RESEARCH ARTICLE

The views of preschool teachers on the contribution of ICT in Environmental Education

Ourania Blavaki

Department of Preschool Education, Faculty of Education, University of Crete, Crete, Greece

Correspondence to: Ourania Blavaki, Department of Preschool Education, Faculty of Education, University of Crete, Crete, Greece; Email: oblavaki@yahoo.com

Abstract: Information and Communication Technologies (ICT) are forms of technology that enhance young children's learning and experiences. When teachers successfully integrate them as targeted tools using computers, tablets, videos, interactive whiteboards, digital games, *etc.*, the quality of teaching and learning can be improved by providing students with an engaging and successful experience. At the same time, environmental conditions worldwide continue to deteriorate at an alarming rate due to a complex web of socio-ecological challenges such as climate change, air pollution, loss of biodiversity, *etc.* In order to drive transformative changes in human behaviour, it is essential to educate and inform individuals from an early age, starting with kindergarten students. Incorporating new technologies into environmental education and other subjects can spark students' interest and facilitate more effective information dissemination and learning. This study investigated the views of 105 preschool teachers on the contribution of ICT to Environmental Education. The research tool used was a questionnaire distributed to teachers via Google Forms. The research questions pertain to teachers' knowledge and opinions about ICT and EE, as well as the frequency of ICT use and media during teaching interventions. Furthermore, the factors that influence the smooth integration of ICTs into EE teaching and the results that this integration brings were investigated. The research showed that the contribution of ICT in EE positively affected the students. Those that stood out were the active participation, the increased interest, the development of teamwork and the mobilisation of the weak students. However, although the teachers pointed out some difficulties in using ICT in their teaching, such as the deficiency of material and technical infrastructure and the lack of time, they also pointed out how significant and influential the contribution of ICT in teaching Environmental Education is.

Keywords: ICT, Environmental Education, teachers' views, primary education

1 Introduction

According to data from the World Bank, the human population has dramatically increased in the 21st century, causing an environmental problem worldwide. Population growth, industrialization, globalization, and technological development must be part of the solution, not a factor in the problem. Environmental problems threaten all living beings and the balance of nature, so that is why they become the focus of our attention and research. Thus, people are now being asked to find solutions to these current problems caused by environmental problems (Sukma et al., 2020).

In order to solve environmental problems, people need to have the appropriate knowledge, which they will acquire through an Environmental Education (EE) framework that aims to raise awareness, consciousness and information about environmental problems (Boca & Sarach, 2019). Research shows that environmental awareness, good environmental decision-making, and essential action to address these problems should be developed from preschool. Thus, through the educational process for students from all levels, we will have the key to preventing and solving environmental problems (Sukma et al., 2019).

ICT can stimulate students' interests and provide the best educational process (Louka, 2023). The role of technology in education has been transformed by the introduction of ICTs, aiming to raise the level of teaching and develop the skills and knowledge of students (Aleksandraki & Zaranis, 2023). Research has shown that high-quality educational programs can positively impact students' academic performance, starting at the age of three (Korb, 2019). Also, it has

been proven that new technologies make learning more student-centred, social, and reflective while children are actively engaged during the lesson and take more initiative using gamification (Papadakis & Kalogiannakis, 2019a, 2019b; Xezonaki, 2002, 2023).

1.1 Literature Review

The research by Papadakis et al. (2018) was conducted on 365 kindergarten children from 21 classes. This study aimed to evaluate the impact of two different digital technologies, computers and tablets, on children's education through the understanding of mathematics. The interventions were delivered in 24 half-hour lessons, and data was collected using the Test of Early Mathematical Ability-3 (TEMA-3). This study showed that the experimental groups had better results, *i.e.*, the tablet group did better than the computer group. In addition, no difference in results was detected according to the student's gender.

The Korb (2019) study conducted among Nigerian children described the benefits and risks of ICT use in children from an early age. It was found that high-quality educational programming can positively impact the academic performance of children aged three years and above. However, it was shown that programs not based on educational content can hurt academic achievement. Further, it clarified that viewing inappropriate content can lead to poor physical, social and cognitive development.

Another study was conducted by Ogegbo and Aina (2020) in South Africa, and its purpose was to examine preschool teachers' perceptions of technology use in classrooms. The qualitative research methodology was used, and data were collected through semi-structured interviews with eight kindergarten teachers and classroom observation. The results showed that teachers understand the advantages of integrating technology in early childhood education and have a positive attitude towards them. However, the factors that hinder teachers are inadequate parental and school support, lack of technological resources, insufficient teacher knowledge and lack of practical training in using developmentally appropriate technology.

Otteborn and Schönborn (2022) studied what activities early childhood teachers implement and perform using tablets. The results from approximately 500 teachers showed that using tablets increases collaboration and student participation. In contrast, the teachers themselves can create meaningful, engaging, self-generated, and rich activities for their students.

Furthermore, a study by Hatzigianni et al. (2023) in Australia was implemented on the role of digital technologies in early childhood education. The researchers visited every school and collected 60 quality improvement plans and 60 teacher evaluation reports. The findings showed that new technologies, such as platforms, tablets, apps, *etc.*, play a vital role in education (Papadakis, 2021).

2 Materials and Methods

2.1 The research's objective and questions

Considering the constantly increasing development of digital technologies, the need for information about the environment, and the treatment of environmental issues, it is understandable that ICT has been dynamically integrated into the learning process and that teaching Environmental Education is essential.

This scientific study aims to examine preschool teachers' views regarding the use of the possibilities offered by ICT in the implementation of lessons related to Environmental Education (EE). More specifically, this study attempts to answer the following questions:

Q1: What are the knowledge and perceptions of preschool teachers about ICT and EE?

Q2: What is the frequency of ICT use in teaching EE in preschool education, and what tools do they use?

Q3: What are the factors influencing the integration of ICT in EE in preschool Education?

Q4: What results does the use of ICT yield during the teaching of EE in preschool Education?

2.2 Research process and participants

Firstly, a systemic review of Greek and foreign (English) literature was conducted to collect information on the research topic and clarify complex concepts. Then, after investigating the problem's nature and the research for similar studies, the questions, the method followed, and the results that emerged from the studies were examined. Thus, the present research was

planned, the research questions were formulated, the data collection method was determined, and the questionnaire was drafted. Notably, the questionnaire was distributed to the teachers after obtaining permission from the ethics committee of the Department of Early Childhood Education (Petousi & Sifaki, 2020).

A questionnaire was used to collect data and was created using the online platform Google Forms, which offers a variety of options for designing the questionnaire. The questionnaire was emailed to preschool teachers working in public and private preschools in Greece. The questionnaire was completed for four weeks (October-November 2023), and data were collected from 105 participant teachers within this time frame. After collecting all completed questionnaires, the results were analysed and processed.

The research sample consisted of primary school teachers and, more specifically, preschool teachers working in public and private schools in Greece. The method of data collection was snowball sampling. This method was chosen because access to teachers was difficult, and the survey needed to be implemented quickly (Creswell, 2016). The questionnaire was distributed to teachers of different ages, genders and years of experience. There were 105 participants, including six males (5.7%) and 99 females (94.3%).

2.3   Data collection tool

As mentioned above, the data for the survey were collected through a digital questionnaire. This tool was chosen, among other reasons, because it requires little time, is easy, can be collected efficiently, and is adapted to each participant in terms of space and time to complete it (Kanaki & Kalogiannakis, 2023).

The questionnaire was constructed exclusively for the context of this study. It consists of 25 questions, and the required completion time is at most 10 minutes. Before its distribution to preschool teachers, a pilot was carried out with a smaller sample of 15 teachers. They made some notes, which were then given in its final form.

The questions are closed-ended, *i.e.*, dichotomous, multiple choice, ranking, and open-ended. To complete the questionnaire, the respondent should answer all the questions except those that were not compulsory because they were linked to the previous question's answer. More specifically, the questionnaire consists of two main sections. The first section concerns the demographic and professional data of the teachers (*i.e.* gender, age, education, years of teaching experience and employment status), and the second section is divided into four subsections corresponding to the research questions. It is also necessary to state that the answers remained anonymous.

More specifically, the first subsection concerns the knowledge and views of preschool teachers on new technologies and Environmental Education. Also, this section has questions about using these digital technologies in the educational process. The second subsection is about how often teachers use ICT, which technological tools they use and whether they use ICT during the implementation of EE programs. The third subsection ties in with the second and refers to the factors that influence the success or not integration of ICT in EE. Finally, the questionnaire concludes with the fourth subsection, which relates to the effects of integrating ICT into Environmental Education teaching. In this subsection, teachers are asked to answer about this integration's positive and negative effects.

2.4   Reliability – Validity

The reliability of the questions was achieved because the questions were completed in a short period. Furthermore, there were several closed-ended questions, which helped to avoid errors, while clear instructions, well-worded questions and proper organisation of the questionnaire ensured the reliability of the research. In addition, the tangible and objective questions, the pilot testing of the questionnaire and the necessary changes afterwards guaranteed the validity of the research (Creswell, 2016).

3   Results

3.1   RQ1: What are the knowledge perceptions of preschool teachers about ICT and EE?

According to the answers to the questionnaire, 77 teachers (73.3%) have ICT-related knowledge, while the remaining 28 (26.7%) do not. Table 1 shows how the 77 teachers have been

trained in ICT.

**Table 1**   How teachers are educated in ICT

Training	Frequency (N)	Percentage (%)
Seminar	33	43.4%
ICT training Level A	40	52.6%
ICT training Level B	32	42.1%
Postgraduate	16	21.1%
PhD	1	1.3%
Other	3	3.9%

According to the answers to the questionnaire, 58 teachers (55.2%) have Environmental Education-related knowledge, while the remaining 47 (44.8%) do not. Table 2 shows how the 58 teachers were educated in environmental education.

Table 2   How teachers are educated in EE

Training	Frequency (N)	Percentage (%)
Seminar/Workshop	48	82.2%
Postgraduate	4	6.9%
PhD	0	0.0%
EE Centre	33	56.9%
Books-Articles	33	56.9%

Another question asked to see whether teachers consider Environmental Education necessary is how often teachers implement teaching programs on EE. (see in Figure 1)
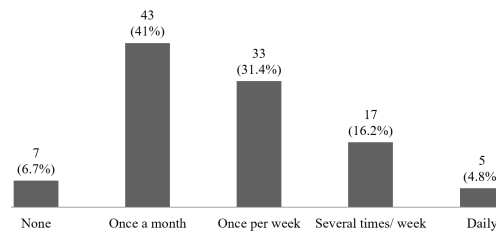
Figure 1   Frequency of implementation of EE programs in teaching

3.2   RQ2: What is the frequency of ICT use in teaching EE in Preschool Education, and what tools do they use?

According to the teachers' responses on whether they use ICT during the teaching of EE, 93 (88.6%) teachers answered positively, while the remaining 12 (11.4%) answered negatively. The 93 teachers who answered positively to the above question were also asked to identify the technological tools they use during EE teaching, presented in Table 3.

Table 3   The technological tools used by teachers

Technological Tool	Frequency (N)	Percentage (%)
Interactive table	27	29%
Educational software	55	59.1%
Electronic games	40	43.0%
Web Exploration	41	44.1%
Digital content	70	75.3%
Virtual Reality games	8	8.6%
3D applications	7	7.5%%
E-learning platform	11	11.8%
Geographical information system	12	12.9%
Teleconferencing with Other schools	16	17.2%
Teleconferencing with local institutions	8	8.6%
Digital library	15	16.1%
Movie screening	57	61.3%

The graph below shows how often teachers use ICT when teaching environmental education.

Also, when teachers were asked if they would like to use ICT more often in teaching EE, 61 (58.1%) answered that they would like to do so, while 44 (41.9%) answered that they would not. (see in Figure 2)
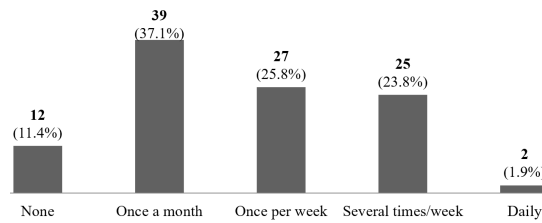
Figure 2   Frequency of ICT use in the EE

One of the open-ended questions in the questionnaire related to teachers' barriers to using ICT in their teaching was optional, and only 62 out of 105 teachers responded. Teachers' answers were related to lack of time during teaching hours, lack of equipment and lack of knowledge. Still, some teachers pointed out obstacles such as the age and number of children, the preparation needed, and the need for more funding from management. Finally, one teacher indicated that he considered the empirical experience more critical.

3.3   RQ3: What are the factors influencing the integration of ICT in EE in Preschool Education?

One aspect that needed to be examined was the teachers' ICT use. Through the research, it was found that five teachers (4.8%) have no facility, 15 (14.3%) have little facility, 29 (27.6%) have some facility, 35 (33.3%) have much facility, and 21 (20%) have very much facility. After that, the factors negatively influencing ICT use in Environmental Education were researched. The negative barriers included anxiety, fear, lack of equipment, lack of help, heterogeneity of knowledge and skills, large number of students, lack of time and difficulty in working with other teachers. Based on the above, they were asked to comment on how each factor affects teachers. Table 4 presents the results found in detail.

Table 4   Factors preventing the use of ICT in EE

Factor	None		Few		Partially		Mostly		Completely	
	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)
Stress	54	51.1%	30	29.5%	17	16.1%	3	2.8%	1	0.9%
Fear	65	61.9%	28	26.6%	11	10.47%	1	0.9%	0	0.0%
Lack of equipment	19	18.0%	30	28.5%	38	36.1%	12	11.4%	6	5.7%
Lack of help	24	22.8%	23	21.9%	36	34.2%	18	17.14%	4	3.8%
Homogeneity of students	22	20.9%	37	35.2%	32	30.4%	13	12.3%	1	0.9%
A large number of students	14	13.3%	26	24.7%	35	33.3%	16	15.2%	14	13.3%
Lack of time	11	10.4%	19	18.0%	40	38.0%	19	18.0%	16	15.2%
Difficulty of cooperation	54	51.4%	24	22.8%	17	16.1%	9	8.5%	1	0.9%

In addition, respondents had the option to add some additional factors that, in their view, prevent the successful integration of ICT in the EE. The question was optional, with 15 responses, but the answers were similar to those of the previous question. Teachers mentioned the barriers, such as the need for more information, lack of resources and tools, and poor relationship with technology.

3.4   RQ4: What results does the use of ICT bring out during the teaching of EE in Preschool Education?

Regarding the results of using ICT in the teaching of Environmental Education, the majority of the teachers, *i.e.* 72 (68.6%) out of 105, noted that the results are positive. In comparison, 26 teachers (24.8%) considered that using ICT has brought positive and negative results. Notably, the teachers have yet to respond that using ICT has only brought about negative results in teaching EE and that seven teachers (6.7%) have no opinion because they have not used them for teaching EE.

The following aspects focus on the extent to which the use of ICTs in Environmental Education has had a positive impact. Teachers were asked to rate the outcomes that they felt were active participation, increased interest, teamwork, critical thinking processes, developing

creativity, increasing cognitive domain, mobilising the weak student, and managing the school environment. The results of this question are presented in Table 5.

Table 5 The positive results of ICT use in the EE

Positive Result	None		Few		Partially		Mostly		Completely	
	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)
Active participation	2	1.9%	9	8.5%	37	35.2%	41	39%	13	12.3%
Increased interest	1	0.9%	7	6.6%	31	29.5%	41	39%	23	21.9%
Teamwork	3	2.8%	25	23.8%	38	36.1%	26	24.7%	10	9.5%
Critical thinking processes	3	2.8%	18	17.1%	42	40%	27	25.7%	11	10.4%
Development of creativity	7	6.6%	15	14.2%	44	41.9%	22	20.9%	14	13.3%
Development of the mental domain	2	1.9%	16	15.2%	44	41.9%	28	26.6%	11	10.4%
Mobilisation of a weak student	1	0.9%	13	12.3%	34	32.3%	35	33.3%	18	17.1%
Managing the school environment	3	2.8%	15	14.2%	38	36.1%	35	33.3%	11	10.4%

Continuing with the adverse effects that the teachers have observed when using ICT in teaching environmental education, it is a distraction, a limitation of understanding, and isolation of students. The results of this question are presented in Table 6.

Table 6 The negative results of ICT use in the EE

Negative Result	None		Few		Partially		Mostly		Completely	
	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)
Distraction	20	19%	58	55.2%	20	19%	5	4.7%	0	0%
Limitation of understanding	30	28.5%	54	51.4%	12	11.4%	6	5.7%	0	0%
Isolation of students	43	40.9%	39	37.1%	11	10.4%	10	9.5%	0	0%

In the last question of the questionnaire, teachers were given the option to point out a different outcome they have observed in their teaching. The question was optional, and there were four answers. One teacher wrote that "The proper use of ICT brings about positive results in education", and another answered that with the use of ICT in EE, there is "Increased interest, encouragement of children and questions about the relevant subject". Finally, the other two comments were that "Children with learning difficulties respond very well to the use of ICT" and that with this use, there is "Addiction and disinterest in socialising with other students".

4   Discussion

Starting from the first question of the research concerning "the knowledge and aspects of preschool teachers on ICT and EE", it is found that regarding ICT, the majority (73.3%) of teachers are trained with the appropriate knowledge to use ICT. More particularly, 72 teachers have chosen to be trained by attending an A or B-level seminar, 16 teachers have completed an ICT-related postgraduate program, and only one has completed a relevant PhD. Also, three teachers stated they had attended e-twinning and Moodle seminars or had an ECDL degree. Notably, 93 out of 105 teachers use ICT in the teaching process. However, these results contrast with findings showing that 110 preschool teachers, despite holding a relevant certificate, need more preparation to teach using ICT (Tympa et al., 2023).

Moving on to training and teachers' views on Environmental Education issues, slightly more than half of them (55.2%) have received relevant information. This knowledge has come either from a relevant seminar or workshop (48 teachers), a postgraduate program (4 teachers), an environmental education training centre (33 teachers), or from reading relevant articles and books (33 teachers).

Their answers differ regarding how often teachers implement lessons related to Environmental Education. Of the 105 teachers, seven do not implement at all, 43 do so about once a month, 33 do it once a week, 17 do it several times a week, and only five do it daily. Most teachers integrate EE into student teaching, findings similar to Sukma et al.'s (2020) research in Indonesia. Finally, there was a question in the questionnaire related to the marriage of the two. Of 105 teachers, 93 use ICT to conduct teaching programs on EE.

The second research question concerned the frequency of use of ICT in the teaching of EE and the educational tools chosen by the preschool teachers. One hundred-five teachers participated in this study, and 93 of them stated that they use ICT when teaching topics related

to Environmental Education. Most of these 93 teachers stated that they use ICT about once a month, 26 teachers use it about once a week, and 12 out of 105 do not. The remaining 27 teachers use ICT to teach EE several times weekly and daily. From these responses, the teachers rarely use ICT to teach EE-related subjects. What concerns the teachers is to what extent they know how to use ICT and whether they will manage to make the most of it to help students (Andreadakis & Kalogiannakis, 2022).

A wide variety of technological tools have been used. More specifically, the most commonly used technological tools are digital media, online movies, educational software, computer games and web browsing. These findings are also in line with those of Torakulovich (2024). Interactive whiteboards, video conferencing with other schools, e-library, geographic information systems, and e-learning platforms were the least frequently used. Finally, those that are barely used are 3D applications, virtual reality games and videoconferencing with local institutions; results that match those of Poyltsakis et al. (2021), who show that 25% of the teachers in their survey did not even know about Digital Simulation Tools and 30% did not know about Digital Learning Objects.

Then the third question concerns the factors that influence the integration of ICT in the teaching of Environmental Education. The teachers' facility greatly influences the integration of ICT. The survey research revealed that out of 105 teachers, five do not know how to use technology tools at all, 15 know a little, 29 know a lot, 35 have good knowledge, and 21 have excellent knowledge. Primarily, as demonstrated in various studies, the factors that prevent teachers from using technological resources are lack of time, lack of help, shortage of equipment, heterogeneity of students' knowledge, lack of funding and insufficient knowledge of teachers (Masoumi, 2020; Ogegbo & Aina, 2020; Tzagkaraki et al., 2021; Marklund, 2022; Santamaria et al., 2023).

Finally, the fourth question concerns the results of using ICT in teaching EE. The most significant percentage of teachers (68.6%) stated that this use produces positive results, while the rest reported that it effectuates both positive and negative results. One of the teachers who participated in this survey stated that using ICT produces exclusively negative results. In contrast, only seven teachers reported no opinion on this question because they have yet to use ICT for teaching EE.

Regarding the positive results, teachers agree that creativity and cognitive skills are increased, weak students are motivated, interest is increased, and active participation by the students is encouraged. The results above fall in line with the findings of several studies conducted on preschool children, and it seems that the integration of ICT in the teaching of EE offers a plethora of positive outcomes (Ampartzaki et al., 2024; Vidakis et al, 2018; Papadakis et al., 2018; Papadakis & Kalogiannakis, 2020; Dong & Mertala, 2021; Otteborn & Schönborn, 2022; Hatzigianni et al., 2023).

We will conclude with the adverse effects of integrating ICT in the educational process of EE teaching. Teachers were asked to respond regarding distraction, limitation of understanding and isolation of students. Teachers reported that students' distraction and limitation of understanding were slightly affected. Finally, exposing students to technological media that are not based on educational content and viewing inappropriate content leads to poor physical, social and cognitive development (Ampartzaki et al., 2024; Korb, 2019; Surirman et al., 2019; Skaraki, 2023; Skaraki & Kolokotronis, 2022).

5   Conclusion

By analysing the demographic data of the present study, we observe that almost the entire sample consisted of women and half of the sample had continued their studies and completed a postgraduate program. Also, most of the sample had attended seminars related to the integration of ICT in the educational process and programs related to Environmental Education. Through this, the teachers understand the requirements of the new school reality and have devoted their time to information and training.

From the research data, we conclude that teachers consider ICT necessary in Environmental Education, and almost all use it when teaching environmental programs. However, over half of the teachers in this study said they would like to use ICT more often. The reasons that prevent them from doing so mainly include the need for more appropriate material and technical infrastructure, the heterogeneity of students' knowledge, and a lack of time.

Finally, the integration of ICT in the teaching process and its combination with environmental

education have various results. Most teachers stated that the results of using ICT in teaching EE are primarily positive, while some declared that there is a combination of positive and negative results. The introduction of ICT in teaching EE ensures a better pedagogical approach, providing significant and multiple benefits. The most indicative ones are active participation, increased interest and motivation of the weak learner. At the same time, however, some adverse effects appear to a limited extent, which, according to the participants, is the most prevalent, which turns out to be distraction. So, the positive effects outweigh the negative ones.

6   Limitations

The present research was conducted to explore the views of primary teachers and, more specifically, preschool teachers on the contribution of ICT in teaching Environmental Education. A limitation of this research could be how the questions were posed to the teachers. Formulating representative questions for each research pillar only allowed for more questions to be asked to cover all aspects of the topic.

In conclusion, suggestions for further research are listed. It would be advisable to carry out similar research with a larger sample of teachers, including those at other educational levels and with teachers worldwide. Finally, in addition to the previous study, observation during teaching could be conducted to thoroughly evaluate the effects of ICT use on children and teachers.

Conflicts of interest

The author declares there is no conflict of interest.

References

Aleksandraki, F., & Zaranis, N. (2023). Greek parents' profile concerning the use of smart mobile devices and their educational applications by preschool and elementary school children. Advances in Mobile Learning Educational Research, 3(2), 851–858.
https://doi.org/10.25082/amler.2023.02.012

Ampartzaki, M., Chatzoglidou, S., Kalogiannakis, M., Tassis, K., Pavlidou, V., Christidis, K., & Eleftherakis, G. (2024). Training Professional Kindergarten Teachers and Preservice Kindergarten Teachers in Astronomy Education: The Challenges of the ABATAC Project. European Journal of Education and Pedagogy, 5(2), 113–122.
https://doi.org/10.24018/ejedu.2024.5.2.818

Ampartzaki, M., Tassis, K., Kalogiannakis, M., Pavlidou, V., Christidis, K., Chatzoglidou, S., & Eleftherakis, G. (2024). Assessing the Initial Outcomes of a Blended Learning Course for Teachers Facilitating Astronomy Activities for Young Children. Education Sciences, 14(6), 606.
https://doi.org/10.3390/educsci14060606

Boca, G., & Saraçlı, S. (2019). Environmental Education and Student's Perception, for Sustainability. Sustainability, 11(6), 1553.
https://doi.org/10.3390/su11061553

Dong, C., & Mertala, P. (2019). It is a tool, but not a 'must': early childhood preservice teachers' perceptions of ICT and its affordances. Early Years, 41(5), 540–555.
https://doi.org/10.1080/09575146.2019.1627293

Hatzigianni, M., Stephenson, T., Harrison, L. J., Waniganayake, M., Li, P., Barblett, L., Hadley, F., Andrews, R., Davis, B., & Irvine, S. (2023). The role of digital technologies in supporting quality improvement in Australian early childhood education and care settings. International Journal of Child Care and Education Policy, 17(1).
https://doi.org/10.1186/s40723-023-00107-6

Henriksson, A.-C. (2018). Primary school teachers' perceptions of out of school learning within science education. Lumat: International Journal of Math, Science and Technology Education, 6(2).
https://doi.org/10.31129/lumat.6.2.313

Kanaki, K., & Kalogiannakis, M. (2023). Sample design challenges: an educational research paradigm. International Journal of Technology Enhanced Learning, 15(3), 266–285.
https://doi.org/10.1504/ijtel.2023.131865

Korb, K. A. (2019). Influence of ICT on Young Nigerian Children's Development. International Journal of Arts Education (IJAE), 1, 179-186.

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

Marklund, L. (2019). Swedish preschool teachers' perceptions about digital play in a workplace-learning context. Early Years, 42(2), 167–181.
https://doi.org/10.1080/09575146.2019.1658065

Masoumi, D. (2020). Situating ICT in early childhood teacher education. Education and Information Technologies, 26(3), 3009–3026. https://doi.org/10.1007/s10639-020-10399-7

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). https://doi.org/10.4102/sajce.v10i1.880

Otterborn, A., & Schönborn, K. (2022). Implementing Digital Tablet Activities in Swedish Preschool Education. Applications of Research in Technology Education, 249–265. https://doi.org/10.1007/978-981-16-7885-1_16

Papadakis, S. (2020). Tools for evaluating educational apps for young children: a systematic review of the literature. Interactive Technology and Smart Education, 18(1), 18–49. https://doi.org/10.1108/itse-08-2020-0127

Papadakis, S., & Kalogiannakis, M. (2020). A Research Synthesis of the Real Value of Self-Proclaimed Mobile Educational Applications for Young Children. Advances in Educational Technologies and Instructional Design, 1–19. https://doi.org/10.4018/978-1-7998-1486-3.ch001

Papadakis, S., Kalogiannakis, M., & Zaranis, N. (2018). The effectiveness of computer and tablet assisted intervention in early childhood students' understanding of numbers. An empirical study conducted in Greece. Education and Information Technologies, 23(5), 1849–1871. https://doi.org/10.1007/s10639-018-9693-7

Papadakis, S., & Kalogiannakis, M. (2019). Evaluating the effectiveness of a game-based learning approach in modifying students' behavioural outcomes and competence, in an introductory programming course. A case study in Greece. International Journal of Teaching and Case Studies, 10(3), 235. https://doi.org/10.1504/ijtcs.2019.102760

Papadakis, S., & Kalogiannakis, M. (2019). Evaluating a course for teaching introductory programming with Scratch to pre-service kindergarten teachers. International Journal of Technology Enhanced Learning, 11(3), 231. https://doi.org/10.1504/ijtel.2019.100478

Petousi, V., & Sifaki, E. (2020). Contextualising harm in the framework of research misconduct. Findings from discourse analysis of scientific publications. International Journal of Sustainable Development, 23(3/4), 149. https://doi.org/10.1504/ijsd.2020.115206

Santamaria, L., Cherrington, S., & Shuker, M. J. (2023). New Zealand early childhood services: Reasons for use or non-use of tablet computers. E-Learning and Digital Media, 204275302311745. https://doi.org/10.1177/20427530231174582

Skaraki, E. (2023). Creating a watermill through steam activities for preschool children in the school yard. Advances in Mobile Learning Educational Research, 3(2), 748–753. https://doi.org/10.25082/amler.2023.02.001

Skaraki, E., & Kolokotronis, F. (2022). Preschool and early primary school age children learning of computational thinking through the use of asynchronous learning environments in the age of Covid-19. Advances in Mobile Learning Educational Research, 2(1), 180–186. https://doi.org/10.25082/amler.2022.01.002

Sukma, E., Ramadhan, S., & Indriyani, V. (2020). Integration of environmental education in elementary schools. Journal of Physics: Conference Series, 1481(1), 012136. https://doi.org/10.1088/1742-6596/1481/1/012136

Torakulovich, M., O. (2024). Innovative information technologies and new methods and tools for their application in today's education. Central Asian Journal Of Education and Innovation, 3(2), 83-92.

Tympa, E., Karavida, V., & Charissi, A. (2023). Greek preschool teachers' readiness to teach online at the onset of the COVID-19 pandemic. International Review of Education, 69(4), 487–510. https://doi.org/10.1007/s11159-023-10000-6

Tzagkaraki, E., Papadakis, S., & Kalogiannakis, M. (2021). Exploring the Use of Educational Robotics in Primary School and Its Possible Place in the Curricula. Studies in Computational Intelligence, 216–229. https://doi.org/10.1007/978-3-030-77022-8_19

Vidakis, N., Barianos, A., Trampas, A., Papadakis, S., Kalogiannakis, M., & Vassilakis, K. (2019). Generating Education in-Game Data: The Case of an Ancient Theatre Serious Game. Proceedings of the 11th International Conference on Computer Supported Education. https://doi.org/10.5220/0007810800360043

Xezonaki, A. (2022). Gamification in preschool science education. Advances in Mobile Learning Educational Research, 2(2), 308–320. https://doi.org/10.25082/amler.2022.02.001

Xezonaki, A. (2023). The use of Kahoot in preschool mathematics education. Advances in Mobile Learning Educational Research, 3(1), 648–657. https://doi.org/10.25082/amler.2023.01.014