COMPUTER SCIENCE AND PRIMARY EDUCATION TEACHERS' PERCEPTIONS, IN USING DIGITAL GAMES AS LEARNING TOOLS. OBSTACLES AND FACTORS THAT LEAD TO THEIR EFFECTIVE USE

Kougioumtzidou Eleni[1i],
Botsoglou Kafenia[2],
Zygouris Nikolaos[3]
[1]Adjunct Professor,
University of Thessaly,
Volos, Greece
[2]Professor,
University of Thessaly,
Volos, Greece
[3]Assistant Professor,
University of Thessaly,
Lamia, Greece

Abstract:

Over the last decade, in addition to their entertainment dimension, digital games, have been used as teaching and learning tools. International literature has shown several studies that evaluate the effectiveness of digital games in the educational process. Many researchers argue that digital games can be of assistance to student's learning and solving problems, as well as develop social and cognitive skills (Gee 2003, Prensky 2007, Oblinger & Oblinger 2005, Watson et al. 2011). This research aimed to computer science teachers and primary education teacher's perceptions, regarding the use of digital games, as a teaching and learning tool, the factors that make their use effective, not to mention the barriers to their use. One hundred twenty teachers participated (70 computer science teachers and 50 teachers), by completing a questionnaire of fifteen questions, on a Likert scale and two open-ended questions. Results demonstrated that both teachers and computer educators agree that the use of digital games is a "good" practice, which enhances and enriches the learning process, provides motivation, and is an effective learning tool. Their design should be addressed to students' personal needs and be based on learning principles. However, it has been observed that computer educators are the ones who use digital games in their teaching, more often as opposed to teachers. The main obstacles that prevent teachers from using technology in their classrooms are the lack of infrastructure, motivation, training, as well as the time available. The elements that seem to be taken into consideration by a teacher, in order to capitalize on digital

[i] Correspondence: email ekougioum@uth.gr

games in the educational process, are personal needs and students' particularities, as well as preparation, feedback and the setting of limits by the teachers. Research findings could be utilized in both digital play use in education and in its development, as a learning tool.

Keywords: digital games, primary education, barriers, teachers, use of digital games, teaching

1. Introduction

In recent decades, digital games have become one of the most popular activities among children. According to Olson (2010), they claim a large part of both children's and adults' daily lives. Digital game, as a term, refers to those games which are played with the participation of one or more players, using an electronic device, which receives players' data and at the same time provides them with digital information, as well as feedback, within the framework of programmed rules. The electronic device can be either a portable one (mobile phone, tablet), or a game console, or a computer (Mitchell & Savill-Smith, 2000; Kirriemuir & McFarlane, 2003).

Technology use, and especially digital games, are an integral part of children's daily lives that can result in the differentiation of their language, way of thinking, as well as information management, compared to older generations. Prensky (2004) points out that the new internet generation, communicates, creates, learns, socializes and evolves differently. For this generation, digital games are a cultural mean of communication, information and socialization that affects individuals' daily lives, in particular young people (De Aguilera & Mendiz, 2003).

From this point of view, the development of learning theories has influenced trends in the design and use of digital games (Wu, 2015). Thus, initially, the first educational games in the 1980s were designed in the context of educational entertainment (edutainment).

The next generation of educational digital games, from the early 1990s, were designed, based on the cognitive constructive approach, focusing on students. At the beginning of the next decade, the third generation of educational games followed, which focused on the processes of games use.

Focusing on the social dimension of learning and based on the principles of constructivism and contextualized learning, the new generation of toys has highlighted the value of socio-cultural interactive activities, collaboration, problem-solving, creativity and meaning in learning (Egenenfeld, 2005)

Games of serious purpose (Malliarakis, 2015) or serious games (serious games), that is the digital games that have integrated pedagogical principles and learning objectives (Simões, Redondo & Vilas, 2013; Tang, Hanneghan & El Rhalibi, 2009), belong to this generation. Serious games have educational content, which is offered in combination with fun, interesting and exciting elements. Students engage in them

cognitively and emotionally, developing new knowledge and skills and drawing satisfaction (Anastasiadis, Lampropoulos & Siakas, 2018).

At the same time, gamification emerged, a new trend of online learning, which is considered as the natural evolution of serious games, as it concerns the application of playful elements in learning activities. According to the definition of gamification, mechanisms and dynamics of games are applied in non-playful applications, aiming on enhancing an individual's involvement and promotion of specific behaviors (Deterding et al., 2011; Simões et al., 2013). Each teacher, having analyzed student's needs, can use appropriate digital games, guided by good practices and learning theories, that correspond to his choices.

In conclusion, each generation of digital games promotes different learning experiences for students and, therefore, teachers should adopt the appropriate approach and update their teaching practices so that educational objectives, practices and desired learning outcomes can be harmonized (Wu, 2015).

2. Literature Review

Digital games' effect on perception, intelligence, knowledge, as well as on students' emotions and motivations for learning, has emerged as the most common positive result of their utilization, in the educational process. When the information provided is directly related to entertainment, then the dynamics of educational recreation, reach its peak. This is the reason the use of digital games can prove particularly effective for students who have low motivation to learn, as it transforms learning activities into fun and appealing to children. The combination that educational entertainment offers, constitutes a driving learning force, not only for adolescents but for children too, while having fun in a single context (Ritterfeld & Weber, 2006).

Regarding teachers' views on using digital games in the classroom, Ertmer et al. (2012) investigated primary and secondary school teachers' beliefs about integrating technology into their lessons, to align with their daily practices. The participants demonstrated student-centered practices, which conform to their pedagogical philosophy. According to Kangas, Koskinen and Krokfors (2017)'s literature review, including 35 articles on the teacher's role while using educational digital games, the teacher's pedagogical role is evident in the majority of studies, as teachers are involved in the preparation of the lesson, the introduction of the games and the procedures during the game and after the game.

In the Netherlands, Huizenga et al. (2017) highlighted the views of secondary school teachers who use digital games in their teaching. Evidence suggested that the main factors, influencing the integration of digital games in teaching, are teachers' experiences and beliefs. Regarding the digital games' effect on their students, teachers mentioned student's active participation, in the learning process and the achievement of desired learning outcomes. Allsop and Jessel (2015) compared primary school teachers' views, in England and Italy. Teachers in both countries had a positive attitude toward teaching

with digital games. The majority stated that they consider them an effective learning tool. In Estonia, Jesmin and Ley (2020) found that most primary and secondary school teachers use digital games on a regular basis, mainly because of their effect on motivating students and as a means of exchanging teaching practice, but also of consolidating new knowledge and skills. Obstacles were technical problems and a lack of available resources.

In Spain, Sánchez-Mena and Martí-Parreño (2017) explored motivations and barriers to using digital games in higher education. According to the results, teachers highlighted the game's dynamic effect on students' attention and motivation and the possibility of facilitating learning. On the other hand, the lack of available resources and time for lessons preparation, the lack of students' substantial interest in games, the teachers' skepticism about digital games' suitability for teaching subjects and the fear that enthusiasm and entertainment, negatively affect the university's atmosphere disturbing the adjacent classrooms, where lectures are held.

In Greece, a survey by Panagos (2019), in which primary school teachers participated, found that digital games are not used in the classroom, although teachers said they would like to include them in their teaching, since the majority of the sample said that utilizes new technologies in teaching. The lack of an organized framework, the insufficient material and technical infrastructure of the school units, the lack of time and the lack of knowledge and readiness of the teachers emerged as the most important reasons why the teachers do not include digital games in their teaching. Athanasopoulos (2018), also investigating primary education teacher's views on the use of digital educational games, found that teachers have a positive attitude, due to their positive experiences. Teachers emphasized on the contribution of games to the motivation of students, the acquisition of knowledge and the development of collaborative and communication skills. However, they pointed out some weaknesses in the design of the games, such as insufficient feedback and lack of difficulty rating. At the same time, as practical obstacles, they highlighted the lack of material equipment, limited time and the inability of students to perceive games as part of the learning process. According to the participants, digital games can be used in the teaching of all cognitive subjects and can help promote interdisciplinarily.

Wu (2015) explored teachers' experiences and attitudes towards play-based learning. The majority of participating teachers had a positive attitude towards the use of digital games and a high sense of competence, with serious games at the forefront of their preferences. Nearly half of the teachers identified the lack of knowledge and skills as significant challenges, while the incompatibility between play-based learning and curricula, the negative attitudes of parents and principals, the lack of support, the short teaching hours and the low quality of educational games.

Rocha, Tangney and Dondio (2018), research, was based on the answers of primary and secondary school teachers from 34 countries. According to the results, the majority stated, that digital games contribute to learning. The experience of designing digital games, by the teachers who participated in the research of An and Cao (2017), was described as beneficial. Teachers developed a positive attitude and positive perceptions

towards the use of digital games in the classroom, while, at the same time, their sense of self-sufficiency was strengthened. All participants stated that digital game design should be part of professional development and educational practice, as through this process teachers realize the potential of games and remove suspicion and skepticism about their effectiveness.

3. Material and Methods

The main aim of the present study was to evaluate computer science teachers and primary education Teacher's perceptions, regarding learning through digital games. Digital game characteristics in order to be effective to learning. Evaluating the use of digital games in learning. Barriers that prevent teachers from using technology in their classroom. Combination of elements, that a teacher should take into consideration of, in order to have the desired results in the classroom.

More specifically the present research protocol tried to outline:
- What are teacher's perceptions about the effective use of digital games in the classroom, as learning tools
- Which are the characteristics that must be considered when designing games so that their use in the classroom promotes learning;
- How should students be assessed when using digital games in learning;
- Which are the barriers to technology use in the school environment;
- Which are the elements that can be combined in their use, in order to have desired effects in the classroom.

3.1 Participants
The research involved 120 primary school teachers in Volos, 47 men and 73 women. 60% of the sample were computer science teachers, while the remaining 40% were Elementary school teachers.
1) Digital game use in classroom, is a "good" use of technology, that enhances learning.
2) Digital game use in classroom enriches learning.
3) Digital game use in classroom motivates students.
4) Digital game use in classroom is a more effective tool for nowadays students than the previous ages ones.
5) Pictures, graphics and diagrams, integrated in teaching, improve learning.
6) Digital games and stimulation are an effective way of integrating pictures and graphics in teaching.
7) Digital games design should be addressed to students' personal needs and their way of learning (visual, acoustic).
8) Victory in digital games should be based rather in skills than random factors.
9) Digital games, which are used for learning, ought to have important content and not being associated with random facts.

10) In order to be effective, digital games should be designed according to principles of learning

11) When students use a digital game in learning, they should not get negative marks for wrong answers.

12) In games there should be no winners and losers, when students show meaningful effort to learn, they should all be recognized as winners.

13) The dynamics of a digital game used in learning, ought to be understandable and interesting for the players and not block or distort learning.

14) I use digital games in my teaching.

15) The use of digital games in teaching and learning process will increase over the next five years.

3.2 Tool and Process

The research tool was a questionnaire, which was based upon a combination of Raymond S. Pastore's and David A. Favlo's (2010) research tool and was completed with supplementary open questions, which arose from the research queries, as well as the variables that emerged from the literature review for the present research. In the first phase, a pilot study was conducted, in order to confirm the tool's reliability.

A Google Form was created to fill in the questionnaires electronically, in order to collect the largest possible sample of teachers. The electronic form was sent by e-mail to the primary education of Volos, as well as to the Center for Informatics of New Technologies (KEPLINET) of Volos. The duration of the distribution and collection of the questionnaires was seven months.

The questionnaire used was based on multivariate Likert scales, consisting of 15 Likert scale questions (5 possible answers 1 = strongly agree, up to 5 = strongly disagree), as well as 2 open-ended questions, as follows:

Cronbach's Alpha index, which was found to be equal to .75, was used, in order to ensure the reliability of the research tool. Regarding the reliability check of the data collection tool used, a pilot survey was conducted, using a questionnaire, on a small sample of primary school teachers in Volos, as an attempt to determine omissions or gaps, in order to make corrections and changes (Creswell, 2011).

A factor analysis of the participants' responses to the 15, questionnaire variables was performed, in order to determine the correlation between these 15 variables. Specifically, a Principal Component Analysis was performed, with orthogonal rotation of the factors and applying a criterion for selecting a number of factors the eigenvalue greater than 1.5, having first ensured that the conditions for exploratory analyses are met. Kaiser–Meyer–Olkin Measure of Sampling Adequacy was .75 and the Bartlett's test of Sphericity, which evaluates whether the correlations between the variables allow the application of factor analysis, was significant (p<.001).

Responses analysis, yielded 3 factors with an eigenvalue greater than 1.5, which in total, explains the 54.33% variance. Those factors were named: A. Learning through Digital Games (7 questions:1, 2, 3, 4, 6, 14, 16), B. Effective Digital Game Design (6

questions: 5, 7, 8, 9, 12, 13), C. Evaluating use of digital games in learning (2 questions: 11, 12). The internal reliability indexes (Cronbach alpha), for all three factors, was satisfactory (Factor A: a=.87, Factor B: a=.77, Factor C: a=.67)

A thematic content analysis was performed, in the open-ended questions, with answers coding and analysis (Isari & Pourkos, 2015), in order to examine teachers' beliefs, about barriers to technology use in the school environment, as well as elements that can be combined in their use, in order to have desired effects in the classroom.

3.3 Statistical Analysis of Research Data

For data statistical analysis, the application of the statistical package SPSS version 25, was used. Descriptive analyses sets of the data collected were performed, averages and standard deviations, for all variables, were calculated. A series of one-way Anova analysis have been taken place, in order to investigate if there were any differences between teachers' subgroups. No statistical significance was found over 0.05. Both elementary school teachers and computer science teachers' perceptions, emerged from the descriptive analysis as follows

4. Results

A. Learning through Digital Games (Factor A)

Computer teachers and educators were asked to express their views, on the inclusion of digital games in the classroom, as learning tools. Both teachers and computer educators, as shown in Table 1, on average, agree that the use of digital games in the classroom is a "good" use of technology (mean score 2.31) that enhances and enriches the learning process (mean score 2.31), motivates students (mean score 2.25), is an effective learning tool for today's students than for students of older generations (mean score 2.33). In addition, teachers were asked to indicate whether they use video games in their teaching process, while computer science teachers, on average, stated that they do, teachers said they were neutral on the question. On average, teachers reported using digital games in their teaching with a mean score of 2.77. The standard deviation of 0.97 indicates a relatively high level of variability in the extent of teachers' personal use of digital games.

Table 1: Average Views of IT Teachers & Teachers on Learning through Digital Games

Questions	Teachers		Computer Science Teachers	
	Mean	SD	Mean	SD
Digital game use in classroom, is a "good" use of technology, that enhances learning.	2,31	,85	2,15	,87
Digital game use in classroom enriches learning.	2,31	,88	2,08	,83
Digital game use in classroom motivates students.	2,25	,81	1,99	,78
Digital game use in classroom is a more effective tool for nowadays students than the previous ages ones.	2,33	,81	2,29	,85
Digital games and stimulation are an effective way of integrating pictures and graphics in teaching.	2,04	,77	1,94	,71

I use digital games in my teaching.	2,77	,97	2,39	,96
The use of digital games in teaching and learning process will increase over the next five years.	2,44	,87	2,06	,73

Note: Likert scale ranged from 1 -5 (1 = Strongly Agree, 2 = Agree, 3 = Neutral, 4 = Disagree, 5 = Strongly Disagree)

B. Effective Digital Game Design (Factor B)

Their perceptions of the design and use of electronic games in the classroom were explored. The views of the whole sample agree, on average, with the fact that games should be designed to address student's personal needs, as indicated by a mean score of 1.79 and their design should be based on learning principles, in order to be effective (mean score 1.75). They should be understandable and arouse children's interest in promoting learning and have important content. On average, teachers believed that the dynamics of a digital game used in learning should be understandable and interesting for the players, without hindering or distorting the learning process, with a mean score of 1.60. The SD of 0.54 suggests a moderate level of variability in teachers' perceptions regarding the balance between game dynamics and learning objectives. Computer Science Teachers, on average, had a slightly lower mean score of 1.54 and a slightly higher SD of 0.58 compared to Teachers.

Table 2: Average Views of IT Teachers & Teachers on Effective Digital Game Design

Questions	Teachers		Computer Science Teachers	
	Mean	SD	Mean	SD
Pictures, graphics and diagrams, integrated in teaching, improve learning.	1,63	,49	1,53	,71
Digital games design should be addressed to students' personal needs and their way of learning (visual, acoustic).	1,79	,62	1,92	,76
Victory in digital games should be based rather in skills than random factors.	1,65	,56	1,75	,75
Digital games, which are used for learning, ought to have important content and not being associated with random facts.	1,58	,54	1,74	,60
In order to be effective, digital games should be designed according to principles of learning.	1,75	,53	1,65	,65
The dynamics of a digital game used in learning, ought to be understandable and interesting for the players and not block or distort learning.	1,60	,54	1,54	,58

Note: Likert scale ranged from 1 -5 (1 = Strongly Agree, 2 = Agree, 3 = Neutral, 4 = Disagree, 5 = Strongly Disagree)

C. Evaluating the use of digital games in learning (Factor C)

Teachers, on average, expressed a neutral attitude towards the view that students when using an electronic game in learning, should not get a negative grade for wrong answers, unlike computer science teachers, who agree with this. Also, the point of view that there should be no winners and losers in games, but they should all be recognized as winners,

while students show substantial learning effort, finds teachers to declare on average neutrality as opposed to computer science teachers.

Table 3: Average views of IT Teachers & Teachers on
Students' Evaluation while Using Digital Games in Learning

Questions	Teachers		Computer Science Teachers	
	Mean	SD	Mean	SD
When students use a digital game in learning, they should not get negative marks for wrong answers	3,02	,93	2,89	,93
In games there should be no winners and losers, when students show meaningful effort to learn, they should all be recognized as winners	2,69	,90	2,39	1,11

Note: Likert scale ranged from 1 -5 (1 = Strongly Agree, 2 = Agree, 3 = Neutral, 4 = Disagree, 5 = Strongly Disagree)

4.1 Open-ended Questions

Two open-ended questions were used, for not anticipated topics, which were analyzed according to thematic analysis principles (Isari & Pourkos, 2015). Common elements / patterns in answers were investigated, based on which, codes were defined. Seven categories of topics emerged from their grouping (Table 4).

In a total sample of 120 teachers, answers to the question "What do you think are the barriers that prevent teachers from using technology in their classroom", were as follows:

Teachers' responses identified 76 reports, according to which lack of training is one of the most important barriers that discourages teachers from using technology in their classroom. At the same time, some teachers refer to the existence of trainings, but emphasize on their inadequacy, as well as the fact that familiarity with new technologies may be insufficient.

A large number of teachers (77 reports) argue that the lack of technological equipment and the non-existence of proper infrastructure, prevent teachers from using technology in the classroom. Schools' premises do not have the appropriate infrastructure, they have great shortages in technological equipment and logistical support. The existence of laboratories, with outdated means, is a deterrent to any use of them.

According to 54 teachers, a particularly important obstacle to not using technology in the classroom, is the lack of appropriate educational software. Specifically, they refer to the fact that, the appropriate tools are not provided by the educational system, as well as to the difficulty of finding or creating a suitable application (games, simulations). They claim that they are not provided with the proper tools and software, as there is "Lack of extensive range of games with pedagogical support" and "Lack of infrastructure of appropriate electronic material and non-matching of books with websites. They believe that there is no suitable educational software that can be used in the classroom so as to promote learning.

According to teachers' answers (27 reports), lack of time constitutes another major obstacle. Teaching hours are rather limited to integrate a new way of teaching resulting a proper performance. At the same time, proper preparation for a new object, requires a lot of time both inside and outside the classroom. At school, as teachers claim, there is a lot of time pressure, as the curriculum is quite demanding, the school syllabus is large in quantity and there is a weakness in keeping the curriculum. "Limitation of time, within the teaching hour" "Lack of time, time required to prepare the course" "Lack of time to prepare, the binding curriculum".

Thirty-one reports were found, according to which, there are no appropriate incentives for the use of technology in the classroom. The lack of motivation, on the part of the state, leads to a "lack of willingness" on their part to use something so innovative, which often requires special effort and dedication of valuable time.

Technophobia, anxiety & fear, are important inhibitory factor in the use of technology in the classroom, as identified in 29 reports by teachers. The fact that many educators are unfamiliar with the use of technology, leads to the avoidance of its use. They believe that damage will be caused to computers, but at the same time "electronic games will have a negative impact on children's psychology & behavior". They also claim that children will use computers uncontrollably, followed by a classroom's control loss.

Parental negative attitude, towards the use of technology in the classroom, is mentioned by 21 teachers as another obstacle. Many parents have linked, computer use to entertainment, considering it, a means of entertainment that can sometimes lead to negative consequences on their children's mental health.

Table 4: Number of Teacher Reports on the Question: "What do you think
are the barriers that prevent teachers from using technology in their classroom?"

Codes	Reports
Need for training	76
Incomplete infrastructure	77
Lack of proper software	54
Lack of time	26
Motivation	31
Technophobia – Anxiety – Fear	29
Negative parental attitude	21

During the process of thematic analysis, the following results were obtained, in the question "According to your opinion, which should be the combination of elements, that a teacher should take into consideration of, in order to have the desired results in the classroom". Five categories of topics emerged from their grouping (Table 5).

Forty-eight reports demonstrated that students' level of knowledge & skills, are important elements, which, when combined, can make the use of digital games in the classroom, constructive & effective. Respondents argue that the teacher should take into account the classroom's level, as its level of knowledge plays a particularly important role. They consider age, knowledge and skills considerable factors in the learning process.

According to the answers of 45 teachers, personal needs, interests, as well as students' particularities, are particularly important elements. Teachers can use technology in their classroom, with beneficial results, if they take into account each child's individual needs. Teaching must support both student needs and interests. In parallel, students' cognitive, educational and family environment must be taken into account. Digital games must be team games, non-violent, and their design should respond to student individual needs and wishes, not to mention pedagogical principles.

Pre-existing knowledge is, for many teachers (35 reports), an important element, which can help the use of digital games in the classroom, and eventually bring the desired results. Children's cognitive background, in computers use, contributes significantly to their proper use, but also to the understanding of their tools. Prior knowledge, significantly helps the task of teachers and creates a familiar and safe learning environment.

According to the opinion of 56 teachers, preparation, organization of time, feedback & establishment of boundaries, should be used in combination, in order to bring the desired results in learning. In order to use a new teaching method, efficient planning is needed, based on pedagogical principles, and accurate organization and management of time.

Motivation, based on the opinion of 34 teachers, can be an important factor, which will help in the constructive use of digital games in the classroom. Computers are a means that arouses children's curiosity and interest, it is clear that even indifferent students can be approached more easily and constructively by using the appropriate motives. Challenging children's willingness to cooperate, their willingness to learn and their interest through appropriate motivation, can lead to desired learning outcomes.

Table 5: Number of Teacher References to the Question: "What do you think are the elements that a teacher should take into account in order for their combination to help the use of electronic games in the classroom, to bring the desired results?"

Codes	Reports
Preparation/ Time management/ Feedback / Limits	56
Students 'cognitive skills / level	48
Personal needs, interests, peculiarities	45
Prior knowledge	35
Motivation	34

5. Discussion

Digital games, in recent years, are one of the most popular activities of children worldwide. Their integration into the educational process is in line with the introduction of new technologies in education and the change of traditional ways of teaching, as they transform the learning and teaching environment into an innovative, fun, motivating process (Cankaya & Karamete, 2009). According to several studies, a large percentage of

teachers intend to use digital games in their teaching (Baek, 2008; Becker & Jacobsen, 2005; Mena & Parreno, 2017).

The conditions, which make effective, both the integration and the use of an educational digital game in the classroom, lie in the appropriate planning, but also in teachers' active participation in the process of organization and design.

According to the results of the present study, the answer to our first research question "What are teacher's views about the effective use of digital games in the classroom, as learning tools", elementary and computer science teachers believe that the use of digital games in the classroom is a "good" use of technology, which enhances and enriches the learning process. Teachers, on average, rated digital game use as a "good" use of technology that enhances learning, with a mean score of 2.31. This suggests that teachers recognize the potential benefits of incorporating digital games into the classroom. Similarly, the finding that teachers believe digital game use enriches learning supports the idea that these interactive tools can enhance educational experiences (mean score of 2.31). These findings align with previous research that highlights the positive effects of digital games on learning outcomes (Gee, 2007; Hainey et al., 2016).

Furthermore, Teachers, on average agreed that digital game use in the classroom motivates students and proves an effective learning tool for today's students, compared to students of older generations. This finding suggests that teachers perceive digital games as engaging and capable of capturing students' interest, potentially leading to increased motivation and participation in learning activities Similar results are found in the world literature where, digital games are a "good" educational practice, which enhances and enriches the learning process (Noraddin & Kian, 2015; Felicia, 2009; Johnson et al.2012, Prensky, 2001; Boyle et al., 2016), motivates (Becker, 2007; Huizenga et al. 2017; Gaudelli & Taylor, 2011). The data also indicate that teachers consider digital game use to be more effective for today's students compared to previous generations (mean score of 2.33). This finding reflects the recognition that digital games align with the preferences and learning styles of modern students, who have grown up in a technology-rich environment. This belief in the effectiveness of digital games for current students is consistent with research that emphasizes the need to adapt educational approaches to match the needs and characteristics of the current generation of learners (Johnson et al., 2016, Bourgonjon et al.2013; Pastore & Falvo, 2010).

Research findings, concerning the second research question "Which are the characteristics that must be considered when designing games so that their use in the classroom promotes learning", reinforces previous research highlighting that digital games should be designed in a way that fulfill students' personal needs, an element which is in line with other studies (Arnab et al., 2013; El Mawas, 2014; Marne et al., 2012). Their design must be based on learning principles so that they can be effective, understandable and arouse children's interest, in order to promote learning and communicate important content. Similar effects were found in several researches by Kebritci, (2010), Sardone & Devlin-Scherer (2010), Overbay et al., (2009).

Additionally, the data indicate that teachers, on average, reported personal use of digital games in their teaching (mean score of 2.77). However, there is relatively high variability in the extent of teachers' personal use, as reflected by the standard deviation of 0.97. This suggests that while some teachers actively incorporate digital games into their instructional practices, others may be less inclined to do so. This variability may be influenced by factors such as teachers' technological competence, access to suitable resources, and pedagogical beliefs (Annetta et al., 2010).

Looking to the future, teachers expressed an expectation of increased use of digital games in teaching and learning over the next five years (mean score of 2.44). This anticipation aligns with the evolving educational landscape, where technology is becoming increasingly integrated into classrooms. The expectation of increased use may be driven by a growing awareness of the benefits of digital game-based learning and advancements in educational technology (Ally, 2009; Kebritchi et al., 2010).

It is worth discussing these interesting facts revealed by the results, regarding the third research question "How should students be assessed when using digital games in learning" significant statistical differences were found between the two groups, as teachers, expressed a neutral attitude towards the view that students when using an electronic game in learning, should not get a negative grade for wrong answers, unlike computer science teachers, who agree with this. Also, the point of view that there should be no winners and losers in games, but they should all be recognized as winners, while students show substantial learning effort, finds teachers to declare on average neutrality as opposed to computer science teachers

Although teachers are very interested in the use of digital games in education, as they are an essential part of children's daily lives, they do not usually have the ability to use them as pedagogical tools. This problem is attributed to a number of obstacles that need to be addressed in practice.

Research findings, regarding to our fourth research question "Which are the barriers to technology use in the school environment", showed that one of the biggest obstacles' teachers face, is the need for training. References to this obstacle can also be found in the research of Mena & José Parreño, (2017), Hamari & Nousiainen, (2015), Ray & Coulter (2010). Inadequate infrastructure, also incommode teachers, to integrate digital games into their teaching. Research by Baek (2008), Al-Awidi & Ismail (2014), Kebritci (2010), also highlighted the lack of infrastructure, as a significant obstacle for teachers. The lack of proper software is another major obstacle. Previous research has also highlighted this, as particularly important (Al-Awidi & Ismail, 2014; Chik, 2011). In accordance with other research (Haines et al., 2016; Ertzberger, 2009; Becker & Jacobsen, 2005; Barnes et al., 2007) comes the lack of time, which does not allow teachers to integrate digital games in their teaching hours. At the same time, a lack of motivation makes it more difficult, for teachers, to include technology in their classroom. Research has shown that teachers avoid using technology in the educational process, as they are not provided with the necessary motivation (Anyaegbu et al., 2012; Simpson & Stansberry, 2009). An equally important obstacle for teachers is technophobia. The stress and fear of using an

item that they are not familiarized with, prevents them from using it on the whole. (Annetta et al., 2013; Demirbilek & Lema Tamer, 2010; Can & Cagiltay, 2006; Ritzhaupt, 2010). Finally, parents' negative attitude to the use of digital games in education, is a deterrent to teachers, a fact that is highlighted by the research of Kutner et all (2008), Rice (2007), Drugaş (2014), Bourgonjon et al. (2010).

According to the results of the research, regarding to our fourth research question "Which are the elements that can be combined in their use, in order to have desired effects in the classroom", one of the elements that a teacher must consider, in order to effectively use digital games in the educational process, is the level of knowledge of students and their skills. Learning abilities, cognitive level, as well as students' age, must be seriously taken into account by teachers, so that they can be properly combined, with corresponding educational digital game and to achieve the desired results (Baek, 2008).

Personal needs, interests and students' particularities are particularly important elements, as an appropriate educational digital game must be structured in such a way as to ensure active participation. The above characteristics are especially significant, in order to achieve the best possible result, which is active participation in learning (Chen and Law, 2010; Urh et al., 2015; Wernbacher et al., 2012).

Creating a familiar and safe learning environment, also presupposes, according to teachers, the existence of students' prior knowledge. The existence of necessary knowledge, regarding technology, facilitates both the understanding of the teaching subject, as well as the smooth conduct of the educational process. Basic technological knowledge, but also classroom dynamics, contribute to the achievement of educational goals (Mena & Parreño, 2017).

Proper organization and time management, as well as proper planning, based on pedagogical principles, are prerequisites for the integration of a new teaching method in the educational process. According to the teachers, feedback, setting of boundaries, appropriate preparation and time organization, in combination, bring desirable results in learning. The right selection of educational material, focused on teaching objectives, in combination with the appropriate feedback and teachers' proper preparation, can lead to the achievement of effective teaching (Lee et al., 2004; Younis & Loh, 2010, Darling-Hammond et al., 2020).

Our research has shown that a particularly important factor, which contributes to the constructive use of digital games in the educational process, is student's motivation. The use of appropriate motivation allows the approach of even indifferent students. Stimulating interest and willingness to collaborate, but also to learn, through motivation, can lead to the completion of learning objectives. Digital games are a favorite pastime of children, which teachers can take advantage of, by using appropriate motivation, in order to achieve educational goals in the classroom (Mena & Parreño, 2017; Saragih, 2016; Kali et al., 2018; Kebritchi et al., 2010; Baek, 2008).

6. Conclusion

The research on teachers' perceptions of digital game use in the classroom provides several benefits. Insights into teacher perspectives as it offers valuable insights into teachers' perceptions of using digital games as an educational tool. Understanding their attitudes and beliefs can help inform the development and implementation of effective educational strategies that incorporate digital games. Validates digital games' positive impact as it confirms that, on average, teachers perceive digital game use as a "good" use of technology that enhances learning, enriches the educational experience, and motivates students. These findings provide empirical support for the potential benefits of digital games in education. It is also highlighting the variability in teachers' perceptions, as indicated by the standard deviations. Recognizing this variability is important as it allows for a better understanding of the factors that influence teachers' acceptance and adoption of digital games in the classroom. This information can guide efforts to address concerns and barriers, and tailor professional development programs to support teachers in effectively integrating digital games into their teaching practices. The finding that teachers believe digital games are more effective for today's students compared to previous generations underscores the importance of adopting student-centered approaches in education. It highlights the need to align instructional methods with the preferences and learning styles of modern students, who are often immersed in technology. The expectation of increased use of digital games in teaching and learning over the next five years suggests a growing recognition of the potential of these tools in education. This finding can inform educational policymakers, administrators, and curriculum developers in planning for future educational initiatives that incorporate digital games and technology. The inclusion of data from both general teachers and computer science teachers allows for a comparison of perceptions between different subject areas. This comparison provides insights into subject-specific considerations and can help identify areas where subject-specific strategies and resources may be necessary.

Overall, this research contributes to the existing literature on digital game-based learning by shedding light on teachers' perceptions and attitudes. The findings can inform educational stakeholders in their efforts to design effective educational interventions that leverage the benefits of digital games for enhanced learning experiences.

While the research on teachers' perceptions of digital game use in the classroom provides valuable insights, it also has some limitations. These limitations should be considered when interpreting the findings and conducting further research in this area. The research used a convenient sampling method, which may limit the generalizability of the results. Future studies should consider using larger and more diverse samples to ensure broader applicability of the findings. It was conducted in Greece, and the sample may not adequately represent the perspectives of teachers from different regions or cultural backgrounds. Including teachers from various geographical locations and diverse demographic backgrounds could provide a broader understanding of the subject.

The research focused on teachers' current perceptions and attitudes towards digital game use. Longitudinal studies that follow teachers over time could provide insights into the changes in their perceptions, beliefs, and practices regarding digital game integration in the classroom. Considering these limitations, future research should aim to address these gaps and provide a more comprehensive understanding of the effective integration of digital games in educational settings.

Policymakers need to advocate for equitable access to technology and the internet for all students, regardless of their socioeconomic background. At the same time, Consideration should be given to accessibility in educational practices. Researchers and policymakers must adhere to ethical standards when collecting, analyzing, and disseminating data as well as keep Promoting responsible and ethical digital behavior. Consequently, educators, researchers, and policymakers should incorporate digital tools and resources into their teaching methods, ensuring that students from disadvantaged communities have equal opportunities to develop digital literacy skills and access educational content online. They should also strive to make digital resources, platforms, and tools accessible to students with disabilities. This involves providing alternative formats, captions, transcripts, and other assistive technologies to ensure inclusive learning environments that cater to diverse needs. Among others they should integrate digital citizenship education into the curriculum, teaching students about online safety, respectful communication, critical thinking, and responsible use of technology. Policymakers should support the development of comprehensive digital citizenship frameworks and allocate resources for training educators in this domain. In parallel, they should also engage in evidence-based practices and utilize research findings to inform their instructional strategies while respecting student privacy rights.

By prioritizing these issues, educators, researchers, and policymakers can create educational environments that are inclusive, respectful of privacy, and empower students to become responsible digital citizens.

In conclusion, the integration of digital games into education aligns with the introduction of new technologies in classrooms and offers a transformative and engaging learning environment. Teachers' views on the effective use of digital games are generally positive, recognizing their potential to enhance and enrich the learning process. The use of digital games is seen as motivating for students and particularly effective for today's generation, who have grown up in a technology-rich environment. Designing games based on learning principles and considering students' individual needs are crucial for promoting learning outcomes. Despite teachers' interest, there are barriers to the use of digital games, including the need for training, inadequate infrastructure, lack of proper software, time constraints, lack of motivation, and technophobia. Overcoming these obstacles and addressing parents' negative attitudes can support the successful implementation of digital games in education. Teachers should consider students' knowledge, skills, interests, and personal needs when selecting appropriate games, while creating a familiar and safe learning environment. Proper organization, time management, and pedagogical planning are essential for integrating digital games

effectively. Finally, motivation plays a crucial role in engaging students and achieving learning objectives through the use of digital games in the classroom. By leveraging students' existing interest in digital games and providing appropriate motivation, teachers can harness the potential of these tools to enhance education.

Findings of this study are consistent with previous research, highlighting common barriers and considerations in the use of technology in the classroom. Addressing these barriers through targeted professional development, investment in technological infrastructure, and fostering positive attitudes among teachers, parents, and students can contribute to the effective integration of technology for enhanced learning outcomes.

Conflict of Interest Statement

The authors declare no conflicts of interest.

About the Author(s)

Kougioumtzidou Eleni (PhD) is an Adjunct Professor in Pedagogy at Pedagogical Competence Department of Polytechnic School at the University of Thessaly, Volos, Greece. She has worked as an Adjunct Professor at the Hellenic Open University and also at the Special Education Department at the University of Thessaly, Volos, Greece. She holds a Degree from the Department of Early Childhood Education of the Aristotle University of Thessaloniki (1998), a Master's degree in Studies in Education (H.O.U., 2011) and a PhD in Education Sciences (University of Thessaly, 2020). She has participated, as a member, in several national projects in the field of education. She has published a couple of articles in international journals and proceedings of international conferences. Her main research interests focus on Innovative trends in Pedagogy related to Teaching through ICT (Information and Communication Technology), Gamification, Digital game-based learning, use of digital systems in education and teaching, Distance learning, Adult education, Teaching and learning. Contact: ekougioum@uth.gr.

Kafenia Botsoglou (PhD) is a Professor in Pedagogy at the Special Education Department at the University of Thessaly, Volos, Greece. Ms. Botsoglou Kafenia is Professor of Pedagogy at the Department of Special Education of the University of Thessaly, where she has been serving since October 2002. She has been a scientific coordinator and has participated as a team member in several national and European projects in the field of education and teaching methodology. She has published more than 60 articles in international journals and proceedings of international conferences. Since 2020, she is the director of the Institute of Teaching and Teacher Education, the research center of IASON of the University of Thessaly. She holds the Degree of the Department of Early Childhood Education of the Aristotle University of Thessaloniki (1990), a Master's degree in Research Methodology (H.O.U., 2004) and a PhD in Education Sciences (A.U.Th., 1998). Her main research interests focus on research and the application of innovative pedagogical and didactic approaches in education as well as on quality issues in the educational process. Contact: kmpotso@uth.gr

Nikos Zygouris (PhD) is an Associate Professor in Neuropsychological Assessment of Children and Adolescents with Digital Technologies at the Department of Computer Science and Telecommunications of the University of Thessaly, Lamia, Greece. He has published more than 60 articles in international journals and proceedings of international conferences. His main research interests focus on research and the application of Clinical Neuropsychology and Educational Applications, Neuropsychology of Learning Disorders, Developmental Neuropsychology, Electrophysiological Applications, Evaluation and Rehabilitation of Psychopathological Disorders of Children and Adolescents, Learning difficulties. Contact: nzygouris@uth.gr

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