

RESEARCH ARTICLE

Digital disruption in early childhood education from teachers' point of view: A qualitative research

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Received: January 4, 2023;

Accepted: February 24, 2023;

Published: February 28, 2023.

Citation: Ali Ahmad, N. A. (2023). Digital disruption in early childhood education from teachers' point of view: A qualitative research. *Advances in Mobile Learning Educational Research*, 3(1), 671-681. <https://doi.org/10.25082/AMLER.2023.01.016>

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Abstract: In the digital age, teachers must have a more favourable attitude toward information and communication technology (ICT). In the current study, the researcher used a qualitative interview to learn more about early childhood teachers (ECTs) perspectives on the use of ICT in online learning during the Covid-19 pandemic. The researcher in Palestine interviewed 63 female early childhood educators to collect data. "Thematic coding techniques" were used to analyze the interview data. Within five main themes, "ICT advantages" (8 sub-subjects), "the significance of ICT competencies" (2 sub-subjects), "promotion of the ICT training" (5 sub-themes), "the uses of ICT" (6 sub-subjects), and "challenges to using ICT", the research gathered specific information on how teachers perceived digital disruption during the Covid-19 pandemic (5 sub-subjects). The findings showed that increased promotion of ICT training that encourages ICT use among ECTs is necessary. This study adds to the body of knowledge regarding the application of ICT in the early childhood teaching process. Additionally, this study expands on empirical research findings that help report on the use of online learning in Early Childhood Education (ECE), particularly in times of crisis.

Keywords: early childhood education, early childhood teachers, ICT, Palestine

1 Introduction

Nowadays, children are born into the digital age (Louka, 2022; Mercan et al., 2022). According to research, children between the ages of 2-4 spend roughly 80 minutes daily at home using smartphones and tablets (Michelle, 2015; Gillen & Kucirkova, 2018). Furthermore, according to Ofcom (2017), kids between the ages of 5-7 spend at least 6 hours each week watching YouTube. This is unquestionably why early childhood education (ECE) teachers should be more knowledgeable about using ICT in the classroom. The findings of studies by Kara & Kursat (2017), Courtney et al. (2014), Dong & Xu (2020), Ogegbo & Aina (2020), and Konca et al. (2016) and Jalongo (2021) demonstrated that early childhood teachers (ECT's) beliefs and attitudes had a favourable influence on the use of ICT. To improve the learning experiences of children, ICT use in ECE has become essential. ICT will also help with administrative and communication operations (Arıcı et al., 2022; Dahal et al., 2022a).

Accordingly, the need for investigations on the perceptions of the ECTs related to ICT seems to attract the attention of several researchers, such as a study conducted by (Kalogiannakis & Papadakis, 2022; Malhotar, 2014; Ghavifekr & Rosdy, 2015; Dong, 2018; Mansour, 2018; Deng et al., 2016; Donnelly et al., 2021; Zinger et al., 2017; Wilson et al., 2017; Tondeur et al., 2020; Mertala, 2019; Jones, 2017; Munyengabe et al., 2017) indicating that teachers have realized the importance of integrating ICT in their teaching process. Similar research was also carried out by (Nikolopoulou et al., 2015; Kaindio et al., 2014; Namat et al., 2020), revealing that many ECTs feel confident when integrating ICT into the teaching process. In addition, Namat et al., 2020, Parette et al., 2010; Tondeur et al., 2012; Ali Ahmad, 2020; Sonia et al., 2019; Andriyah & Asih, 2021; Kim, 2020) some researchers (Namat et al., 2020; Parette et al., 2010; Tondeur et al., 2012; Ali Ahmad, 2020; Sonia et al., 2019; Andriyah & Asih, 2021; Kim, 2020) reported that ECTs consider that the use of ICT is suitable in ECE, especially in creating various activities to support children's cognitive development (Gözüm et al., 2022).

As a whole, ECE aims to evolve the potential of children, through fun, creative, and meaningful environments and activities, in addition to improving skills and self-confidence with the current situation, overcoming obstacles and carrying responsibilities while in primary school later. ECE is fundamental education to increase the potential of children before entering the primary school environment. For the time being, ICT is becoming increasingly significant to be incorporated into the teaching and learning process of preschool in the 21st century with the hope that Palestinian education is on par with education in other developed countries (Karakose et al., 2022).

The Covid-19 pandemic has recently mandated the use of ICT at all educational levels, including ECE (Sunar et al., 2022). Even while using ICT to help the learning process has numerous advantages, it will undoubtedly be difficult for education levels where most of the learning process does not heavily utilize ICT, such as in the ECE in Palestine. Before the Covid-19 epidemic, face-to-face instruction was used in all early childhood settings in Palestine (Ali Ahmad, 2022). However, the Covid-19 epidemic necessitates online learning in all early childhood institutions (Sunar et al., 2022). This is undoubtedly quite upsetting for Palestinian ECTs unfamiliar with using ICT in the teaching process (Ali Ahmad, 2022). Therefore, this study aimed to ascertain how ECTs in Palestine felt about applying ICT to the teaching and learning process. The study's findings offer insight into how ICT is used to support the teaching and learning process in ECE and a summary of how online learning is used in this field during the Covid-19 epidemic.

The justifications for conducting the current research are that it is a continuation of previous works carried out by the researcher in the same field in the year 2020, a survey study about the obstacles to Integrate ICT in kindergartens' education from the headmistresses' viewpoint in the Salfeet Governorate / Palestine, while the study conducted in 2022 is a qualitative study about the digital disturbance in ECE in the midst of and post "COVID – 19" Pandemic Period from teachers' viewpoint in the Salfeet Governorate / Palestine. While the above two studies were limited to a geographical area, this study includes all Palestinian governorates (*i.e.*, West bank and Gaza strip).

This paper is structured as follows: First, the research motivation based on the literature was presented. Second, this paper presents the methodology, including research design, data collection, and analysis. Afterwards, this paper presents the results, followed by an analysis and discussion. This paper presents the conclusion and limitations, and suggestions finally.

2 Methodology

Figure 1 represents the methodology flowchart that indicates the steps the research followed.

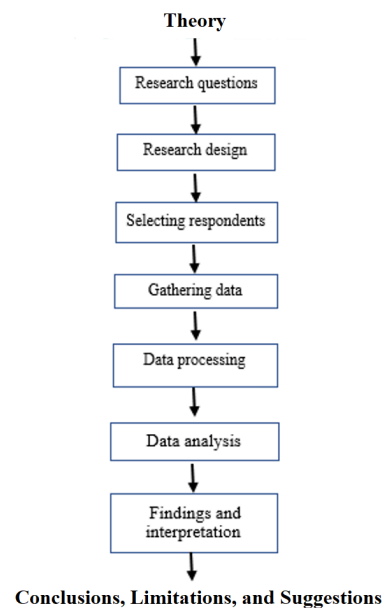


Figure 1 Methodology flowchart

2.1 Research design

A qualitative methodology, including interviewing techniques, was used in this investigation (Petousi & Sifaki, 2020). This method is thought to aid the researcher in gathering extensive and in-depth knowledge concerning perspective (John, 2003). The interview questions were broken up into two parts, with the first section focusing on the respondents' demographic data and the second section answering the following five research questions (RQs):

- RQ1. What are the advantages of ICT in ECE teaching and learning?
- RQ2. How important are ICT skills for teachers in ECE?
- RQ3. How do the institutions encourage ICT skill-upgrading training for the ECTs?
- RQ4. How is ICT used in ECE teaching and learning?
- RQ5. What are the difficulties encountered while utilizing ICT for ECE teaching and learning?

2.2 Data collection

From December 2020 to February 2021, the researcher used various social media to encourage ECTs to participate in the current study. 63 ECTs from Palestine (West Bank & Gaza Strip) were approved for interviews in total. Table 1 presents the data regarding respondents. In light of the Covid-19 epidemic, the interview process was conducted online with a duration of about 15 to 25 minutes using Google Forms to capture the responses.

Table 1 Respondents' profile

Personal Details	Category	No.	Percentage
Age	20 – 29	21	33.33
	30 – 39	25	39.69
	≥ 40	17	26.98
Qualifications	Diploma	15	23.81
	Bachelor	37	58.73
	Higher education	11	17.46
Years of Teaching Experience	1 – 4	14	22.22
	5 – 9	36	57.15
	≥ 10	13	20.63
Geographic Location	Nablus	9	14.29
	Tulkarm	10	15.87
	Jenin	8	12.69
	Salfeet	12	19.05
	Ramallah	9	14.29
	Hebron	7	11.11
Gaza Strip	8	12.70	

2.3 Data analysis

The data were examined using “thematic coding approaches” (Richard, 1998). The principal objective of this research was to identify the common themes within all respondents' responses. 1) The five primary themes were used to classify all interview transcripts; 2) To identify the topic category, the answers' results that have been grouped were reviewed numerous times (each respondent may provide one response, more than one response, or no response at all); 3) The relationships between each respondent's responses were further examined. The researcher performed these three procedures manually to reduce subjectivity.

3 Results

3.1 ICT benefits for ECTs

As shown in Table 2, eight sub-themes of the advantages of ICT for teachers were discovered by thematic analysis of the interview data. These conclusions indicate that the following beneficial effects occurred when the teachers, in this case, the study employed ICT:

- (1) ICT facilitated teachers' successful delivery of the lesson plan;
- (2) ICT can improve teachers' pedagogical skills;
- (3) The teacher can facilitate online learning by using ICT. ICT use can improve the clarity with which learning content is explained;
- (4) ICT can give pupils opportunities to interact with technology. Early infancy is characterized by a high level of curiosity, which makes young children particularly eager and interested when learning to use ICT;
- (5) ICT can assist teachers in creating lesson plans. ICT gives instructors excellent reference materials, teaching strategies, and media that align with kids' developmental and learning needs. This has prompted the creation of educational innovations that will raise the standard of both teaching and learning;
- (6) ICT can speed up pupils' understanding of the lesson material. Early infancy is a part of the Alpha generation in this digital age. This generation has grown up around touch screens and relies heavily on displays for information;
- (7) ICT can enhance parent communication with a student's online learning assignment. Positive connections between parents, teachers, and students require effective communication. Many social media sites, including WhatsApp, Messenger, etc., can be utilized to improve communication between teachers and parents;
- (8) Teachers are now more innovative and creative because of ICT. ICT can be used to improve innovative instruction.

Table 2 Benefits of using ICT

No.	Sub-themes	Respondents	Response Sample
1	Promote teachers to creative teaching	8	“Encourage innovation and inventiveness.” “Foster creativity in the educational process”
2	Improve parent-teacher communication	11	“Simplifying parent-child communication.” “Enhancing teacher-parent communication.”
3	Assist students in acquiring new technological skills	6	“Students learn better with technology.” “Engaging pupils with technologies.” “Making learning more appealing to students.”
4	An easy method of material preparation	5	“Searching for learning materials.” “Can provide teachers with more ideas and inspiration.”
5	Provide students with learning opportunities	7	“Enhancing educational experiences for students”. “Increasing the interest in the instructional process.”
6	Efficient at encouraging student play	9	“Developing effective learning.” It can be utilized to aid with learning. “Improving instruction and learning.”
7	Aiding educators to stay current with technology.	8	“Growing knowledge in the globalization era.” “Can assist educators in keeping up with advances in science and technology.” “Can assist teachers in acquiring all knowledge.” “Can support teachers in improving their technical literacy.”
8	Easy way to share materials	9	“Can assist teachers in sharing educational resources.” “Share materials with ease.” “Store materials digitally.”

3.2 The significance of ICT competencies for teachers

The results of the thematic analysis of the interview data revealed two sub-themes on the significance of ICT competency mastery for ECTs, as shown in Table 3. These results indicate that all responders had a favourable viewpoint on the significance of ICT competency mastery for ECTs. This was undoubtedly a strong beginning for ECE in the current digital era.

Table 3 Respondents perceived the significance of ICT competencies

No.	Sub-themes	Respondents	Response Sample
1	Very Significant	44	“Technology is becoming more advanced and sophisticated.” “Teachers must understand how to use technology.”
2	Significant	17	“ICT is a resource for learning”. “Improving ICT skills can speed up the learning process.”

3.3 Promotion of the ICT training for teachers

The results of the thematic analysis of the interview data revealed five sub-themes on how the institutions support training to advance the ICT skills of early childhood teachers, as shown in Table 4. These results show a wide range in how teachers perceived the institutions’ promotion of ICT training for improving teachers’ ICT competencies. To increase ECTs’ ICT proficiency, institutions must offer more assistance.

Table 4 Respondent’s perception of the promotion of the ICT training

No.	Subthemes	Responses	Response Sample
1	Very Unsupportive	24	“No training has been provided”
2	Fairly Unsupportive	12	“Lack of training on ICT”
3	Moderate	8	“Basic (initial) ICT training”
4	Fairly supportive	9	“Training on the use of digital media such as Instagram, Pinterest etc.”
5	Very Supportive	10	“1 to 2 times for ICT training per week”

3.4 The uses of ICT in the teaching process

The interview results’ thematic analysis revealed six sub-themes on the use of ICT in early childhood education, as indicated in Table 5. These results indicate that the following teaching activities are assisted by ICT during the Covid-19 epidemic in this case study:

- (1) Activities that involve drawing and colouring in the classroom;
- (2) Digital picture book learning in early childhood education must be concrete, according to one of its guiding principles. Technology like digital picture books, which can provide kids with realistic pictures, can help with this;
- (3) Producing instructional videos. With free online video editing tools, teachers may produce informative videos;
- (4) Teachers used the resources that were available for video conferencing activities;
- (5) Distributing the lesson plans and homework assignments;
- (6) Watching instructional Videos on particular subjects.

Table 5 The uses of ICT in teaching

No.	Sub-theme	Responses	Response samples
1	Drawing and colouring activities	4	"ICT can be used in student-created drawing and colouring activities."
2	Accessible digital picture books	5	"Digital picture books can assist children in learning to read." "To share digital image books with pupils."
3	Creating educational videos	7	"Can help teachers create and edit movies." "Can help teachers generate instructional videos." "Can help teachers create instructional videos to explain the lessons."
4	Classroom video calls	19	"Using video calls for guest speakers, teaching digitally through Zoom Meetings, and using Google Meet."
5	Sharing teaching resources	13	"Using WhatsApp to share files" "Using WhatsApp to share discussions and information" "Adding teaching resources to Google Classroom."
6	Showing videos	15	"Watching short history movies" "Watching animation videos" "Watching films for students"

3.5 Challenges teachers Face when using ICT

Six sub-themes of the problems of adopting ICT were discovered by thematic analysis of the interview data, as indicated in [Table 6](#). These data indicate that the following was the primary difficulties experienced by the teachers in these case studies during the Covid-19 pandemic:

- (1) The majority of teachers stated that a poor internet connection was the main obstacle to the use of online learning;
- (2) Teachers need to use ICT effectively to conduct online learning. The ICT equipment's restricted availability impacts the need for more technical competence among classroom instructors;
- (3) There currently needs to be more ICT resources available in kindergartens to facilitate online learning;
- (4) Not all parents of students have positive ICT device experiences, making it challenging to undertake online learning;
- (5) Some pupils' parents needed more technology for online learning;
- (6) Time constraints using ICT in teaching and learning.

Table 6 Challenges for using ICT

No.	Sub-theme	Respondents	Respondents sample
1	Inadequate (Poor) Internet connection	13	"Patchy internet connection" "low-quality internet network"
2	Teachers' lack of technical experience	14	"The teachers' online learning experience was not that nice" "Many teachers feel inadequate and confused when utilizing ICT equipment"
3	There need to be more ICT resources in classrooms.	15	"Due to the restricted quantity of laptops at the kindergarten and the absence of projectors and laptops, the teachers alternated using their computers".
4	Parents of students need to gain more familiarity with technology.	5	"Parents of kids have a poor understanding of technology, not all parents of students have used laptops, and some parents of students do not know how to operate a laptop."
5	Parents of the student lack the proper equipment	6	"Most parents of kids lacked access to laptops, and not all parents of students possess smartphones."
6	Time limitations	10	"There is not enough time due to the many teaching daily burdens."

4 Discussion

4.1 ICT benefits for ECTs

According to the findings of the interviews with early childhood instructors in Palestine, there were eight positive effects when the teachers used ICT (Ampartzaki et al., 2022). The top 5 advantages of ICT for ECTs were identified in this case study as “the simple way to share resources,” “help teachers to keep up with technology,” “effective to encourage student’s play,” “provide a learning experience to the student,” and “easy way to create materials.” The other advantages of employing ICT in the education process included “helping pupils to gain new technical abilities,” “improving parent-teacher communication,” and “promoting teachers to creative teaching.” This finding is supported by Gillen & Kucirkova (2018), Namat et al. (2020), and Aditya et al. (2021), where using ICT in ECE and the way digital technology gives children’s opportunity for richness in pedagogy and practice in ECE. It plays a vital role in preschool in assisting the development of children (Ali Ahmad, 2022).

There are various discussion points within the eight categories of ICT benefits that the teachers noticed. According to the pupils, the initial benefit is the biggest (Ampartzaki et al., 2021). The introduction of various ICT tools into the early childhood setting affects the growth of teachers’ creativity and innovation. This is excellent for maintaining the teaching and learning process, which calls for ECTs to be highly creative. Additionally, assistance was provided to teachers to enhance their teaching delivery strategy. Students who use high-quality learning materials learn more efficiently and become excited.

Parents of students claim that ICT has advantages. Effective communication is made possible during online learning because of ICT. The quality of instruction and kids’ growth could be enhanced by improved communication between parents and instructors (Duta et al., 2015; Awang & Zawawi, 2015; Namat et al., 2020; and Aditya et al. (2021). Active communication could have been more effective and slowed the teaching and learning process. The advantages of ICT are also seen in the light of the teachers selves (Papadakis & Kalogiannakis, 2022). The use of ICT has helped teachers become more proficient in using technology. In order to improve the quality of the teaching process in the digital era, teachers can continuously adapt to changing circumstances (Sonia et al., 2019). It can be stated that the results obtained in this direction are in parallel with the literature (e.g., Ali Ahmad, 2020; 2022; Aditya et al., 2022; Dahal et al., 2022a; Deng et al., 2016; Malhotra, 2014).

4.2 The significance of ICT competencies for teachers

The results showed that all teachers in this study confirmed that developing ICT competencies was critical. All teachers have a positive perspective on the need to improve ICT competencies (Lavidas et al., 2022). This was undoubtedly a positive thing to encourage the increase of ICT competence for ECTs (Sonia et al., 2019). More training, consultations, and workshops are needed to improve ICT competencies for the success of online learning (Abuhmaid, 2011; Purnomo & Ghofar, 2018; Wong & Daud, 2018; Murithi & Yoo, 2021). This suggests that the results align with the literature (e.g. Andrisyah & Asih, 2021; Casillas-Martín et al., 2019; Cebi & İlknur, 2020).

4.3 Promotion of ICT training for teachers

The findings indicated that Palestine still had a poor promotion rate for ICT training for ECTs. This is evident because only 19 replies from teachers mentioned that they were receiving support from a facility to provide ICT training for instructors. ICT training aids educators in incorporating technology into the ECE classroom (Sonia et al., 2019; Andrisyah & Asih, 2021; Saprikis et al., 2019). The findings obtained in this direction are in parallel with the prior studies (e.g. Abuhmaid, 2011; Mamat et al., 2020; Malhotra, 2014).

4.4 The uses of ICT in the teaching process

Six activities will be used throughout the deployment of online learning, according to the findings of an interview with ECTs in Palestine. The top ICT usage in the classroom was identified as “showing videos,” “sharing teaching resources,” “classroom video calls,” and “creating educational videos.” Drawing and colouring activities were also viewed as additional activities when employing ICT in the educational process, along with “Accessible digital picture books.” It is clear from the six ICT-supported activities for teachers that the usage of ICT was still restricted to experimenting with and utilizing applications for sending materials and assignments, such as WhatsApp, Google Meet, and Zoom. With ECE’s qualities emphasizing play and interaction, learning objectives may need to be met more effectively (Kim, 2020). More innovation and growth are required regarding ICT use in the early childhood setting (Kalogiannakis & Papadakis,

2017). This result is consistent with many previous works (e.g. Ghavifekr & Rosdy, 2015; Jo Tondeur, 2017; Mwanda et al., 2017).

4.5 Challenges faced by teachers in using ICT

The results of the interviews with ECTs in Palestine have led to the identification of six significant problems during the implementation of online learning. The main difficulties encountered when utilizing ICT in the teaching process were listed as “not enough ICT tools in classrooms,” “teachers’ lack of technical skills,” “bad internet connection,” “Lack of technology experiences of teachers,” and “time restrictions.” This finding is supported by Ali Ahmad (2020). Other difficulties with employing ICT in the educational process were “lack of technological experiences of student’s parents” and “lack of sufficient equipment on student’s parents.” The biggest challenge is related to IT infrastructure for the success of online learning, both related to the availability of internet networks and ICT devices such as hardware and software (Papadakis et al., 2021).

This is evident among the six challenges teachers face when implementing ICT in the teaching and learning process. Many factors cause the signal to be unstable in various places, such as geographic location, type of network, and sometimes unstable electricity networks, which are common in Palestine, especially in the Gaza strip. Additionally, using ICT is a must for online learning. However, there were still few ICT resources available in kindergartens. This is since before the pandemic, ICT use in ECE was only between 10 and 25 per cent of face-to-face learning (Ali Ahamd, 2020).

ECTs’ ICT skills are a barrier that frequently appears in the online learning process. The teachers needed help with the extensive stages of ICT use, the use of foreign languages, and abundant resources and instructional materials. To enhance ICT competencies, exercises (training) involving computers or other ICT devices are required (Sonia et al., 2019; Kim, 2020; Çebi & Reisoglu, 2020; Casillas-Martín et al., 2019). Moreover, it was still difficult to get parents of pupils to support their online study. Parents of students participated more in the learning process when it was done online. Due to a lack of ICT resources at home, most online learning is done on mobile devices, and many parents have never used a laptop or other types of ICT equipment. It is worth mentioning in this regard that the challenges facing teachers in the use of information and communication technology in education in Palestine are the same as in developing countries, as shown by the results of many studies (e.g. Ali Ahmad, 2020; Sonia et al., 2019; Mamat et al., 2020; and Aditya et al., 2021; Ali Ahmad, 2022; Mwanda et al., 2017).

5 Conclusion

The digital disruption in ECE is discussed in this paper from the viewpoint of the teachers. The study’s findings concluded that ECTs have a positive attitude toward using ICT in response to the five research questions posed. Concerning the Covid-19 epidemic, this study mainly supported the idea that ICT can be disruptive to teaching and learning in some ways. This study also revealed that ECTs still need help incorporating ICT into online lessons and activities. Additionally, despite knowing how to use ICT, ECTs are hindered from doing so successfully due to a lack of technical support and ICT training. Due to its real-world methodology, this study adds to the body of empirical research findings that may be used to describe the practice of online learning in ECE.

In conclusion, based on the results, the new generation accepts the importance of ICT, whether teachers or learners. The effect of this work on theory gives new input for ECTs that the advantages of ICT integration in the teaching and learning process either from public or private preschools, especially in crises, as in the Corona pandemic, in light of the rapid digital transformations. This work’s findings showed that ICT’s role in teaching and learning allows ECTs to rethink basic pedagogical styles for children to apply in classrooms. Even though ICT knowledge and skills among ECTs’ is not so good due to many challenges and lack of training, using ICT in teaching activities is very significant. Thus, Digital technology and innovative approaches must be introduced to students early before they are outpaced by constantly changing technology. By adopting digital technology in pedagogy, overcoming challenges, and continuous training, ECTs become strong proponents and advocates and catalysts for educational innovation. Using several social media, besides their entertainment value, has raised much attention in education and research because of their embedded advantages for learning. Despite many educators being sceptical about digital technology, entertaining activities can help children develop cognitive skills like critical thinking, reasoning, and problem-solving skills.

6 Limitations and suggestions

One of the limitations of this study is examined from the perspectives of ECTs in Palestine. Therefore, the results of this study cannot be generalized. However, this study has looked into a

new phenomenon to comprehend better how the digital revolution may affect ECE. Future studies should examine how parents are involved in online learning. After that, more context of other countries is recommended for future research.

References

- Abuhmaid, A. (2011). ICT training courses for teacher professional development in Jordan. *Turkish Online Journal of Educational Technology*, 10(4): 195-210.
- Ali Ahmad, N. (2020). The Obstacles to Integrate Information and Communication Technology (ICT) in Kindergartens' Education from the Headmistresses View Point: A Survey Study in Salfet Governorate / Palestine. *Journal of Education and Human Development*, 9(3):109-121.
<https://doi.org/10.15640/jehd.v9n3a12>
- Ali Ahmad, N. (2022). Digital Disturbance in Early Childhood Education in the Midst of and Post COVID - 19 Pandemic Period: A Qualitative Study from Teachers' Viewpoint. *American Journal of Educational Research*, 10(8): 484-490.
<https://doi.org/10.12691/education-10-8-2>
- Ampartzaki, M., Kalogiannakis, M., & Papadakis, S. (2021). Deepening our knowledge about sustainability education in the early years: Lessons from a water project. *Education Sciences*, 11(6), 251.
<https://doi.org/10.3390/educsci11060251>
- Ampartzaki, M., Kalogiannakis, M., Papadakis, S., & Giannakou, V. (2022). Perceptions about STEM and the arts: Teachers', parents' professionals' and artists' understandings about the role of arts in STEM education. In *STEM, Robotics, Mobile Apps in Early Childhood and Primary Education: Technology to Promote Teaching and Learning* (pp. 601-624). Singapore: Springer Nature Singapore.
https://doi.org/10.1007/978-981-19-0568-1_25
- Dini, J. P. A. U. (2021). The impact of distance learning implementation in early childhood education teacher professional competence. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, 5(2), 1815-1824.
<https://doi.org/10.31004/obsesi.v5i2.1009>
- Awang, H., & Daud, Z. (2015). Improving a communication skill through the learning approach towards the environment of engineering classroom. *Procedia-social and behavioral sciences*, 195, 480-486.
<https://doi.org/10.1016/j.sbspro.2015.06.241>
- Aditya, B. R., Ismiatun, A. N., Atika, A. R., & Permadi, A. (2022). Digital disruption in early childhood education: a qualitative research from teachers' perspective. *Procedia Computer Science*, 197, 521-528.
<https://doi.org/10.1016/j.procs.2021.12.169>
- Casillas-Martín, S., Cabezas-González, M., & García-Peñalvo, F. J. (2019). Digital competence of early childhood education teachers: attitude, knowledge and use of ICT. *European Journal of Teacher Education*, 43(2), 210-223.
<https://doi.org/10.1080/02619768.2019.1681393>
- Çebi, A., & Reisoğlu, İ. (2020). Digital competence: A study from the perspective of pre-service teachers in Turkey. *Journal of New Approaches in Educational Research (NAER Journal)*, 9(2), 294-308.
<https://doi.org/10.7821/naer.2020.7.583>
- Chen, L., Chen, T. L., Lin, C. J., & Liu, H. K. (2018). Preschool teachers' perception of the application of information communication technology (ICT) in Taiwan. *Sustainability*, 11(1), 114.
<https://doi.org/10.3390/su11010114>
- Blackwell, C. K., Lauricella, A. R., & Wartella, E. (2014). Factors influencing digital technology use in early childhood education. *Computers & Education*, 77, 82-90.
<https://doi.org/10.1016/j.compedu.2014.04.013>
- Dahal, N., Manandhar, N. K., Luitel, L., Luitel, B. C., Pant, B. P., & Shrestha, I. M. (2022a). ICT tools for remote teaching and learning mathematics: A proposal for autonomy and engagements. *Advances in Mobile Learning Educational Research*, 2(1), 289-296.
<https://doi.org/10.25082/AMLER.2022.01.013>
- Deng, F., Chai, C. S., Tsai, C. C., & Lee, M. H. (2014). The relationships among Chinese practicing teachers' epistemic beliefs, pedagogical beliefs and their beliefs about the use of ICT. *Journal of Educational Technology & Society*, 17(2), 245-256.
- Dong, C. (2018). 'Young children nowadays are very smart in ICT'—preschool teachers' perceptions of ICT use. *International Journal of Early Years Education*, 1-14.
<https://doi.org/10.1080/09669760.2018.1506318>
- Dong, C., & Xu, Q. (2021). Pre-service early childhood teachers' attitudes and intentions: young children's use of ICT. *Journal of Early Childhood Teacher Education*, 42(3), 203-218.
<https://doi.org/10.1080/10901027.2020.1726843>
- Donnelly, D., McGarr, O., & O'Reilly, J. (2011). A framework for teachers' integration of ICT into their classroom practice. *Computers & education*, 57(2), 1469-1483.
<https://doi.org/10.1016/j.compedu.2011.02.014>
- Duta, N., Panisoara, G., & Panisoara, I. O. (2015). The Effective Communication in Teaching. Diagnostic study regarding the academic learning motivation to students. *Procedia-Social and Behavioral Sciences*, 186, 1007-1012.
<https://doi.org/10.1016/j.sbspro.2015.04.064>
- Eckhoff, A. (2011). Creativity in the early childhood classroom: Perspectives of pre service teachers. *Journal of Early Childhood Teacher Education*, 32(3), 240-255.
<https://doi.org/10.1080/10901027.2011.594486>

- Ghavifekr, S. & Rosdy, W. A. W. (2015). Teaching and learning with technology: Effectiveness of ICT integration in schools. *International Journal of Research in Education and Science (IJRES)*, 1(2), 175-191.
<https://doi.org/10.21890/ijres.23596>
- Gillen, J., & Kucirkova, N. (2018). Percolating spaces: Creative ways of using digital technologies to connect young children's school and home lives. *British Journal of Educational Technology*, 49(5), 834-846.
<https://doi.org/10.1111/bjet.12666>
- Gözüm, A. I. C., Papadakis, S., & Kalogiannakis, M. (2022). Preschool teachers' STEM pedagogical content knowledge: A comparative study of teachers in Greece and Turkey. *Frontiers in Psychology*, 13, 1-19.
<https://doi.org/10.3389/fpsyg.2022.996338>
- Jalongo, M. R. (2021). The Effects of COVID-19 on Early Childhood Education and Care: Research and Resources for Children, Families, Teachers, and Teacher Educators. *Early Childhood Education Journal*, 49(3), 763-774.
<https://doi.org/10.1007/s10643-021-01208-y>
- Tondeur, J., Scherer, R., Siddiq, F., & Baran, E. (2017). A comprehensive investigation of TPACK within pre-service teachers' ICT profiles: Mind the gap!. *Australasian Journal of educational technology*, 33(3), 46-60.
<https://doi.org/10.14742/ajet.3504>
- Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.
- Jones, S. J. (2017). Technology in the Montessori Classroom: Teachers' Beliefs and Technology Use. *Journal of Montessori Research*, 3(1), 16-29.
<https://doi.org/10.17161/jomr.v3i1.6458>
- Kaindio, M. P., & Wagithunu, M. N. (2014). Integrating information communication technology skills in preschool education in Kenya. *Mediterranean Journal of Social Sciences*, 5(5), 89.
<https://doi.org/10.5901/mjss.2014.v5n5p89>
- Kalogiannakis, M., & Papadakis, S. (2017). A proposal for teaching ScratchJr programming environment in preservice kindergarten teachers. In *Proceedings of the 12th Conference of the European Science Education Research Association (ESERA)* (pp. 21-25).
- Kalogiannakis, M., & Papadakis, S. (2022). Preparing Greek Pre-service Kindergarten Teachers to Promote Creativity: Opportunities Using Scratch and Makey Makey. In *Children's Creative Inquiry in STEM* (pp. 347-364). Cham: Springer International Publishing.
https://doi.org/10.1007/978-3-030-94724-8_20
- Nuri, K. A. R. A., & Cagiltay, K. (2017). In-service preschool teachers' thoughts about technology and technology use in early educational settings. *Contemporary Educational Technology*, 8(2), 119-141.
<https://doi.org/10.30935/cedtech/6191>
- Karakose, T., Polat, H., Yirci, R., Tülübaş, T., Papadakis, S., Ozdemir, T. Y., & Demirkol, M. (2023). Assessment of the Relationships between Prospective Mathematics Teachers' Classroom Management Anxiety, Academic Self-Efficacy Beliefs, Academic Amotivation and Attitudes toward the Teaching Profession Using Structural Equation Modelling. *Mathematics*, 11(2), 449.
<https://doi.org/10.3390/math11020449>
- Kim, J. (2020). Learning and teaching online during Covid-19: Experiences of student teachers in an early childhood education practicum. *International Journal of Early Childhood*, 52(2), 145-158.
<https://doi.org/10.1007/s13158-020-00272-6>
- Konca, A. S., Ozel, E. & Zelyurt, H. (2016). Attitudes of preschool teachers towards using information and communication technologies (ICT). *International Journal of Research in Education and Science*, 2(1), 10-15
<https://doi.org/10.21890/ijres.21816>
- Lavidas, K., Apostolou, Z., & Papadakis, S. (2022). Challenges and opportunities of mathematics in digital times: Preschool teachers' views. *Education Sciences*, 12(7), 459.
<https://doi.org/10.3390/educsci12070459>
- Louka, K. (2022). Programming environments for the development of CT in preschool education: A systematic literature review. *Advances in Mobile Learning Educational Research*, 3(1), 525-540.
<https://doi.org/10.25082/AMLER.2023.01.001>
- Malhotra, P. (2014). Integration of ICT in Teaching and Learning. *International Journal of Research*, 10, 198-209.
- Mamat, N., Kamarudin, K., Ali, S. R., & Noh, N. M. (2020). The Integration of Information and Communication Technology (ICT) in Teaching and Learning in Government and Private Preschools in Malaysia. *International Journal of Academic Research in Business and Social Sciences*, 10(11), 104-112.
<https://doi.org/10.6007/IJARBS/v10-i11/7881>
- Mansour, N. (2008). The experiences and personal religious beliefs of Egyptian science teachers as a framework for understanding the shaping and reshaping of their beliefs and practices about science-technology-society (STS). *International journal of science education*, 30(12), 1605-1634.
<https://doi.org/10.1080/09500690701463303>
- Mercan, Z., Papadakis, S., Can Gözüm, A. İ., & Kalogiannakis, M. (2022). Examination of STEM Parent Awareness in the Transition from Preschool to Primary School. *Sustainability*, 14(21), 14030.
<https://doi.org/10.3390/su142114030>

- Mertala, P. (2019). Teachers' beliefs about technology integration in early childhood education: A meta-ethnographical synthesis of qualitative research. *Computers in Human Behavior*, 101, 334-349. <https://doi.org/10.1016/j.chb.2019.08.003>
- Neumann, M. M. (2015). Young children and screen time: Creating a mindful approach to digital technology. *Australian educational computing*, 30(2), 1-15.
- Munyengabe, S., Yiyi, Z., Haiyan, H., & Hitimana, S. (2017). Primary teachers' perceptions on ICT integration for enhancing teaching and learning through the implementation of one laptop per child program in primary schools of Rwanda. *Eurasia Journal of Mathematics, Science and Technology Education*, 13(11), 7193-7204. <https://doi.org/10.12973/ejmste/79044>
- Murithi, J., Yoo, J.E. (2021). Teachers' use of ICT in implementing the competency-based curriculum in Kenyan public primary schools. *Innov Edu.*, 3(5): 1-12. <https://doi.org/10.1186/s42862-021-00012-0>
- Mwanda, G., Mwanda, S., Midigo, R., & Maundu, J. (2017). Integrating ICT into Teaching and Learning Biology: A Case for Rachuonyo South Sub-County, Kenya. *American Journal of Education and Information Technologies*, 1, 17-23. <https://doi.org/10.11648/j.ajeit.20170102.12>
- Nikolopoulou, K., & Gialamas, V. (2015). ICT and play in preschool: early childhood teachers' beliefs and confidence. *International Journal of Early Years Education*, 23(4), 409-425. <https://doi.org/10.1080/09669760.2015.1078727>
- Ofcom. (2017). *Children and Parents: Media Use and Attitudes Report*. London, UK.
- Ogegbo, A. A., & Aina, A. (2020). Early childhood development teachers' perceptions on the use of technology in teaching young children. *South African Journal of Childhood Education*, 10(1), 1-10. <https://doi.org/10.4102/sajce.v10i1.880>
- Papadakis, S., & Kalogiannakis, M. (2022). Exploring preservice teachers' attitudes about the usage of educational robotics in preschool education. In *Research Anthology on Computational Thinking, Programming, and Robotics in the Classroom* (pp. 807-823). IGI Global. <https://doi.org/10.4018/978-1-6684-2411-7.ch035>
- Papadakis, S., Vaiopoulou, J., Sifaki, E., Stamovlasis, D., Kalogiannakis, M., & Vassilakis, K. (2021). Factors That Hinder in-Service Teachers from Incorporating Educational Robotics into Their Daily or Future Teaching Practice. In *CSEDU* (2) (pp. 55-63). <https://doi.org/10.5220/0010413900550063>
- Parette, H. A., Quesenberry, P., & Blum, C. (2010). Missing the Boat with Technology Usage in Early Childhood Settings: a 21st Century View of Developmentally Appropriate Practice. *Early Childhood Education Journal*, 37(5), 335-343. <https://doi.org/10.1007/s10643-009-0352-x>
- Petousi, V., & Sifaki, E. (2020). Contextualizing harm in the framework of research misconduct. Findings from a discourse analysis of scientific publications. *International Journal of Sustainable Development*, 23(3/4), 149-174. <https://doi.org/10.1504/IJSD.2020.10037655>
- Purnomo H. S., & Rohman, M. G. (2018). Improving teachers' ICT competencies as learning innovations in the digital age]. *Seminar Nasional Sistem Informasi (SENASIF)*, 2, 1487-1494.
- Boyatzis, R. E. (1998). *Transforming qualitative information: Thematic analysis and code development*. Thousand Oaks, CA: SAGE.
- Saprikis, V., & Anastasia, K., & Charitoudi, G. (2019). The Impact of ICT Training on Teachers' Perceptions and Use of the Technology in Education: A case of Greece. Conference: 34th IBIMA Conference. At: Madrid, Spain
- Casillas Martín, S., Cabezas Gonzalez, M., & Garcia Penalvo, F. J. (2020). Digital competence of early childhood education teachers: attitude, knowledge and use of ICT. *European Journal of Teacher Education*, 43(2), 210-223.
- Anwariningsih, S. H., & Ernawati, S. (2013). Development of interactive media for ICT learning at elementary school based on student self learning. *Journal of education and Learning (EduLearn)*, 7(2), 121-128. <https://doi.org/10.11591/edulearn.v7i2.226>
- Sunar, P. K., Dahal, N., & Pant, B. (2022). Using digital stories during COVID-19 to enhance early-grade learners' language skills. *Advances in Mobile Learning Educational Research*, 3(1), 548-561. <https://doi.org/10.25082/AMLER.2023.01.003>
- Tondeur, J., Van Braak, J., Ertmer, P. A., & Ottenbreit-Leftwich, A. (2017). Understanding the relationship between teachers' pedagogical beliefs and technology use in education: a systematic review of qualitative evidence. *Educational technology research and development*, 65, 555-575. <https://doi.org/10.1007/s11423-016-9481-2>
- Tondeur, J., Van Braak, J., Ertmer, P. A., & Ottenbreit-Leftwich, A. (2017). Understanding the relationship between teachers' pedagogical beliefs and technology use in education: a systematic review of qualitative evidence. *Educational technology research and development*, 65, 555-575. <https://doi.org/10.1007/s11423-016-9481-2>
- Wilson, J. D., Notar, C. C., & Yunker, B. (2003). Elementary In-Service Teacher's Use of Computers in the Elementary Classroom. *Journal of Instructional Psychology*, 30(4).
- Wong, A. Y., & Daud, K. (2018). ICT Competencies among School Teachers: A Review of Literature. *Journal of Education and Learning (EduLearn)*, 12(3), 376-381. <https://doi.org/10.11591/edulearn.v12i3.5579>

- Yazıcı Arıcı, E., Keskin, H. K., Papadakis, S., & Kalogiannakis, M. (2022). Evaluation of Children's Discourses Regarding Imaginary Companion: The Case of Türkiye. *Sustainability*, 14(24), 16608. <https://doi.org/10.3390/su142416608>
- Zinger, D., Tate, T., & Warschauer, M. (2017). Learning and teaching with technology: Technological pedagogy and teacher practice. *The SAGE handbook of research on teacher education*, 577-593. <https://doi.org/10.4135/9781526402042.n33>