a significant role in expanding the educational opportunities and resources available to individuals with special needs, while also enhancing teachers' self-efficacy and creating a learning environment for evidence-based teaching (Mahama et al., 2026).

Research on ICT and special education has shown that using ICT positively influences pre-service and in-service teachers' approaches toward students, as well as their professional knowledge (Al-Mamari et al., 2020; Martino et al., 2023), instructional attitudes (Tzohar-Rozen et al., 2025), self-efficacy (Ibrahim et al., 2025; Tilak et al., 2025), and inclusive teaching skills (Al-Mamari et al., 2020; Howorth et al., 2026; Nie et al., 2025). In addition, the benefits of ICT use for teachers in terms of student learning lie in the fact that it enables teachers to provide personalized educational content to their students. For example, assistive technologies such as speech recognition and text-to-speech (Ünay et al. 2025) can encourage students at different levels to participate in class and facilitate their active engagement. Studies have indicated that ICT technologies, such as multimedia and digital applications, positively enhance students' motivation to learn and classroom interaction. The use of ICT technologies helps students with special needs develop their social skills and self-efficacy, thereby supporting their transition toward greater independence in their learning processes.

Overcoming educational barriers for every student with SEND requires designing and implementing individualized programs that consider their specific characteristics and support their personal development. These barriers and difficulties can be addressed by integrating ICT strategies for students in special education classrooms. The current educational reform in Kazakhstan envisions the development of inclusive education to create conditions for children with special needs to thrive.

Table 1. Results of a review of previous systematic review studies

Previous reviews	Year	n	Databases	Purpose	Main results
Bsharat et al. (2026)	2004-2025	14	ProQuest database	Special education teachers' attitudes toward AT, viewed across cognitive, affective, and behavioral dimension using systematic review	Teachers generally hold positive attitudes and persistent challenges regarding training, resource availability, and implementation towards AT.
Griffiths and Slaughter (2026)	2014-2024	24	Web of Science core collection, MEDLINE, CINAHL, PsycINFO, ERIC and British Education Index	To explore the landscape of AT training for professionals working in special education contexts.	AT had been inconsistently available, with systemic barriers including time, funding, and lack of awareness of available opportunities, while confidence and self-efficacy emerged as the most frequently measured indicators of training success.
Park et al. (2023)	1988-2022	14	Academic Search Ultimate (n = 314), APA PsycInfo (n = 192), Education Source (n = 454), ERIC (n = 620), and MEDLINE	To examine the effects of assistive technology instruction on preservice teachers.	Positive gains in self-reported AT skills/knowledge, assessed AT skills/knowledge, and attitudes/perspectives toward AT, regardless of modality, instructional methods, or measurement approach after participating in the AT instruction.

Note. n: Number of included studies

A CRITICAL REVIEW OF PREVIOUS REVIEWS

Most researchers agree that access to appropriate ICTs can reduce disparities in inclusive education. In this vein, researchers in teacher education programs have sought to examine the effects of ICT among pre-service and in-service teachers to support their professional development. To this end, scholars have conducted several studies (see **Table 1**). For example, Griffiths and Slaughter (2026) conducted a scoping review to examine the landscape of assistive technology (AT) training for professionals working in special education contexts. Using the PRISMA-ScR framework and a systematic search to identify sources that explored or discussed AT training, professional perceptions, and reported outcomes, they found that AT training is highly valued by professionals. However, it is inconsistently available, with systemic barriers including limited time, funding constraints, and lack of awareness of available opportunities. Confidence and self-efficacy emerged as the most frequently measured indicators of training success.

Bsharat et al. (2026) conducted a systematic review of publications on special education teachers' attitudes toward AT across cognitive, affective, and behavioral dimensions. They also examined accessibility, psychosocial, and academic benefits, as well as implementation challenges across the reviewed studies. The review included 14 empirical studies (2004-2025) from diverse educational settings. The results indicate that teachers generally hold positive attitudes toward AT and perceive it as enhancing student independence, engagement, and academic performance. However, persistent challenges remain regarding training, resource availability, and implementation. Park et al. (2023) systematically reviewed the effects of AT instruction on preservice teachers, including 14 studies in their analysis. Their results showed positive gains in self-reported AT skills/knowledge, assessed AT skills/knowledge, and attitudes/perspectives toward AT, regardless of modality, instructional methods, or measurement approach after participating in the AT instruction. Their results also indicated the need for additional research within teacher preparation programs.

METHOD

The systematic review method is defined as the synthesis of findings from studies, achieved by conducting a comprehensive search of research conducted in the relevant field and applying various inclusion and exclusion criteria. It is essential for systematic reviews to be comprehensive and reproducible, and for the methods used in the literature search and the criteria used in study selection to be clearly specified. The primary objective of a systematic review is for researchers to present the findings related to the topic under investigation through themes based on the data obtained.

Table 2. A list of keywords that were used during the database search

	Keywords
Special education teacher training	"Special Educational Needs", "Special Needs Students", "Disabilities", "Inclusive Education", "Developmental Disabilities", "Learning Disabilities", "Neurodiversity", "Autism Spectrum Disorder", "Intellectual Disability", "Sensory Impairments"
ICT technologies	"Information and Communication Technology", "ICT", "Assistive Technology", "Educational Technology", "Digital Learning Tools", "Mobile Learning", "Virtual Reality", "Augmented Reality", "Artificial Intelligence in Education", "Instructional Technology", "E-Learning", "Adaptive Technology"

Database Search

In this study, articles published between 2016 and 2025 on ICT technologies and special education pre-service and in-service teachers were reviewed to answer the research questions. In this context, the articles were sourced from the Scopus database. Scopus was chosen because of its extensive, international, and interdisciplinary coverage of peer-reviewed journals in the fields of special education and educational technologies (ICT). However, this choice implies that, in terms of the comprehensiveness of this systematic review, some special education ICT applications that fall outside the Scopus index or are found in the gray literature may have been excluded from the analysis. Nevertheless, Scopus's strict indexing criteria for peer-reviewed journals and its broad subject coverage help to preserve the representativeness and methodological reliability of the findings in the present study.

To this end, articles published in the Scopus database on ICT and special education teachers were reviewed using the keywords listed in **Table 2**. During the initial search, a total of 4,433 articles were identified. Subsequently, editorials, reviews, and conference proceedings were excluded, reducing the total to 3,841. Next, exclusions were made based on the inclusion criteria, further reducing the total by 92 and bringing the number down to 3,749. Two reviewers then examined the full texts of the 92 studies. Following this review, 11 studies were deemed suitable for this systematic review. The inclusion and exclusion criteria established by the researcher for the data included in the results of the systematic review are presented below.

a. The study must be published in English.

b. The studies must have been conducted between 2016 and 2025.

1. e. The participant group must consist of pre-service and in-service special education teachers.

Keywords to be used in the search process to address the research questions have been identified. In determining the keywords, umbrella terms such as "special education" and "ICT technologies" were selected. The list of keywords used in this context is provided in **Table 2**. Additionally, these keywords were combined in the database using Boolean operators (AND, OR) to broaden the scope of the search. This approach allowed access to studies where the concepts were used both together and separately, with the aim of expanding the scope of the search. The use of Boolean operators in this manner supports the reproducibility of the search process in systematic review studies and contributes to the methodological transparency of the research.

Inclusion and Exclusion Criteria

The primary objective of the inclusion criteria is to ensure that the research sample or study group consists directly of special education teachers or special education teacher candidates. In this context, with regard to ICT technologies, the focus is on the use of ICT in the context of teacher education, professional development, curriculum integration, or technological competencies. Regarding exclusion criteria, studies conducted with general elementary, middle, and high school teachers that do not involve special education have been excluded from the scope. Thus, studies that do not include the participation of special education teachers or teacher candidates (those conducted solely with students, administrators, or parents) have been excluded from the scope.

The studies identified at the end of the screening process were processed by the researchers in Microsoft Excel, with a separate code assigned to each study. The identified studies were selected based on inclusion and exclusion criteria determined by the researcher. During this process, studies were included according to the PRISMA flow diagram (see **Figure 1**). The PRISMA method is a checklist developed for meta-analyses and systematic reviews to guide research, ensure transparent conduct, and support the validity and reliability of studies (Page et al., 2021). The PRISMA checklist prepared for this study is presented in **Figure 1**.

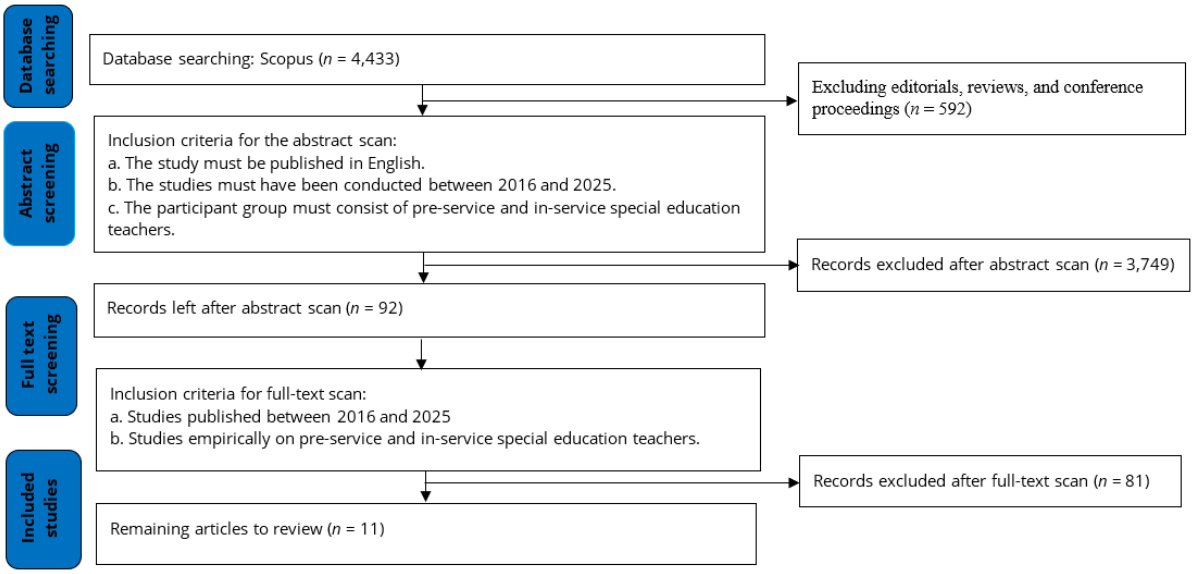


Figure 1. PRISMA guidelines for data collection (the authors' own elaboration)

Table 3. Comprehensive information on the inclusion and exclusion criteria used in the research

Category of main criteria	Inclusion criteria	Exclusion criteria
Participants	Preservice special education teachers	General education and subject teachers in preschool, elementary school, middle school, and high school
	In-service special education teachers	Prospective general education teachers
Focus	Integration and use of ICT	Studies conducted with students but not involving teachers or teacher candidates
	Teacher training for pre-service and in-service special education teachers	Studies on ICT technologies outside the scope of special education
Context	Studies on the use of technology in special education teacher training	Studies cover general education classrooms that do not involve special education.

In light of these criteria, comprehensive information on the inclusion and exclusion criteria is presented in **Table 3**. Accordingly, this study identified only those studies conducted with in-service special education teachers or pre-service/prospective special education teachers. In contrast, general education/subject-area teachers (elementary, middle, and high school general education teachers) were excluded. With regard to ICT technologies, studies focusing on educational technologies, assistive technologies, and teacher training/competencies were included in the analysis. Consequently, publications that did not address the teacher dimension or fell outside the scope of special education were excluded from the analysis.

Data Analysis

The results of the studies within the scope of this research were analyzed in accordance with the study's objectives. Microsoft Excel was used for the analysis, which employed a descriptive analysis method. The study first presented general information about the included studies in tables, while interpreting and presenting detailed analyses in the results section. To ensure reliability in systematic reviews, independent researchers should examine the data and report them comparatively (Thyer, 2010). In this study, to determine the level of reliability, the data were evaluated separately by two faculty members specializing in special education. Accordingly, two expert coders independently and simultaneously reviewed the articles, without communicating with each other, in accordance with the established inclusion and exclusion criteria. After the coding process, their evaluations were compared based on these criteria, and the percentage of agreement between the coders was calculated as 93%. This 93% reliability coefficient indicates that the coding protocol was clear and that a high level of consensus was achieved among the researchers. This high agreement rate strongly supports the consistency of the findings in this systematic review and the methodological quality of the study. Based on the feedback from the experts, the study's reliability level was calculated using interrater reliability among two coders and the researchers, and the result was found to be 93%.

RESULTS

Study Descriptions

The titles of the journals in which 11 articles were published in ten journals. These journals are the Journal of Education and e-Learning Research, Journal of Research in Innovative Teaching & Learning, Journal of Social Studies Education Research, Technology, Pedagogy and Education, International Journal of Evaluation and Research in Education, Asia Pacific Journal of Educators and Education, Education and Information Technologies, Journal of Information Technology Education: Research, European Journal of Teacher Education, and Comunicar (Media Education Research Journal).

In terms of participant levels, the participants in the studies examined consisted of two main groups: pre-service teacher candidates and in-service teachers. Studies involving the first participant group included pre-service special education teacher candidates (Howorth et al., 2026; Ibrahim & Ajlouni, 2024; Ibrahim et al., 2025; Nie et al., 2025; Tzohar-Rozen et al., 2025; Ünay et al., 2025), while studies involving in-service teachers include Al-Mamari et al. (2020), Martino and Naqvi (2023), Supermaniam et al. (2025), Tilak et al. (2025), and Yasar-Akyar et al. (2022).

In terms of the methods used in the studies examined, they were grouped under quantitative, qualitative, and mixed-methods research designs. Accordingly, five studies used quantitative research methods (Al-Mamari et al., 2020; Ibrahim & Ajlouni, 2024; Ibrahim et al., 2025; Nie et al., 2025; Tzohar-Rozen et al., 2025), while only one study employed a qualitative method (Supermaniam et al., 2025). In terms of mixed-methods research, five studies (Howorth et al., 2026; Martino & Naqvi, 2023; Ünay et al., 2025; Tilak et al., 2025; Yasar-Akyar et al., 2022) employed a mixed-methods approach.

Features of Studies

The main objectives of the studies analyzed in this research, including the participants, the methodology used, the ICT technology employed, and the main findings, are presented in **Table 4**.

Table 4. Comprehensive information of studies reviewed

Rank	Studies	Purpose	Country & participants	Methodology	ICT technology used	Main findings
1	Al-Mamari et al. (2020)	Examining the impact of the online training module on teachers' awareness, knowledge, and skills regarding children with giftedness and learning disabilities.	Omman, 60 women teachers	Semi-experimental & quantitative research	Zoom, Google Meet, WhatsApp, Moodle, and digital presentations	A significant increase in self-awareness scores was found among teachers who participated in online training compared to the control group.
2	Howorth et al. (2026)	To assess the digital competencies and UDL practices of pre-service special education teachers	Pre-service teachers, faculty members, and administrators	Mixed approach	Assistive technologies and digital resources	There has been a significant increase in pre-service teachers' digital literacy and technology integration skills, as well as their ability to integrate UDL, thanks to comprehensive professional development.
3	Ibrahim et al. (2025)	To examine the relationship between special education teacher candidates' frequency of ChatGPT use and their teaching self-efficacy and their internship stress, and to assess ChatGPT's ability to predict internship stress.	Jordan, 143 preservice teachers	Quantitative research	Generative artificial intelligence (ChatGPT)	Self-efficacy predicted teachers' stress levels. Furthermore, the intensity of ChatGPT use did not predict perceived stress.

Table 4 (Continued).

Rank	Studies	Purpose	Country & participants	Methodology	ICT technology used	Main findings
4	Ibrahim and Ajlouni (2024)	Exploring the ChatGPT's achieving national educational standards among preservice special education teachers	Jordan, 166 preservice teachers	Quantitative research	Generative Artificial Intelligence (ChatGPT)	ChatGPT has been found to be highly effective in meeting individual learning and developmental needs.
5	Martino and Naqvi (2023)	To evaluate flexibility, accessibility and impact on knowledge of remote training on autism spectrum disorder delivered via smartphones to teachers	Tanzania, 84 in-service teachers	Mixed/ multimodal data collection methods	Smartphones, WhatsApp, and web-based mobile learning modules	Mobile learning has proven to be highly flexible and feasible, with an 84% participation rate; while no significant difference in knowledge was found due to the teachers' high initial knowledge levels, the accessibility of the mobile platform has been confirmed.
6	Nie et al. (2025)	To examine the effectiveness of a virtual reality environment in helping teacher candidates develop applied behavior analysis teaching skills for children with autism.	China, 40 preservice teachers	Experimental	A virtual reality environment and applied behavior analysis tasks.	A statistically significant increase in participants' professional development was observed.
7	Supermaniam et al. (2025)	To evaluate the impact of interactive mobile multimedia applications on teachers' digital pedagogical competencies and professional identities.	Malaysia, 10 in-service teachers	Qualitative case study	Smartphones and mobile multimedia	Teachers have taken on the roles of digital content creators and mentors.
8	Tilak et al. (2025)	To investigate the effect of technology-supported collaborative professional development sessions (vision board and behavior management) on special education teachers' collective perceptions of self-efficacy.	United States, 21 in-service teachers	A mixed-methods approach using multiple data sources (quantitative/ test/regression, qualitative visual network analysis/narrative).	Vibe and Newline interactive whiteboard and digital vision boards.	A significant increase in teachers' collective self-efficacy scores. Teachers with the most experience showed the greatest improvement.
9	Tzohar-Rozen et al. (2025)	To examine the effect of a technology- and mathematics-focused hackathon program on pre-service teachers' TPACK levels.	Israel, 63 preservice teachers	Quantitative research	Interactive storytelling tools, Active Floor motion systems, 3D printers, and various math software	A significant increase across all dimensions of TPACK scores
10	Ünay et al. (2025)	To evaluate the effects of an online course on pre-service teachers' competencies in creating digital social stories.	Turkey, 33 preservice teachers	Mixed research	Web 2.0 tools (StoryboardThat, Pixton, PhotoStory, Audacity), digital images, and audio editing tools	A statistically significant increase in scores for digital social story creation. Additionally, positive results regarding digital social story creation
11	Yasar-Akyar et al. (2022)	To examine the contribution of workshop-based digital storytelling to teachers' professional development and an inclusive approach to education.	Dominican Republic, 47 in-service teachers	Mixed research	Digital Storytelling tools	Through digital storytelling, students have been able to express their ideas, build empathy, and create inclusive learning environments.

Effects of ICT Technologies

Pedagogical skills

One of the most significant outcomes of ICT for special education teacher candidates and in-service teachers is that ICT contributes to their pedagogical competencies related to instructional design and technological knowledge (e.g., Howorth et al., 2026; Tzohar-Rozen et al., 2025). For example, Howorth et al. (2026) examined the effects of integrating emerging technologies to enhance special education teacher preparation through a strategic partnership focused on technological innovation in teacher education. They reported that comprehensive professional development, sustained support, and the adoption of UDL principles are necessary to develop pre-service teachers' skills so they can incorporate technology into their classroom practices.

The study by Tzohar-Rozen et al. (2025) aimed to develop pre-service special education teachers' TPACK competencies and assess the impact on their attitudes toward designing technology-based mathematics activities for students with special needs. Their results revealed positive improvements in each component of TPACK, with the most notable gains observed in technological knowledge. Students' attitudes improved, particularly regarding their ability to cope with challenges. Furthermore, all pre-service special education teachers demonstrated greater improvement across all areas of TPACK. Similarly, the study by Ünay et al. (2025) found that online training sessions conducted using Web 2.0 tools such as StoryboardThat, Pixton, and Audacity significantly improved pre-service teachers' skills in creating digital social stories and designing instructional materials. In particular, it has been noted that the use of generative artificial intelligence, such as ChatGPT, can provide significant benefits in developing Individualized Education Program goals, adapting curricula for students with disabilities, and meeting special education standards, as perceived by teacher candidates (Ibrahim & Ajlouni, 2024). In this regard, teacher candidates have indicated that AI can offer practical solutions for analyzing student development data and tracking measurable outcomes (Ibrahim & Ajlouni, 2024). However, virtual reality simulations have been shown to significantly increase pre-service teachers' success in completing applied behavior analysis tasks for children with autism (Nie et al., 2025).

Professional development and self-efficacy

The integration of technology has not only helped participants develop their technical skills but has also transformed their perceptions of professional self-efficacy and their teaching identities (Ibrahim et al., 2025). In a study conducted with pre-service teachers, Ibrahim et al. (2025) examined the relationship between pre-service teachers' self-efficacy in teaching students with disabilities, their use of ChatGPT, and their perceived stress levels during practicum. Their findings revealed that the intensity of ChatGPT use and self-efficacy were moderate, while perceived stress was also moderate. Regression analysis showed that self-efficacy significantly predicted perceived stress, whereas ChatGPT use did not show a significant effect.

Supermaniam et al. (2025) examined the impact of the interactive mobile multimedia applications training program, an eight-week blended professional development initiative for Malaysian special education teachers. They designed instruction around TPACK and UDL principles and found

(1) a pedagogical shift toward learner-centered, multimodal lesson design,

(2) a transformation of teacher identity as content creators and mentors, and

(3) sustainability through the reusability of digital resources and grassroots peer collaboration.

They concluded that mobile multimedia training can operationalize UDL principles, foster teacher self-efficacy, and establish school-based ecosystems of innovation.

In another study, Tilak et al. (2025) examined the role of technology-mediated collaborative practices during professional development. Teacher collective efficacy among inclusive teachers is strongly related to student achievement and a healthy school culture. Mastery experiences with specific tasks related to teaching and learning can foster collective efficacy. The results also showed that cutting-edge technologies (Vibe and Newline collaborative all-in-one hardware and software interfaces) were used to engage teachers in an interdisciplinary vision-boarding activity to outline academic, social, and technological goals within and across subject areas. In addition, there was a significant overall increase in collective efficacy among teachers after the professional development session. Through the contributions of ICT technologies, participants

demonstrated more positive progress in professional transformation and self-efficacy, as well as in coping with classroom challenges (Tzohar-Rozen et al., 2025).

Flexibility

In the studies reviewed, the findings indicate that mobile devices and e-learning platforms have increased the accessibility and flexibility of professional development, particularly in resource-limited regions and under extraordinary circumstances (Al-Mamari et al., 2020; Supermaniam et al., 2025). Al-Mamari et al. (2020) examined the effects of online training modules on teachers' knowledge. Teachers in the experimental group received a two-week online training module. The results indicated significant differences in the Self-Awareness Scale post-test in favor of the teachers in the experimental group, who received the online training module to improve their awareness.

Thus, the study by Al-Mamari et al. (2020) showed that online education delivered via smartphones, WhatsApp, Zoom, and Moodle led to a significant increase in teachers' knowledge and self-awareness regarding their students (Al-Mamari et al., 2020; Martino et al., 2023). The findings of Supermaniam et al. (2025) revealed that professional development focused on ICT technologies laid the groundwork for teacher collaboration and the formation of "micro-communities of practice" (Supermaniam et al., 2025). The research by Ünay et al. (2025) involved designing and implementing an online course to improve special education teacher candidates' competencies in preparing digital social stories (DSS). The results showed a significant increase in the DSS preparation competencies of special education teacher candidates who participated in the online course. In addition, they indicated that the course provided participants with insights into the components and stages of DSS preparation.

Limitations and Future Research

Although the overall findings suggest that ICT technologies are helpful and supportive in improving pre-service teachers' pedagogical skills, professional development, self-efficacy, and flexibility, this research has limitations that should be considered when interpreting the results. The primary concern is that only 11 published studies met the inclusion criteria for this review. Of these 11 survey studies, five used quantitative research methods, while only one employed a qualitative method. The remaining five studies used a mixed-methods approach. In addition, regarding the use of one database, SCOPUS, it is recommended that future studies expand their scope by incorporating additional databases into the process to provide a more holistic view of the literature.

Based on these results, the need for future research to use robust methods is evident. In particular, among the studies included in this systematic review, there was a lack of reporting of effect sizes for ICT technologies. Therefore, more studies are needed that provide statistical data on the effectiveness of ICT technologies on teachers' skills, professional development, and other skills or competencies. In line with this need, future researchers should conduct more studies on the effectiveness of ICT technologies during SEND instruction. Similarly, there is a need for more studies reporting results for specific variables, such as different methods and participants' characteristics. Another limitation is that only research published between 2016 and 2025 was covered. Therefore, only a limited range of research was examined, based on the purposes of this article. Consequently, there is a need for more systematic reviews that include earlier years of research on ICT technologies and special education teachers.

Educational Implications and Conclusion

This study suggests that ICT instruction in teacher training has overall positive and helpful effects. Therefore, we argue that ICT technologies should be used to train both future and in-service teachers in universities. The findings of this review also indicate that ICT tools are important and beneficial for teachers in both pre-service and in-service teacher education. Consequently, faculty members in teacher education programs should work to identify the most effective ICT tools and technologies to support teachers' professional development and training. They also need to define and clarify the roles and responsibilities of teachers in the use of ICT technologies in teacher education programs.

The positive results regarding the use of ICT in teacher training show that faculty members and teachers, both pre-service and in-service, should possess ICT-related knowledge and skills to enhance students'

educational outcomes and improve educational practices through the practical use of ICT tools and technologies. Thus, studies in SEND programs can be undertaken to support further learning and be strengthened academically. Based on the data in this study, it is recommended that teacher training programs consider using ICT tools to develop their curricula and practicum activities in teacher education. Additionally, teacher training programs have the responsibility to implement educational and pedagogical practices related to ICT tools and technologies, such as generative artificial intelligence, during teacher education and professional development activities. To achieve this, more evidence on the use of ICT tools in teacher training is necessary to inform instructional methods and techniques and to integrate effective examples of ICT use with SEND students in schools.

Author contributions: AAA: conceptualization, writing – review & editing; **GAA:** conceptualization, data curation, formal analysis, supervision, resources, validation; **LAB:** validation, visualization; **SMU:** writing – original draft; **AD:** data curation, writing – review & editing; **AB:** writing – review & editing. All authors approved the final version of the article.

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