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ICT IN PRESCHOOL EDUCATION. AN INTERDISCIPLINARY REVIEW OF SCIENTIFIC LITERATURE

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Abstract:
This work is an attempt at an interdisciplinary reading of the scientific literature on the use of ICT in the case of preschool education, highlighting some of its sociological and pedagogical dimensions. A study of the relevant literature reveals that the need to integrate ICT into the pedagogical practices implemented at the micro level of compulsory education in the schools in European Union countries especially influenced the formation of modern preschool curricula whose content follows academic logic. In order to include ICT in preschool education, the ability to effectively handle digital media and tools needs to be integrated into the habitus of kindergarten teachers, as does the activation of their predispositions for the didactic use of specific media in their daily school life. In this way, the aim is to strengthen the digital literacy of the students, who, as digital natives, already have some experiences of a digital nature. The advantages of utilizing ICT in Kindergarten are linked to the development of students' cognitive skills, as well as to the assistance of their learning effort through activities that include the problem-solving process. The entry of ICT into preschool education is also associated with concerns, such as the concern for the safe use of digital media by young children, but also the effects of online content on shaping their social interactions and individual behaviors.

Keywords: ICT, preschool education, curriculum, kindergarten teachers, habitus, digital literacy, digital tools

1. Introduction

The modern period of globalization can also be characterized as a digital age, as Information and Communication Technologies (ICT) play a decisive role in shaping many aspects of the modern socio-economic reality and the daily social interaction

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between people in the 21st century (Cornali & Tirocchi, 2012; Giddens & Sutton, 2020; Qureshi, 2011).

The dynamic advent of computers in various fields of modern Western societies since the 1990s, including education, have made the computer-supported learning environment a reality, which is of intense concern to researchers. This fact is reflected in the number of relevant scientific works published, many of which are interdisciplinary in nature (see: Angeli & Valanides, 2014; Djeki *et al.*, 2022; Machkour *et al.*, 2025; Shandryk *et al.*, 2024).

The entry of ICT in the case of pre-school education has been the subject of a dialogue between members of the scientific community especially in recent decades where they are used in the educational process and are a feature of specific cognitive areas of the curriculum in some countries (Drigas & Kokkalia, 2014a; Koustourakis, 2007, 2014). In fact, a wide variety of ICT-based applications appear to be suitable educational "tools" that can be used by preschool and primary school students for teaching and learning purposes (Hapsari *et al.*, 2023; Karl & Molnár, 2020; Liu *et al.*, 2014; Plowman & Stephen, 2005; Tavernier & Hu, 2020; Zaranis & Kalogiannakis, 2011; Zaranis *et al.*, 2013).

According to the UNESCO Institute of Information Technologies in Education, the pedagogical use of ICT in pre-school education is carried out through the use of appropriate educational software and applications aimed at enhancing the learning experience of children and encouraging cooperation between them using digital media (Kalas, 2010). In addition, based on the Global Organization for the Education of Young Children (NAEYC) it is believed that the effective utilization of digital technologies, as tools aimed at providing learning to children, can take place through the use of appropriate educational applications, the training of teachers and the cultivation of a cooperative climate between teachers and parents (Ihmeideh & Al-Maadadi, 2018).

In the context of a review of the international scientific literature, it emerges that an important area of concern is the investigation of the perceptions and attitudes of preschool teachers regarding the use of ICT in Kindergarten (see: Alomyan & Alelaimat, 2021; Ihmeideh & Al-Maadadi, 2018; Konca *et al.*, 2016; Ogegbo & Aina, 2020). Researchers are also concerned with investigating the effect of ICT use by preschool children on their learning process and on their general psycho-social development (see: Anđelić *et al.*, 2014; Gohar, 2017; Panagiotakou & Pange, 2010; Zaranis, 2011). A number of scientific works also investigate the ability and training of kindergarten teachers regarding the effective use and integration of ICT in their educational work (see: Chen & Chang, 2006; Codilla & Codilla, 2020; Yang & Hong, 2022).

This work is an attempt at an interdisciplinary reading of the scientific literature on ICT in the case of preschool education, highlighting some important sociological and pedagogical characteristics and effects concerning the curriculum, the students and the teacher who uses them in his classroom.

2. ICT and Preschool Education Curricula

The formation of educational curricula, which includes preschool curricula, is a social process of recontextualization, as in a specific historical moment the dominant political and economic forces decide and choose the kind of knowledge they think students need to be taught (Apple, 2013; Bernstein, 2000; McLachlan *et al.*, 2018). In the case of European Union countries, an important moment that led to the reform of compulsory education curricula was the implementation of the decision made by the European leaders at the Lisbon conference in 2000. According to this decision, European Union countries were to implement and finance the appropriate political actions that would contribute to the integration of ICT into school knowledge and the pedagogical practices that would be applied to teach it. The goal behind this was the acquisition of technological literacy (digital literacy) by European students (Commission of the European Communities, 2001). It is about the students' acquisition of the appropriate technological habitus, which was considered a necessary condition for their inclusion in the labor market so that, as tomorrow's workers, they contribute to the creation of a European society of knowledge, which has a positive economic impact for the countries and citizens of the European Union (Council of Europe, 2003; Koustourakis, 2007). Therefore, the existence of technological literacy (digital literacy) seems to be an important element of the culture of the modern European "citizen" in order for him to be able to move comfortably in the globalized social and economic field (Giddens & Sutton, 2020; Papen, 2006; Reddy *et al.*, 2020). In fact, the young people born in the 21st century are considered "digital natives" because in their habitus, it seems that digital technology manipulation skills have been integrated since they grow up and are socialized in a "rich" technological family and social environment (Konca & Koksalan, 2017; Koustourakis & Panagiotakopoulos, 2011; Palaiologou, 2016; Prensky, 2012).

According to Bourdieu, habitus, as a structured and as a structuring structure, is formed in the context of the successive socializations of a social subject. It begins to be built during childhood in the context of family socialization (primary habitus) and continues the evolutionary course of its formation at school (secondary habitus) and later in the professional arena (tertiary habitus), as well as in the wider social environment in which the individual moves and is active (Bourdieu, 1979, 1986). The concept of habitus constitutes a system of permanent (pre)dispositions of perception, thought and action and is connected to the cultural characteristics of the human personality, which he acquires and internalizes during his historical journey. Therefore, habitus consists of a range of knowledge, skills, preferences and behaviors, which, as internalized structures, influence and shape each individual's actions and choices (Asimaki & Koustourakis, 2014; Bourdieu, 1979, 2000, 2006; Koustourakis, 2023).

The need to integrate ICT into school knowledge and pedagogical practices implemented at the micro level of compulsory education in schools also influenced the formation of Kindergarten curricula, because in their everyday school life, the aim is to strengthen the technological skills of students in the 21st century who, as digital natives, have started from infancy to socialize in the context of their family environment in

familiarizing themselves with and using digital devices, such as smartphones and tablets (Qian & Hu, 2024; Šušterič *et al.*, 2025). In particular, in the field of the European Union, the political decisions of the Lisbon conference (2000) resulted in countries, such as Greece, radically restructuring school and preschool curricula (Alahiotis & Karatzia-Stavlioti, 2006; Koustourakis, 2007). More specifically, for the formation of the Greek preschool curriculum, the transition was made from a pre-existing developmental logic to an academic logic according to the standards of economically developed countries, such as Australia, Canada, Germany and the USA (Koustourakis, 2014, 2018b). Thus, the cognitive areas Language, Mathematics, Environmental Studies, Computer Science and Creation and Expression (Government Paper, 2003; Koustourakis, 2014, 2018a) were identified for the first time in the specific curriculum, from which kindergarten teachers need to draw cognitive elements to shape their daily teaching program. In addition, the goals of the cognitive area "Computer Science" state that it is necessary to familiarize the toddlers with the computer and modern technological tools, in order to achieve their digital literacy (Government Paper, 2003, p. 590). These are goals that are promoted both through teaching toddlers how to operate a computer, and through the use of ICT by kindergarten teachers as supplementary and supportive tools in their daily school life.

Then, in the countries where academic logic is followed in the formation of the preschool curriculum, the effort and instructions for the cultivation of digital literacy in students are reflected in the contents of cognitive areas that appear with the names "Exploring and interacting with my environment" (Finnish National Agency for Education, 2022), "Understanding the world" (Department for Education, 2023), Mathematics, Science, Technologies, Communication (see: Government of Western Australia, 2023; Illinois State Board of Education, n.d.; The Ontario Public Service, 2016). In these cases, for the development of students' digital literacy, kindergarten teachers are asked to discover and utilize the technological experiences that their students have from their family and wider social environment.

They should even try to connect the specific experiences, the daily knowledge that the toddlers bring to school, with the teaching activities that they are going to carry out in their classrooms. In addition, Kindergarten teachers are invited to exploit the possibilities of ICT in a playful and pleasant way for children, using them as complementary and supporting means to achieve the teaching goals provided for each cognitive area by the country's curricula (Edwards & Bird, 2017; McLachlan *et al.* 2018; Plowman & Stephen, 2005; Tavernier *et al.*, 2020).

3. Kindergarten teachers and ICT

In order to achieve the goals of integrating ICT into preschool education, it is necessary to integrate the ability to effectively handle digital media into the habitus of kindergarten teachers, as well as to have activated the disposition for their pedagogical use at the micro level of their classrooms. It is characteristic that among the first actions funded by the European Union at the beginning of the 21st century was the training of teachers to strengthen their professional habitus with technological knowledge that would allow

them to integrate ICT into everyday school life (Commission of the European Communities, 2001; Council of Europe, 2003). Evidence that shows that ICT is an element of the habitus of modern kindergarten teachers is their ability and disposition to use the internet for educational purposes and the digital media and technological tools available to them, such as tablets and educational robots (Bakala *et al.*, 2021; Rini *et al.*, 2024; Zaranis *et al.*, 2013). Moreover, the detection of whether the professional habitus of kindergarten teachers includes and activates ICT can be achieved through the observation of their pedagogical choices by investigating the potential digital practices they adopt and implement in their classrooms (Bourdieu, 2000, 2006; Rini *et al.*, 2024).

The application of "emergency remote teaching" during the period of Covid-19 contributed to the possible adaptation and development of the habitus of kindergarten teachers (Hodges *et al.*, 2020). That is, the remote temporary continuation of the educational project using the available technological means (such as: digital educational platforms, online teaching platforms, e-mail, open educational resources). In order to carry out distance teaching with their pupils, the Kindergarten teachers had to either individually or collaboratively become active and act independently to improve and adapt their digital knowledge and skills, to find and/or create appropriate digital educational materials that could be used in their online courses, as well as to exchange opinions and ideas about the ways of implementing distance teaching and the pedagogical use of available digital media (Aizenberg & Zilka, 2023; Klusmann *et al.*, 2022; Panesi *et al.*, 2021; Visnjic-Jevtic *et al.*, 2021). This was a highly stressful and perhaps difficult time for many Kindergarten teachers as they attempted to adapt to the challenging new reality (Klusmann *et al.*, 2022; Munastiwi & Puryono, 2021; Timmons *et al.*, 2021). They had to readjust their professional habitus in a very short period of time by forming, as far as possible, a positive attitude regarding the remote realization of their educational work. This was necessary because the implementation of distance teaching required frequent and continuous communication between the kindergarten teachers and their students' parents. In fact, it was necessary for kindergarten teachers to train and guide their students' parents in how to support and assist their children's participation in the distance education project (Blume, 2020; Koustourakis, 2023; Misirli & Ergulec, 2021; Niikko & Ugaste, 2025). Therefore, the time of the pandemic affected the formation of the habitus to some extent, that is, it affected the ability, dispositions and in general the culture of the kindergarten teachers who taught at a distance at the time, in the pedagogical use of ICT at the micro level of schools and their school classrooms (Koustourakis, 2023; Rini *et al.*, 2024). However, both the specific period and the current pedagogical need to utilize technological means and tools in everyday school life bring to the fore the need for the professional development of kindergarten teachers through their ongoing training and training in modern and evolving digital technologies (Klusmann *et al.*, 2022; Miulescu, 2020; Pliogou *et al.*, 2024).

In the next section, we will refer to some of the digital media and tools that can be used in modern kindergartens to carry out the lifelong educational project.

4. Utilization of digital tools and applications in the field of preschool education

In today's educational "landscape" it seems that the use of digital tools and applications is a necessity in the case of modern Kindergartens where the goals are interaction between students and teachers, student experimentation and supporting their learning efforts (Kaware & Sain, 2015; Machkour *et al.*, 2025; Magen-Nagar *et al.*, 2013). In particular, in the context of the educational process, it seems that the use of the following digital media and applications is appropriate.

4.1. Mobile devices

For the implementation of the aims of modern compulsory education curricula for the gradual acquisition of digital literacy by students starting from their studies in Kindergarten, it seems that the use of portable devices, i.e. tablets and smartphones, is necessary. Their integration into the educational routine can lead to the formation of an attractive interactive learning environment within which the students' interest in the taught school knowledge is enhanced. Also, the use of mobile devices promotes collaboration and communication both between the children themselves and between teachers and their students' families (Lindahl & Folkesson, 2012; Qian & Hu, 2024; Šušterič *et al.*, 2025; Zaranis *et al.*, 2013).

The use of tablets in the context of the daily teaching process can activate students' interest in the subjects being taught, encouraging their motivation to learn. Also, it can strengthen the students' social and individual skills and also promote interaction between them through the "gamification" of learning by implementing specific digital learning activities.

The design of the tablets with the graphics they contain seems to make it easier for children to understand how they work. Thus, tablets can be considered as suitable teaching tools for young children. However, the effectiveness of the use of the specific tools is a function of the users, i.e. the teachers who plan the learning process and the students who are trained in an appropriate way to use them (Christie & Johnson, 2009; Kjällander & Moinian, 2014; Plowman, 2016; Zaranis *et al.*, 2013).

4.2. Educational software and hypermedia environments

In order to use digital media in teaching, it is necessary to integrate appropriate software for the preschool age. Such are the cases of practice and practice software, simulation environments, development and creation environments, programming environments, as well as hypermedia environments. In particular, development and creation environments, such as Kidpix, and programming environments, such as Scratch, allow for the implementation and promotion of learning objectives through educational play. They can also contribute to the implementation of problem-solving learning activities, as well as to the cultivation of pre-language and pre-math skills in young children (Etten, 2000; Judge *et al.*, 2004; Misirli *et al.*, 2021; Papadakis *et al.*, 2016).

4.3. Interactive boards

The integration of interactive whiteboards into everyday school life requires the parallel use of a computer and a video projector, which are connected. With the didactic use of interactive tables, Kindergarten students are given the opportunity to follow the content of a lesson, such as the "olive and its harvest", in an interactive way. In this case, students can acquire interesting information in a multimedia way. Also, cooperative learning is encouraged, and students' interest is activated, as through specific icons, which they touch on the interactive surface of the board, they can search for additional information on aspects of the subject being taught (Demeshkant *et al.*, 2023; Drigas & Papanastasiou, 2014).

4.4. Educational robots, social interactive robots and programming games

A modern trend in ICT tools that are utilized in the modern Kindergarten are programming games and educational robots. In this case, students have the opportunity to come into contact with STEM (Science, Technology, Engineering, and Mathematics) approaches and engage in educational activities related to learning to code and basic elements of programming and robotics. Students' contact with educational robots and programming games, such as Beebot, gives them the opportunity to learn basic programming concepts, develop problem-solving skills and make decisions by adopting computational thinking in order to perform a series of actions and "steps" in a game (Bakala *et al.*, 2021; Papadakis, 2020).

Moreover, socially interactive robots can serve as assistants to the kindergarten teacher in carrying out the teaching (Ružić & Balaban, 2024). For young children, storytelling is a powerful way to reinforce the learning of the language code and contribute to their education by conveying knowledge, cultural elements, ideas and feelings. Storytelling can be done using a socially interactive bot. In this case, the use of this particular robot can be seen as an attempt to extend older methods of telling stories where puppet theater or traditional theater was used. It is worth noting that using a socially interactive robot as a storyteller can enrich the narrative by expressing emotions through simulation, which can be “articulated” with movements by the humanoid robot that mimic human behavior (Breazeal, 2002). In fact, children's participation and involvement in storytelling can be enhanced if socially interactive robots are "combined" with other media, such as PowerPoint presentations (Conti *et al.*, 2020; Sugimoto, 2011).

4.5. PowerPoint

The use of PowerPoint in the context of the teaching implemented in kindergarten classrooms can enhance the children’s learning experience. This tool enables the presentation of course content in an engaging way and can be used to support students' emerging literacy (Liu *et al.*, 2014).

4.6. "Tools" to support "inclusion" in the classroom

The use of ICT in the Kindergarten is linked to the possibility of designing or using special tools which aim to support the participation of children with special educational needs

in the learning effort. In this case, ICT may act as a mediating means of 'inclusion' for the particular students, who may use some special tools, such as adapted keyboards, mice, monitors, etc., to be able to participate in the educational process based on their own particular learning pace. For example, the use of AudioChile, a 3D audio-visual environment, can help children with visual impairments to distinguish environmental sounds (Drigas & Kokkalia, 2014b).

5. Advantages of using ICT in preschool education

The use of ICT in the educational process implemented in Kindergartens seems to have a positive effect on the children's learning experience because it contributes to the development of their creativity, activates their curiosity and helps them enter into a problem-solving process (Brito, 2010; Fesakis *et al.*, 2011; Ghavifekr & Rosdy, 2015; Magen-Nagar *et al.*, 2013).

In addition, the use of ICT can contribute to strengthening the cognitive development of kindergarten students in the various learning areas of the preschool curriculum, such as language cultivation. The integration of ICT in preschool education can also contribute to the development of the child's observation skills, the cultivation of the imagination, creativity, and can also be part of a process of experimentation and discovering new things (Drigas & Kokkalia, 2014a; McLachlan *et al.*, 2018; Palaiologou, 2016).

The use of ICT in Kindergarten seems to contribute to the development of students' early reading, language and communication skills. A wide variety of ICT-supported applications, such as digital books, appear to enhance children's speaking and writing. Also, the use of ICT acquaints children with open learning environments, providing them with possibilities for a multimodal approach to fairy tales and stories. Multimedia tools, such as digital stories and interactive games, provide rich language environments, so that children have the opportunity to become familiar with a wide range of vocabulary, but also have the opportunity to express themselves. Furthermore, the use of ICT in Kindergarten, through the use of tablets and "smart" mobile phones, can strengthen children's early mathematical skills (Drigas & Kokkalia, 2014a; Liu *et al.*, 2024; Papadakis *et al.*, 2016).

Computer-assisted instruction in the kindergarten classroom appears to significantly impact children's cognitive, emotional, language, and reading abilities (Vernadakis *et al.*, 2005). In particular, regarding the use of the computer in preschool education, it seems to have a positive effect on the students' learning of various cognitive subjects (Tsitouridou & Vryzas, 2004), as well as on phonological awareness (Segers & Verhoeven, 2005).

The use of interactive whiteboards in the kindergarten classroom seems to strengthen the group way of learning and enables the active participation of students, the development of effective cooperation for the implementation of group activities, encouraging dialogue and the sharing of ideas and opinions in real time in the context of the use of digital tools and software. In addition, interactive whiteboards allow for the

adoption of differentiated teaching methods, which promotes the active participation of all students in the learning process (Beauchamp & Kennewell, 2010; Drigas & Papanastasiou, 2014).

Furthermore, the integration of ICT in the Kindergarten provides multiple advantages, beyond the students, to the teachers and also to the parents. The use of digital technology and the exploitation of its potential contribute to the expanded professional development of preschool teachers, while simultaneously strengthening their motivation to further enhance their professional profile in the context of the modern digital educational "landscape" of the 21st century. Kindergarten teachers can create online groups with their colleagues, develop collaborations and share knowledge to gain a range of experiences from the context and conditions of the learning process in the school classroom, to "follow" specialist websites and to be trained regarding the content of their work, as well as to keep up with updated knowledge and information. Teachers' skills in the use of digital technology are linked to its safe and careful application, as well as to the selection of appropriate equipment that promotes the perceptual and physical abilities of young children (Bay, 2022; Carlson & Gadio, 2002).

In relation to parents, the use of ICT in Kindergarten seems to provide benefits, as technological tools such as smartphones, wearables and various digital applications enable teachers to communicate with parents and share information about the children's progress in kindergarten. In this perspective, there is a digital "channel" of communication between school and family with an emphasis on learning and student development. In the event that the students' parents are unable to attend face-to-face informational meetings at the kindergarten, they have the option of participating in online meetings via video call. Furthermore, as long as parents are digitally aware, learning can be extended and continued at home, with parents being participants in their children's activities (Bay, 2022; Zaranis & Oikonomidis, 2016).

6. Problems stemming from the use of ICT in the case of preschool education

Although the integration of ICT in the Kindergarten has significant advantages, it is also accompanied by some challenges and concerns, which we will refer to shortly afterwards. These challenges must be managed by both teachers and parents in order to make the use of ICT in the educational process beneficial for preschool students (Drigas & Kokkalia, 2014a).

Concerns and concerns about the use of digital media and devices by young children are related to issues regarding the time limit for their safe and beneficial use, as well as the appropriateness of the online content that they come into contact with. (Zimmer *et al.*, 2019). This is due to the fact that the way children interact with modern digital technologies seems to shape their habitus and is, therefore, an important modern factor that affects their socialization (Giddens & Sutton, 2020; Koustourakis, 2023). In particular, medical studies show that the extensive degree of "consumption" of digital devices by young children tends, in a more general context, to have a negative effect on their health and development. Furthermore, it is argued that children's long access to

digital devices may limit their physical interaction with people in their social environment and limit some necessary physiological activities, such as playful interaction with peers. It also appears that children's participation in face-to-face activities, which involve the characteristics of cooperation and manipulation of things and objects, tends to play an important role in their future success in mathematics and science. Early learning in young children through unstructured face-to-face play appears to activate their development of problem-solving skills and self-regulation. In fact, the effects of long-term and extensive use of screen devices connected to digital technology may manifest themselves in the children's distant future (Magen-Nagar & Firstater, 2019; Wolak & Kim, 2023).

In addition, the lack of live communication and physical interaction among preschool students during the implementation of "emergency remote teaching" appeared to create some problems in the adaptation of students to live daily teaching after the end of the pandemic (Paul & Reason, 2024). This is because lifelong social interaction is of key importance for the development of kindergarteners' social skills. Of course, although ICTs can facilitate certain types of interactive learning and serve emergency purposes, such as in the case of a pandemic, they cannot replace living learning, which takes place through unmediated social interactions (Mustafa & Mohammed, 2023). In fact, kindergartens in countries where attendance is compulsory are an important secondary factor in shaping the habitus of young students, as through the lively interaction that takes place in their classrooms, they acquire specific knowledge and skills, their tastes and attitudes on specific issues are formed and, in general, their personality is "built" (Asimaki & Koustourakis, 2014; Bourdieu, 1986; Rini *et al*., 2024).

An additional concern arising from the application of emergency remote teaching in preschool education to continue the educational work in emergency conditions is linked to the issue of social inequalities. This is due to the fact that a group of the population faces difficulties in terms of access and the appropriate use and utilization of digital technology to carry out the learning process in kindergarten at a distance. In fact, from relevant studies, it appears that many infants were excluded from participation in the remote implementation of the educational project during the period of the pandemic due to socio-economic factors. Such factors were some parents' unemployment, some parents' technological illiteracy, as well as the lack of financial resources for the supply of the necessary computing means. This fact is linked to the phenomenon of the digital divide in the cases of preschool students who came from non-privileged socio-economic strata (Koustourakis, 2023; Vassallo *et al*., 2021).

Then, the use of socially interactive robots in the field of early childhood education seems to raise specific concerns and ethical dilemmas. Such a reflection is connected to the question of the safe use of such a robot in the context of the educational process, where it is necessary for the students and the teacher to interact with it (Woo *et al*., 2021). In particular, taking into account that some activities within a Kindergarten classroom are implemented in an unorganized way, as is the case with free play, it is possible that the particular robot has not been properly programmed and that not all possible scenarios have been taken into account that would prevent a possible injury to a toddler (Vasic &

Billard, 2013). Also, in several cases, educators know little about how socially interactive robots work and cannot effectively intervene to deal with situations where the technology does not work as expected. From this point of view, it would be preferable to only use a socially interactive robot in educational environments that are staffed by teachers who have specialized technological knowledge for their operation and pedagogical use. Finally, an ethical consideration concerns the issue of privacy for students, parents and teachers in the case of the use of socially interactive robots in Kindergartens. For example, if such a robot can "remember" information and "record" it, this may raise issues of privacy for the student and possibly their family (Tolksdorf *et al.*, 2021, pp. 132-133).

7. Concluding remarks

Based on what was approached in the above sections of this work, we come to the following conclusions:

The decision of the European leaders at the Lisbon conference in 2000 seems to have contributed to European Union countries, such as Greece, reforming the curricula of both compulsory and pre-school age education. In particular, these countries decided to implement a series of political actions that would contribute to the integration of ICT in pedagogical practices to support the educational project with the main objective being European students' acquisition of technological literacy (Commission of the European Communities, 2001). In the case of kindergartens where curricula that follow academic logic are implemented, it seems that through the use of ICT in everyday school life, emphasis is placed on strengthening the students' technological skills. In fact, these toddlers, as digital natives, have already started from infancy to become familiar with the use of digital devices in the context of their family environment (Qian & Hu, 2024; Šušterič *et al.*, 2025).

In order to achieve the goals of using ICT in preschool education, it is necessary to integrate the knowledge and ability to effectively handle the internet, digital media and digital applications into the habitus of kindergarten teachers. It is also necessary to activate the dispositions of kindergarten teachers for the pedagogical use of the digital media and applications available to them in the everyday life of their school classrooms. The implementation of "emergency remote teaching" to continue the educational work during the Covid-19 period seems to have contributed to the development of the habitus of many kindergarten teachers by incorporating specialized elements of digital literacy, due to the fact that in this case the kindergarten teachers had to act both individually and collectively to acquire the know-how to handle ICT in order to simultaneously implement their distance education work in a modern and asynchronous way. Also, kindergarten teachers at that time had to guide their students' parents in the ways they should help, strengthen and support their children's participation in the distance education process (Koustourakis, 2023; Rini *et al.*, 2024). In fact, both the experience of the pandemic period and the current pedagogical need to use ICT in the school environment bring to the fore the need for the ongoing training of kindergarten teachers in modern digital technologies

for their professional development (Klusmann *et al.*, 2022; Miulescu, 2020; Pliogou *et al.*, 2024).

Then, to realize, facilitate and support the educational work in modern kindergarten classrooms, it seems that a variety of digital tools and applications can be used. This category includes mobile devices, interactive whiteboards, educational and socially interactive robots, as well as programming games, which enrich the content of a course and make it engaging and interactive, while also offering students the opportunity to experiment and create (Kaware & Sain, 2015; Machkour *et al.*, 2025; Magen-Nagar *et al.*, 2013; Zaranis *et al.*, 2013).

The ICT-supported Kindergarten environment appears to have a positive impact on children's learning experiences and contributes to their cognitive development and the development of their language and communication skills. Also, the use of ICT in kindergarten classrooms seems to be able to influence the way toddlers play and interact by mobilizing their curiosity and promoting the development of their creativity, contributing positively to the successful implementation of problem-solving activities.

However, the use of digital media by young children raises concerns related to the time frame for their safe use, the appropriateness of the online content with which children "interact", as well as whether children's extensive degree of access to and contact with digital devices limits their physical activities and physical interaction with their fellow human beings. Concerns and ethical dilemmas also arise regarding the possibility of violating the privacy and personal data of preschool students who interact with socially interactive robots within their school classrooms (Tolksdorf *et al.*, 2021).

Completing this work, we believe that it would be of scientific interest to conduct large-scale studies that focus, on the one hand, on the pedagogical use of the various ICT tools by primary and secondary education teachers in the context of their daily educational work. And, on the other hand, on the investigation of the factors that influence and hinder the teachers' utilization of ICT in the educational process.

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