



CULTIVATING PRESCHOOL STUDENTS' DIGITAL COMPETENCE THROUGH DEVELOPMENTALLY APPROPRIATE SOFTWARE

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Abstract:

Technology can be a powerful and engaging tool for collaborative and creative learning, helping students and teachers to access, create and share digital content, and express themselves creatively. In this paper, we will try to refer to the cultivation of digital competence from a very early age based on research data and the developmentally appropriate use of digital tools and software based on learning theories by presenting an indicative map of digital tool use in the classroom based on the European reference frameworks DeSeCo and DigComp Edu.

Keywords: DeSeCo, DigComp Edu, developmentally appropriate use of digital tools, kindergarten

1. Introduction

Digital technology is not only affecting the way we go about our lives, but is transforming traditional structures, methods, and assumptions about how we communicate, learn, work and live our lives in general. However, the reality is that 44% of Europeans still lack basic digital skills while 79% of Europeans use the internet regularly (at least once a week) (Foti, 2021, DigComp, 2018). The predictions showed that the majority of job types will require digital skills in the future, which was confirmed by the COVID-19 pandemic and the new data released (Foti, 2020).

It is now an assumption that Information and Communication Technologies (ICT) which refers to Digital Technologies such as computers, mobile phones, laptops, printers and scanners, televisions, cameras, electronic games, digital cassette recorders, software products and Internet services, (Aldhafeeri et al, 2016) have contributed significantly to the cultivation of a new pedagogical concept, based on the active and experiential way of

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learning and the development of new competences and skills, so that students can cope with the demands of the modern era.

The European Commission, through a series of practical policies and actions and in cooperation with the Member States, has given priority to supporting the development of digital skills for teachers, workers, and innovation in every sector, while the rapid pace of change and the constant development of technologies highlight the need to equip ourselves with specific skills relevant to our work, but also with general skills that enable us to adapt to change, keep up with the digital world and The Open Public Consultation (OPC) on the Digital Education Action Plan 2021-2027 with a survey (Karpiński et al, 2020) gathered the views of citizens and stakeholders, including institutions and public and private sector organizations, on the future of digital education during the COVID-19 crisis highlighting, among other things, the need to strengthen, adapt and invest in a wide range of digital skills and competences (European Commission, 2020).

2. Digital competence in kindergarten

Initially clarifying the term competence and according to Perrenoud (1995), competence is defined as high-level expertise that requires the integration of multiple cognitive resources when dealing with complex situations. According to the OECD and the DeSeCo project (Description and selection of key competences, 2003), competence is about responding to complex demands and performing different tasks in an appropriate manner and is acquired through active participation in social practices, which can be developed both in the formal educational framework, through the curriculum, and in informal and informal settings (OECD, 2003).

According to the European Parliament and Council (2006), *“Digital competence implies the critical and secure use of information society technologies for work, leisure, and communication. It is based on basic ICT skills: the use of computers to retrieve, evaluate, store, produce, present and exchange information, as well as to communicate and participate in collaborative networks using the Internet”*.

Digital competence is based on essential Information and Communication Technology (ICT) skills and the ability to communicate and participate in collaborative networks using the Internet, while creative and safe use of information and communication technologies is essential to achieve goals related to work, employability, learning, leisure time use, inclusion, and participation in society (European Commission, 2018; Foti, 2021).

Digital literacy also requires knowledge of the main computer applications, such as word processing systems, spreadsheets, databases, information storage and management, as well as the development of various skills related to accessing, processing, and using information for communication, content creation, security and problem solving, both in formal, informal, and informal contexts (European Commission, 2018).

Knowledge on using available technological resources in order to solve real problems in an effective way, as well as evaluating and selecting new sources of information and technological innovations are included in what we describe as digital competence, according to the European Commission (2018). Cultivating this competence also requires the development of an active and critical attitude towards technologies, in understanding the possibilities and dangers of the Internet and the communication by online tools while respecting legal and ethical values in using them.

Moreover, digital competence implies participation and collaborative work, as well as motivation, curiosity to learn and improve the use of technologies (European Commission, 2018). Digital competence means that people can use digital technology in a confident, critical, and safe way.

The introduction of Information and Communication Technologies - ICTs. E (Information Communication Technologies - ICTs) leads to new communication implications, including in the field of education, where students are practiced in "*digital skills*" leading to so-called "*digital literacy/literacy*" (Koutsogiannis, 2011) or "*information literacy*" (Kapaniariari & Papadimitriou, 2012), essential in an era of rapid technological developments and intense socio-economic inequalities arising from its opposite, 'digital illiteracy', creating in the global sphere new geographical borders of inequality not based on class but on education (Leontidou, 2012)

The vast body of research on children's education and development has been instrumental in designing programs for young children's use of technology, with the goal of learning and developmental benefits for children (NAEYC, 2009b). The pedagogical use of ICT in early childhood education is achieved when appropriate educational software, applications and tools are used that can support and enhance children's learning, contributing to their cognitive, social, emotional, and personal development (Nikolopoulou, 2014).

Although previous research has particularly emphasized the negative effects of digital technologies on children's cognitive development and self-control. Researchers' perceptions change radically from decade to decade. Today, the use of new technologies is now taken for granted and the question is whether it can be used in education for the maximum benefit of students as children now seem to be familiar with new technological tools as early as infancy (Nolan & McBride, 2013).

According to the 2017 research conducted by Common Sense Media in America, 84% of children aged 0 to 8 years old use digital devices (Smuseva & Rolich, 2018). In 2015 a survey was conducted in Russia by Hi-Tech.Mail. Ru among more than 5000 parents. The results showed that children start using gadgets for the first time between the ages of one and 3 years, while 85% of parents give adult "smart" devices to children (Smuseva et al., 2018).

In Europe, very young children (0-8) show particularly elevated patterns of internet use, and most children under 2 in developed countries have an online presence (or digital footprint) through their parents. The research project 'Young children (0-8) and digital technology', co-founded and coordinated by the European Commission's Joint

Research Centre involving 234 families in 21 countries, had as its main finding that children's digital skills seem to develop from a very early age, mainly at home, observing and mirroring parents and older siblings' digital behaviour, while parents try to balance and preserve their children's digital engagement, sometimes more and sometimes less, with their children's own digital presence.

We are therefore living in the 4th industrial revolution and the digital age, because of rapid technological development and the ever-new achievements that are flooding our daily lives. Children almost universally are exposed to digital devices and new software from a very early age as recipients of the cultural good of technology.

The questions that arise are not whether to introduce NTs in kindergarten but how to help kindergarten and teachers with the necessary knowledge, tools, and strategies to cope with the rapid changes in the modern digital environment (Preradovic et al., 2017) and what are the appropriate and constructive uses of technology in children.

3. Learning theories and software

To understand the way in which software is used and selected, a brief reference and connection with learning theories should be made, starting from the theories of behaviorism, which consider only the changes, the transformations of externally observed behavior and systematically study only the external reactions of individuals, rejecting hypotheses or interpretations based on the internal mental processes of people. Learning according to behavioral theories means stimulus-response connections and repetitions strengthen the connections and thus learning, while positive reinforcements (such as rewards) strengthen a particular 'learning' and negative ones weaken it.

Based on the theories of behaviorism are the guidance, tutorials and drill and practice software, which are suitable for performing operations, memorization, assessment, and supervised teaching, exerting a great influence on the design and use of ICT applications, as it placed great emphasis on the continuous and active participation of the learner, encouragement, practice, and the role of rapid feedback (Komis, & others. (2007).

Cognitive theories, particularly constructivism, attach a great deal of importance to the internal, cognitive processes of the individual. Learning in these theories is not transmitted, but is a process of personal construction of knowledge, which builds on prior knowledge by requiring the rearrangement and reconstruction of the individual's mental structures to adapt to the new knowledge, but also to "accommodate" the new knowledge.

J. Piaget's epistemology considers that the development of the child's logical and scientific thinking is a developmental process with several stages and each student constructs knowledge in his/her own way, actively, and is not just a passive receptor of information and "knowledge" (Piaget, 1958). J. Bruner proposed as a basic theory of learning the discovery learning where students discover knowledge through discovery processes - by experimenting, testing, verifying, or disproving and the gradual discovery

of knowledge which can be a very important motivation for the learner. (Bruner, 1997). The educator can help or even guide (guided discovery) by playing the role of animator, facilitator, and guide in the process of discovery.

The educational software and environments that support the idea of knowledge building are open-source software where children can manipulate and transform information. It is possible to adapt the task they are asked to carry out to their abilities, as well as to structure and reconstruct children's thoughts and experiences through discovery methods (Bratitsis, 2015) Several ICT-based learning activities are supported by constructivist learning theory such as microcosms which are computer-based simulations of real environments in which students construct knowledge as they explore and design new worlds (Web Applications 2. 0, Glogster, Padlet).

According to sociocultural theories, learning takes place within specific cultural contexts (language, stereotypes, perceptions) and is essentially created by the interaction of the individual with other individuals, in specific communicative circumstances and through the implementation of common activities. Sociocultural theories support collaborative learning in all its forms and therefore a course organised to take these theories into account must be carefully designed to encourage collaboration between students and, more generally, social interaction, guidance, support, and mediation (Komis, 2010).

Next, Gardner's theory of Multiple Intelligence suggests that people do not learn in the same way, nor do they have the same abilities, but perceive the world in eight different ways. Consequently, children should also have opportunities in the learning process to exercise all forms of intelligence and ICT can reveal many benefits for the learning process, both for teachers and pupils through activities covering a wide range of forms of online activities e.g., interactive games, virtual experiments, supervisory materials, audiovisual materials and the opportunity for children from an early age to come into contact with a significant number of educational applications.

4. Digital tools and early childhood education

Young children generally have a varied and balanced life incorporating sports, outdoor play and creative activities in which digital activities play only one role. However, they are daily consumers of audiovisual media service products (AVMS), (smart) TV, video, and games, via smartphones, tablets, video game consoles, laptops and more rarely computers. The most popular are small screens (although smart TV is impressive) that enable mobility and have availability, ownership and autonomy of choice and use.

Children have their first contact with digital technologies and screens at a very early age (under 2 years), usually through their parents' devices, which are not adapted for them from the start, and they learn very quickly how to interact with digital devices by observing the behavior of adults and older children. Even if they have not yet mastered reading and writing, they develop their own strategies: autocompletion, voice

recognition, and picture recognition, doing so, most of the time, in isolation and autonomously, following a trial-and-error learning path that is not exempt from risks.

Technology now occupies an important role both in our society and in everyday life which positively influences the integration of digital and web-based applications and software in pre-school education. These applications and software document their educational value and practice in preschool education as they are linked to pedagogical theories of learning. Technological activities can have both beneficial and negative effects on the knowledge acquisition process and socialization of young children, and this is due to the way they are approached by the pedagogical team.

To contribute positively to the all-round development of young children, it is suggested that they be implemented in a climate of cooperation and communication and that they foster interaction and exchange of views within the pedagogical team. The positive impact of digital and online applications in early childhood education can be achieved through mixed and small groups of children working with the available digital and online applications, as well as through individual and group technological activities, and with the supportive guidance of an adult.

For young children, digital technology is useful for four main purposes: (1) recreation and entertainment with videos and games (2) information and learning with search engines to obtain information or to learn but also to feed their interests, imagination, and creativity (3) creation through software and applications that encourage it and (4) communication.

In the image below (Figure 1) you can see a map of digital tools for classroom practice and the hyperlinks from the recommended digital tools.

Figure 1: Digital tools for classroom practice



Χάρτης Αξιοποίησης Ψηφιακών Εργαλείων στην Τάξη

Ασφάλεια - Safety: [Better Internet for Kids](#), [Safe Internet Day \(SID\)](#), [eSafety Label](#), [SELMA](#)
Καινοτομία- Innovation: [eTwinning](#), [Code Week](#), [SELFIE](#)
Συνεργατική Μάθηση- Collaboration: [Padlet](#), [Miro](#), [Whiteboard.fi](#), [Slack](#), [Explain Everything](#)
Κωδικοποίηση- Coding: [Hour of Code](#), [Scratch](#), [Code Week](#), [eTwinning Σεμινάριο με Bee-Bot](#), eTwinning seminar in Bee-Bot
Παιχνιδοποίηση- Tinkering: [Class Craft](#), [Class Dojo](#)
Δημιουργία Περιεχομένου- Creation: [Canva](#), [Prezi](#), [Bitmoji](#), [iMovie](#), [Audacity](#)
Αξιολόγηση-Evaluation: [Google Forms](#), [Google Drive](#), [Flipgrid](#), [Kahoot](#), [Edublogs](#), [Quizziz](#), [Wix](#)
Διαδικτυακή Διαχείριση Τάξης – Class Management: [Google Classroom](#), [Edmodo](#), [Moodle](#), [Microsoft Teams](#)

5. Conclusions

The educational system, the school, and the teachers can have a significant influence on the acquisition of digital competences of students - including creativity - when digital technology is integrated as active learning tools. Developing digital literacy at school from an early age (kindergarten) would also help to raise awareness of security issues and to build critical thinking and resilience in the digital context.

Finally, the effective integration of digital technology in the curriculum would influence parents' positive perceptions of digital technology as a learning tool and increase parents' support for acquiring digital skills useful for the digital future, while more and more parents believe that digital technologies are dominant and consider digital skills to be essential for their children's education, expecting schools to play a key role in the digital culture of the new generations.

Conflict of Interest Statement

The author declares no conflicts of interest.

About the Author

Paraskevi Foti is an Educational Coordinator in Regional Directorate of Primary & Secondary Education of Attica and formerly Head of the 4th Kindergarten of Agia Varvara. She has studied classic piano and theory at the National Conservatory of Athens, and she has completed her master's degree (MEd) in Intercultural Education and Management of Diversity. Her second degree is in Psychology from National and Kapodistrian University of Athens with a specialization in Pedagogical Psychology and her doctoral dissertation (PhD) is entitled: "The contribution of ancient Greek language to art and language of Aesop and the added value of ICT Technology" with an Excellent degree. Her first book, "Otherness, Prejudice and Stereotypes in the School Class. Teacher Management Methods" (ed. Grigoris, 2016) was selected as a University chart at Harokopeio University of Athens and she has participated in a collective volume on digital educational scenarios (ed. Grigoris, 2017). Another book is "Understanding our Language, Ancient and New Greek through Aesop" (ed. Grigoris, 2020), and the next one is entitled "STREAM and Educational Robotics for children aged 3-8 years" (ed. Grigoris, 2020). She has published in many international and national conference proceedings as

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