

The incidence of information and communication technologies in early childhood classrooms: A systemic literature review

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ABSTRACT

The importance of information and communication technology (ICT) in education has been increasingly acknowledged due to advancements in technology. Prior research has explored several perspectives on the “use of ICT in early childhood education (ECE) and has highlighted many obstacles to its implementation in the classroom setting”. The synthesis of these research does not lean towards a singular perspective or definitive result, so allowing for further investigation of the issue at a more profound level. This systematic literature review seeks to enhance the current body of knowledge on teachers’ attitudes toward the efficacy of using ICT in ECE classrooms. By using PRISMA procedures, a total of 12 studies were selected to investigate the perspectives of teachers about the use of ICT, the current methods employed, and the efficacy of teaching at ECE level. The study’s findings indicate that, in general, teachers exhibit a significant propensity toward the use of ICT in ECE. However, the implementation of ICT in classrooms is constrained by several factors.

Keywords: information and communication technology, early childhood education, attitude, practices, effectiveness, pre-schoolers, pre-school teachers

INTRODUCTION

The demand to use “information and communication technology (ICT)” has tremendously increased in recent times and has become an indispensable part of all educational systems including “early childhood education (ECE)”. Essentially, it is to meet the learning demands of different students according to their capacities (Mertala, 2017). It has been established that using ICT encourages self-efficacy and resourcefulness among young students. It also enhances the skills of teachers and provides opportunities for linking schools and extending learning avenues beyond the boundaries of traditional classrooms (Liyawatta et al., 2022; Mertala, 2017). This might also contribute to improving the teaching and learning environment in ECE by promoting optimum academic achievement via the development of psychomotor skills in children (Kerckaert et al., 2015; Rafiq et al., 2022).

In the current era, ICT has predominance in the lives of younger children who are preoccupied with the screen most of the time and are engaged in the use of computers, tablets, smartphones, television, etc. (Matthew et al., 2015). ICT encompasses a diverse range of advanced technology resources and gadgets that are used for communication. They are designed to gather, produce, manage, and disseminate information (Adebanjo & Rasheed, 2021). The scope of ICT may be expanded to include electronic devices used for storing and retrieving information, which is partly driven by the potential to establish a synergistic link between advanced technological innovation and individual components (Matthew et al., 2015). This implies that the people who interact with technology (in case of teaching- teachers) determine how effective the use of it in terms of teaching. The effectiveness of ICT is determined when it is employed either as a medium of instruction or medium of delivery (Duker et al., 2018).

For, the instructional processes, ICT provides teachers with the opportunities to conduct learner-centered teaching, where the quality of instructions can be enhanced using the latest technologies, information sources, and latest knowledge to enhance the learning environment. Based on the knowledge accessed through ICT, teachers can also improve their educational delivery system by using several ICT tools for a better understanding of students (Soetan et al., 2014). It has been observed that efforts are being made to use ICT in schooling, which has generated promising outcomes, whereas, at ECE level, its integration is limited with lesser desired outcomes (Soetan et al., 2014). Teachers of this level have shown lesser interest in the application of ICT for instructional purposes, which has generally decreased the infrastructural investment by stakeholders at ECE level in terms of making early schools resourceful with ICT (Duker et al., 2018). Early childhood teachers must enhance their knowledge and proficiency in ICT and associated technologies to fully grasp the crucial role they play in enabling technology for young children.

When discussing the use of ICT in ECE, it is important to first provide a detailed explanation of what ECE entails. ECE, as defined by Adebajo and Rasheed (2021), encompasses the educational experiences that children acquire in a school setting throughout the critical period from birth to age five. It is sometimes called playgroup or pre-school. ECE is essential in facilitating a seamless transition for children from their home environment to the school setting. It offers sufficient care and oversight for children while parents are not around due to job or business commitments (Soetan et al., 2014). At this stage, children are often given engaging materials at school to facilitate learning via play. This serves as a means for them to express their inner emotions, curiosity, and creativity, which entails exploring and solving problems (Adebajo & Rasheed, 2021). Pre-schools provide pupils a conducive atmosphere for the whole development of their physical, intellectual, and emotional faculties. Children often engage in experiential learning, where they gain knowledge by active manipulation (Kerckaert et al., 2015). It has been suggested that learning that engages many sensory organs is of high quality, since youngsters may interact utilizing all five senses. The realism of this approach lies in its active encouragement of children's active participation. The items or gadgets include DVD players, televisions, electronic devices, phones, digital cameras, computers, e-books, multimedia players, streaming media devices, programmable toys, robots, and electronic musical instruments (Liu et al., 2014). Children readily embrace games and multimedia tools, particularly those that integrate instruction and enjoyment (Soetan et al., 2014). These gadgets have been proposed to enhance the effective development of psychomotor abilities in youngsters. The literature has firmly proven that the use of ICT in education promotes improved comprehension, increases memory retention, and boosts learners' academic performance (Alkan & Kocak, 2015; Afzal & Rafiq, 2022). By introducing ICT at an early stage, children will already have a solid foundation in technology by the time they reach higher education institutions. For instance, the current administration of tertiary institution tests is being carried out using computers. Consequently, several youngsters without computer literacy or proficiency in computer abilities have difficulties with computer-based examinations. Integrating ICT in pre-schools is essential since young children are already familiar with modern technology in their households. They are readily adapting to various ICT devices, which are rapidly becoming essential tools in education, homes, workplaces, and communities (Duker et al., 2018).

Numerous researchers have carried out literature reviews to study the effectiveness of ICT in the ECE context. Historically, it has been argued whether young children may be allowed to use technology at school or not (Alper, 2013; Blackwell et al., 2014; Zomer & Kay, 2018). Various authors suggested that the use of ICT is not good for young children (Gillespie, 2014). Today, it is very common to see toddlers use electronic gadgets watch videos on tablets and explore the internet. It has been elaborated in many studies that digital technologies can help children in engaging meaningful activities. They can provide them with opportunities to develop, explore, learn, and communicate (Lavicza et al., 2022). In ECE, the term ICT can be limited to the use of technological tools including digital video cameras, telephone or cell phones, computer games, interactive toys, communication tools, internet, headphones, microphones, television, and video conferencing tools (Olowe & Kutelu, 2014). Literature also indicates that teachers have varying opinions on the use of ICT in ECE. While instructors have acknowledged the benefits of ICT, their utilization in the classroom is significantly influenced by their computer self-efficacy (Teo et al., 2019). A very interesting study on computational thinking and coding skills of pre-schoolers concluded that mobile applications like Scratch Jr aid in affecting positively the computational thinking and coding skills of students (Stamatios, 2022). Two similar studies also explored the use of robotics and another mobile app in teaching pre-schoolers and found them to have positive effects on the students (Kalogiannakis & Papadakis, 2020; Papadakis & Kalogiannakis, 2022).

The existing research lack definitive findings about the efficacy of using ICT for educating ECE pupils. Furthermore, conflicting results emerged while examining the stance of ECT instructors towards the use of ICT in the classroom. While some individuals found it beneficial and had a favorable outlook on its use, others grudgingly recognized its importance and saw it as a source of difficulty for instructors (Rafiq et al., 2023). This allows for the investigation of the subject within a global framework, considering the technology's widespread applicability. Therefore, SLR was carried out. Considering the previous research undertaken on the use of ICT in ECE, my objective is to conduct a comprehensive evaluation of the available studies pertaining to the implementation of ICT in ECE classrooms. This study examined research publications that explored instructors' perspectives on the efficacy of using ICT in ECE. The purpose of this study is not to discuss the specific types of ICT tools used in ECE, but rather to examine the effectiveness of their usage in teaching when compared to older techniques. This study aims to investigate the attitudes and instructional methods used by pre-school teachers on the integration of ICT in their classrooms. Additionally, it seeks to assess the effectiveness of these practices in facilitating learning at the pre-school level.

This research is intended to provide the answers to the following research questions:

RQ1. What are the attitudes and practices of pre-school teachers toward the use of ICT in classrooms?

RQ2. How effectively ICT is used for teaching pre-schoolers?

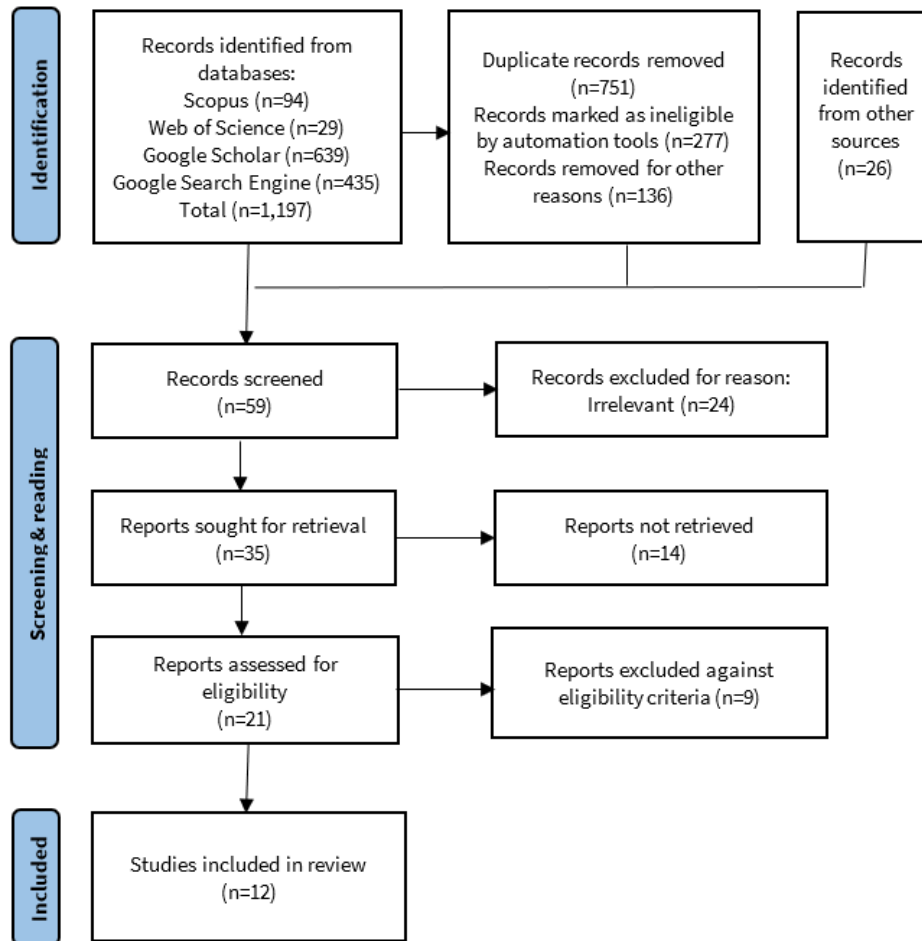
Previous studies have explored different perspectives on the use of ICT in ECE and have found many obstacles to its implementation in the classroom setting. The synthesis of these research does not lean towards a singular perspective or definitive result, so allowing for additional investigation of the issue at a more profound level. This systematic literature review (SLR) seeks to enhance the current body of research on teachers' viewpoints about the efficacy of using ICT in ECE classrooms.

METHODOLOGY

During the study, an SLR was conducted to examine the attitudes and behaviors of pre-school educators regarding the use of ICT in the classroom setting, as well as to assess the efficacy of ICT in instructing pre-school-aged children. PRISMA procedures and recommendations for SLR (Page et al., 2021; Siddaway, 2014) were used for this purpose. The electronic search was conducted using the primary search phrases suggested based on my research questions. The topics included in the study are ICT, attitudes

Table 1. Main & alternative search terms for structured literature search

Main terms	Alternative terms
Information & communication technology	ICT, information technology, IT, digital technology, DT, & computer technology
Attitude	Behavior, perspective, opinion, & viewpoint
Practices	Strategies, teaching practices, & methods
Effectiveness	Effective use & usefulness

**Figure 1.** Number of searched, identified, dropped, & included publications according to PRISMA protocols (Siddaway, 2014)

and behaviors, usage of ICT in classrooms, pre-school instructors, and efficacy. To gather particular research, more search phrases were explored by searching for their synonymous counterparts. As an example, the substitute name for “ICT” was “IT”. Likewise, the term “early childhood education” was restated as “pre-school education”. In addition to alternate terminology, more general or specific terms (such as “attitude” or “behavior”) were also used. **Table 1** presents a summary of the search keywords used in the systematic literature search. The ultimate search phrases were established by amalgamating both the primary and substitute terms.

To conduct the paper search, it is recommended to use widely utilized scientific literature databases and platforms (Siddaway, 2014). Therefore, I employed popular and easily available databases such as Google Scholar, Google Search Engine, Scopus, and Web of Science. In addition, I referred to the bibliography and reference part of the selected papers to locate other works that were relevant to my research. A spreadsheet was generated to catalog and document the search, while the Mendeley program was used to maintain bibliographic data.

During the preliminary search, 1,197 papers were identified using the above-mentioned databases. After removing duplication, dropping papers against other reasons, and including 26 papers retrieved using a bibliography, 59 papers were shortlisted for the screening stage of PRISMA protocol. The screening of articles included the following steps: I read the abstract of all the publications whose titles indicated the key terms linked to the use of ICT in ECE and recorded the entry if the abstract addressed my research question or eliminated the publication otherwise. After the systematic search, the studies from the bibliographies were also screened. During the screening phase, 24 papers were dropped owing to the reason that ICT integration and ECE were not treated as central aspects. The remaining 35 papers sought retrieval while 14 papers were denied retrieval owing to multiple reasons. The remaining 21 papers were screened against the eligibility criteria and nine papers were further excluded against it. A total of 12 papers were included finally. **Figure 1** elaborates on PRISMA protocols regarding the search, screening, reading, and inclusion of the related publications.

The identified studies were classified according to five given criteria points:

1. The studies may range from the period 2012 to 2022.
2. The participant may include pre-service and in-service pre-school teachers.
3. The Use of ICT Practices in the ECE context covered.
4. The attitude of pre-school teachers towards the use of ICT is focused.
5. Effectiveness of ICT whether it is useful or not.

All these aspects are elaborated on in the result section below.

RESULTS

Following the completion of the screening and analysis of the selected research, the findings were further developed. The ensuing systematic literature study provides a precise set of criterion points, including:

- (1) the use of ICT practices in the ECE context,
- (2) the perspective of pre-school teachers towards the usage of ICT, and
- (3) the efficacy of ICT in terms of its usefulness.

Table 2 presents a comprehensive summary of all studies that were ultimately discovered.

Table 2. Use of ICT practices in ECE context, attitude of pre-school teachers, effectiveness of ICT whether it is useful, & methodological approach of selected publications

Study	PD	Participants	Context	Focus	Effectiveness	MA
Kerckaert et al. (2015)	2015	In-service pre-school teachers	Flanders (Belgium) Pre-schools	How ICT use in Flemish preschools	Despite teachers have positive attitudes toward use of ICT, but barriers (lack of resources & competency) inhibit use.	Online survey quantitative approach
Dong and Newman (2016)	2016	In-service pre-school teachers	Chinese pre-schools	Chinese ECE teachers' views on use of ICT in pre-schools	This study shows that Chinese preschool teachers had an emergent understanding of ICT usage in early childhood education (ECE). Limited recognition.	Mixed-method Interviews & observation
Palomino (2017)	2017	Prospective early childhood & primary teachers	University (teacher education) & primary school teachers in Spain	Perceptions of prospective early childhood & primary teachers about using ICT	According to ECE teachers, it is effective and useful.	Descriptive survey & quantitative approach
Alkhalwaleh et al. (2017)	2017	In-service early years teachers	Jordanian pre-schools	Early years teachers' perspectives regarding role of computer technology in supporting children's learning	The preschool teachers did not have a certain understanding of the benefits of computer use for children.	Semi-structured interviews qualitative approach
Preradović et al. (2017)	2017	In-service early years teachers	Croatian kindergarten schools	Role & attitudes of kindergarten educators in early ICT education	More than one-third of kindergarten educators in Croatia have neutral attitude towards issue of early ICT education.	Descriptive survey & quantitative approach
Chen et al. (2018)	2018	In-service pre-school teachers	Pre-schools in Taiwan	Perception of application of ICT	Teachers have favorable attitudes toward ICT applications in teaching & administration fear of side effects.	Interpretive phenomenology qualitative approach
Gjelaj et al. (2020)	2020	In-service pre-school teachers & parents of pre-schoolers	Pre-schools in Kosovo	Teachers' & parents' attitudes & practices about role of digital technology supplies in young children's development	Only one of eight pre-school teachers reported a positive attitude regarding impact of digital technology on children's development.	Mixed-method approach (in-depth interviews & online survey)
Romero Tena et al. (2020)	2020	In-service pre-school teachers	Pre-schools in Spain	How ECE teachers make use of ICT & its frequency	These technologies were not openly & consistently used. Mostly administrative & bureaucratic tasks were performed.	Descriptive survey & quantitative approach (component analysis, descriptive analysis, & multivariate analysis)
Dong and Mertala (2021)	2021	Pre-service pre-school teachers	University (teacher education) in Finland	Teachers' perceptions of ICT	ICT used as a new tool to carry out traditional teacher-centered & teacher-initiated practices in a more efficient manner.	A broader mixed-method approach

Table 2 (Continued). Use of ICT practices in ECE context, attitude of pre-school teachers, effectiveness of ICT whether it is useful, & methodological approach of selected publications

Study	PD	Participants	Context	Focus	Effectiveness	MA
Konca and Erden (2021)	2021	In-service pre-school teachers	Pre-school in Turkey	Teachers' usage of digital technologies (DT) in early childhood education	Positive attitude but their DT usage was limited to a few types of activities.	Cross-sectional survey
Adebanjo and Rasheed (2021)	2021	In-service pre-school teachers	All registered private nursery schools of Ogun State, Nigeria.	Use of ICT in ECE in Ijebu North Local Government of Ogun State, Nigeria	Attitude is positive; however, teachers do not engage in activities that promote usage of ICT devices in ECE classrooms due to limited resources.	Expose-facto research design
Lee (2021)	2021	In-service pre-school teachers	Malaysian pre-schools	Relationship between pre-school teachers' teaching experience & their usage of ICT & the Internet in ECE	ICT beliefs are perceived usefulness & perceived ease of use. It influenced attitudes towards using ICT in classroom practice. Difference in belief & practices of ICT was observed.	Correlation quantitative approach

Note. PD: Publication date & MA: Methodological approach

Table 3. Use of ICT practices in different pre-school contexts

GLC	Study	Point of focus
Belgium	Kerckaert et al. (2015)	ICT uses in Flemish pre-schools.
China	Dong and Newman (2016)	Teachers' views on use of ICT in pre-schools.
Spain	Palomino (2017) & Romero Tena et al. (2020)	-Perceptions of prospective early childhood & primary teachers about using ICT. -How ECE teachers make use of ICT and its frequency.
Kosovo	Gjelaj et al. (2020)	Teachers' and parents' attitudes and practices about the role of digital technology supplies in young children's development.
Croatia	Preradović et al. (2017)	The role and attitudes of kindergarten educators in the early ICT education.
Malaysia	Lee (2021)	Relationship between pre-school teachers' teaching experience & their usage of ICT & Internet in ECE.
Jordan	Alkhalwaldeh et al. (2017)	Early years teachers' perspectives regarding role of CT in supporting children's learning.
Taiwan	Chen et al. (2018)	Perception of the application of information communication technology
Nigeria	Adebanjo and Rasheed (2021)	The use of ICT in ECE in Ijebu North Local Government of Ogun State, Nigeria.
Finland	Dong and Mertala (2021)	Teachers' perceptions of ICT
Turkey	Konca and Erden (2021)	Teachers' usage of DT in early childhood education.

Note. GLC: Geographical location context & CT: Computer technology

Use of ICT Practices in ECE

The use of ICT practices at the ECE level was studied in all the identified publications. All the listed studies have the use of ICT in focus as a direct or indirect objective. The selected studies comprise pre-schools of different geographical locations in the world. Kerckaert et al. (2015) focused on the pre-schools of Belgium; The views of Chinese ECE teachers were also included (Dong & Newman, 2016). **Table 3** describes the contextual broadness of the study in terms of ECE pre-schools and the point of focus.

Attitude of Pre-School Teachers Towards Use of ICT

The majority of research have shown that instructors use ICT, such as video clips, radio, sound clips, for instructional purposes, as well as for administrative tasks such as creating worksheets and lesson planning. Kerckaert et al. (2015) said that instructors possess favorable views towards the use of ICT and acknowledge its efficacy in instructing ECE students. However, the limited availability of resources and the insufficient competence of teachers hinder its widespread implementation. Their conclusion indicates that instructors at the ECE level have a restricted use of ICT in their teaching practices. In their research, Dong and Newman (2016) found that Chinese pre-school instructors had a rudimentary understanding of the use of ICT in ECE. They had a limited understanding of the significance of ICT for both young children and themselves. While instructors possess a positive mindset towards the use of ICT and acknowledge its value in ECE in terms of practical application, they employ it in a restricted manner. Palomino (2017) examined the viewpoint of pre-service ECE teachers on the use of ICT in ECE. Interestingly, the study found that pre-service teachers see ICT as a more powerful instructional tool compared to in-service primary teachers. In the Jordanian context, it has been observed that pre-school instructors lack a clear comprehension of the benefits and advantages of young children's computer use, specifically about ICT. Therefore, their experience in ECE is restricted in terms of practical application (Alkhalwaldeh et al., 2017). A survey done in Croatia found that most instructors had a neutral view on the advantages of ICT (Preradović et al., 2017). Research done in Taiwan found that instructors in ECE had a restricted use of ICT due to concerns about potential health consequences on children's vision (Chen et al., 2018). Additional research has also shown that pre-school instructors have a less favorable attitude towards the use of ICT (Gjelaj et al., 2020) and that its implementation in instruction is restricted (Dong & Mertala, 2021; Konca & Erden, 2021; Lee, 2021; Romero Tena et al., 2020). Particular research distinguished itself by showcasing the optimistic disposition of instructors and their readiness to implement it on a larger scope. However, the implementation of this technique is constrained by a scarcity of resources (Adebanjo & Rasheed, 2021).

Table 4. Effectiveness of ICT in teaching at ECE level

Study	Participants	Practice	Effectiveness
Kerckaert et al. (2015)	In-service pre-school teachers	Limited	Effective
Dong and Newman (2016)	In-service pre-school teachers	Limited	Ineffective
Palomino (2017)	Prospective early childhood & primary teachers	Extensive	Effective
Alkhalwaldeh et al. (2017)	In-service early years teachers	Limited	Ineffective
Preradović et al. (2017)	In-service early years teachers	Limited	Neutral
Chen et al. (2018)	In-service pre-school teachers	Limited	Effective
Gjelaj et al. (2020)	In-service pre-school teachers & parents of pre-schoolers	Limited	Ineffective
Romero Tena et al. (2020)	In-service pre-school teachers	Limited	Ineffective
Dong and Mertala (2021)	Pre-service pre-school teachers	Limited	Ineffective
Konca and Erden (2021)	In-service pre-school teachers	Limited	Effective
Adebanjo and Rasheed (2021)	In-service pre-school teachers	Limited	Effective
Lee (2021)	In-service pre-school teachers	Limited	Effective

Effectiveness of ICT at ECE

This study also aimed at exploring the effectiveness of ICT in teaching at the ECE level. In this regard, I explored the view of ECE teachers on whether they consider it useful or not. **Table 4** explains the view of teachers in this regard.

Table 4 suggests that the practice of ICT at the ECE level is limited as listed in 11 studies. According to six studies, the use of ICT is effective in teaching as students learn better with it while five studies considered it ineffective. The stance of teachers remained neutral in only one study.

DISCUSSION

The primary research inquiry of this comprehensive literature review is to ascertain the attitudes and behaviors of pre-school educators toward the use of ICT in educational settings. Regarding attitude, most research has shown that instructors exhibit a favorable disposition toward the use of ICT in ECE classrooms (Chen et al., 2018; Kerckaert et al., 2015; Konca & Erden, 2021; Lee, 2021; Palomino, 2017). The authors Chen et al. (2018), Dong and Newman (2016), Lee (2021), and Romero Tena et al. (2020) acknowledge the importance of understanding its relevance in instructing ideas and organizing their tasks. These results are consistent with previous studies that have also shown that most instructors at ECE level have a favorable attitude toward the usage of ICT (Liyanawatta et al., 2022; Mertala, 2017; Soetan et al., 2014). However, in terms of practice, 11 studies out of 12 identify limited practice due to several reasons. The teachers practice ICT in ECE in a limited way due to a lack of competency (Alkhalwaldeh et al., 2017; Kerckaert et al., 2015), lack of resources (Adebanjo & Rasheed, 2021), and potential side effects like weak eyesight (Chen et al., 2018). Similar conclusions are drawn in a few other studies that also concluded that the practice of ICT in ECE is limited to administrative work (Alper, 2013; Blackwell et al., 2014; Zomer & Kay, 2018). The study also identified that majority of ICT practice is done in terms of administrative work like planning lessons and making resources to aid the teacher-centered approach (Chen et al., 2018; Dong & Newman, 2016; Romero Tena et al., 2020). This finding aligns with another study that also came up with similar conclusions (Zomer & Kay, 2018).

The second study question sought to investigate the efficacy of using ICT in instructing pre-school-aged children. Of the 12 investigations conducted, six yielded the conclusion that it was effective (Adebanjo & Rasheed, 2021; Chen et al., 2018; Kerckaert et al., 2015; Konca & Erden, 2021; Palomino, 2017). These findings endorse the findings of several other studies that concluded with the same results (Gillespie, 2014; Teo et al., 2019; Olowe & Kutelu, 2014). The results of 5 studies in this SLR concluded that ICT is ineffective in ECE classrooms, and the same learning can be achieved using traditional means of teaching (Alkhalwaldeh et al., 2017; Dong & Mertala, 2021; Dong & Newman, 2016; Gjelaj et al., 2020; Romero Tena et al., 2020). These results deviate from the consensus of the research included in SLR as well as numerous additional studies that were not included in it. The rationale for these results may be elucidated by referencing another research that demonstrates a correlation between teachers' involvement with ICT and their attitude towards technology, as well as their self-confidence in using technology for educational purposes. The instructors' insufficient understanding and competence in managing ICT may lead to an attitude that hinders their use of it, causing them to see it as ineffective (Varol, 2013).

Limitations

The limitation of this SLR is that only the retrievable studies were included. The factors like hurdles to the usage of ICT in ECE lay outside the aims of this study. These factors surfaced in many studies that could have explained the negative attitude and limited practice of ICT at this level. I tried to minimize these limitations by including robust results as it is said that SLR may be seen as a means to get sensible answers to an absorbed research investigation (Siddaway, 2014).

CONCLUSIONS & OUTLOOK

A comprehensive search was conducted on popular literature platforms to gather relevant information for this research. Eventually, a total of 12 papers were selected to investigate the use of ICT in ECE. The objective of this research was to investigate the disposition of ECE teachers towards the incorporation and use of ICT in the instructional process. The study also examined the

use of ICT and the overall perspective of instructors on its effectiveness in delivering knowledge at this educational level. The study's findings indicate that although most instructors possess a favorable disposition towards using ICT as an instructional tool in ECE, virtually all of them exhibit restricted use of it inside the classroom. This limited practice is the result of several reasons including lack of competency, lack of resources, potential health risks, and lack of personal engagement in handling ICT gadgets.

Half of the studies included in this SLR deemed the use of ICT as effective in terms of teaching while the other half gravitated towards the opposite view as they opined that the same learning can be achieved using traditional means at this level. This provides additional opportunities for future research to investigate the underlying factors contributing to this outcome. Further research might investigate the obstacles hindering the use of ICT in education at the ECE level, to provide a more detailed explanation for its limited implementation at this stage.

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Ethical statement: The author stated that this systematic literature review is focused on synthesizing information from previously published studies and does not involve direct engagement with human participants. As this research solely relies on the analysis of existing literature, it does not involve interventions, interactions, or the collection of primary data from human subjects. Therefore, formal approval from an ethics committee is not applicable, and the study is conducted in accordance with established ethical standards for secondary data analysis. Given that the review is based on information already available in the public domain through published studies, there is no direct interaction with individual participants. As a result, the concept of informed patient consent is not applicable to this systematic literature review.

Declaration of interest: No conflict of interest is declared by the author.

Data sharing statement: Data supporting the findings and conclusions are available upon request from the author.

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