

# Digital Game-based Learning and Serious Games in Education

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## ABSTRACT

Nowadays, students are significantly influenced by the digital era and are constantly handling digital information. As a result, they form their personalities in the light of flexible communities, pursue to be directly connected, require prompt responses and social interaction and prefer learning based on experiences. Undoubtedly, modern students are not fully keen on and attracted by conventional education methods and thus they are seeking for more interesting, fun, motivating and engaging learning experiences. The increasing popularity of digital games has led to their being broadly utilized and applied. In education, digital games are mostly applied in the form of serious games which focus more on primary purposes. Serious games offer motivating and engaging experiences, interactive learning environments and collaborative learning activities. Hence, they are considered as a proper educational tool which enhances learning procedures and satisfies and fulfills students' needs and requirements. The pedagogical approach of utilizing digital educational games is called digital game-based learning and can be described as the "coming together" of interactive entertainment and serious learning through digital games. Game-based learning is the act of designing interactive learning activities that can gradually convey concepts and guide students towards an end goal. Furthermore, it promotes a student-centered learning environment in which students' wellbeing and soft skills are cultivated in a dynamic, enjoyable and playful way. This study briefly describes students' new needs and requirements for more interactive and engaging learning experiences and analyzes the concept and the impact of serious games in education. Additionally, it points out the characteristics and features of serious games and the significance of motivation in students' learning procedure. It analyzes the digital game-based learning approach and presents some of its benefits. Finally, it summarizes the main properties and potentials of digital game-based learning and serious games in education.

**Keywords:** Education, Game-based learning, Serious games, Educational games, Interactive learning environments, Collaborative learning.

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## 1. INTRODUCTION

Play is considered to be a common activity and an excellent experience for children, adolescents and adults. According to Rieber et al. (1998), play comprises an intense learning experience in which the participants voluntarily invest a lot of time, energy and commitment, while concurrently deriving great enjoyment from the overall experience [1]. Moreover, play is an important mediator for people's learning and socialization throughout life and is a proper, remarkable and respectable way to enhance learning procedure [2]. Nowadays, play in the form of digital games is gaining ground and popularity.

Owing to the rapid advancement of technology and life digitalization, digital games have prevailed globally and they have become an integral part of our social and cultural environment [3]. Not surprisingly, digital games have become the most popular computer related activity in the home [4]. The increase in the amount of time spent playing games by children, adolescents and adults can explain and justify the increase in digital games popularity [4], [5]. Although fun and entertainment are the first aspects that attract people to spend many hours playing games, the effective principles and/or approaches, which are embedded in game designs, facilitate positive learning outcomes and keep them engaged [6], [7]. Digital games provide engaging experiences, interactive learning environments, as well as collaborative learning activities; hence, they have drastically increased in popularity over the last years. As a result, digital games are now considered a powerful social, technological and cultural force that cannot simply be ignored by industries, enterprises, governmental organizations and academic communities [8], [9]. Thus, a considerable amount of research examining digital games implementation and impact in various application domains has been conducted.

Education constitutes one of the main application fields in which the successful implementation of digital games can bring about a lot of innovative and positive changes as interactive online environments comprise a key feature to the new generation of students. Thanks to the increasing research into the impact of digital games on education, we can now rip their benefits to enhance the educational learning process. Digital games are mostly applied in education in the form of serious games. Particularly, "serious

games” is a term which describes any game-based initiative which focuses more on primary purposes than just pure entertainment and it mostly refers to the use of digital games in education and various industries. Hence, it goes without saying that serious games have become a renowned field of academic research, thanks to the numerous benefits it yields [10], [11].

In this study, we briefly go over students’ new needs and requirements for more interactive and engaging learning experiences and we present and analyze the concept of serious games in education as a means to fulfill and satisfy them. Furthermore, we describe the characteristics and features of serious games and we point out the significance of motivation and engagement in students’ learning procedure. Additionally, we analyze the digital game-based learning approach and present some of its benefits. Finally, after providing suggestions and conclusions, we summarize and point out the main properties and potentials of game-based learning and serious games in education.

## **2. SERIOUS GAMES IN EDUCATION**

The new generation of students has been significantly influenced by the digital era and is constantly utilizing Information and Communication Technology (ICT) in their daily lives. More specifically, as students form their personalities in the light of flexible communities, they pursue to be directly connected, request prompt responses, require social interaction and prefer learning based on experiences [12]. Thus, it is obvious that their way of thinking, their concept of effective learning as well as their educational needs and requirements have drastically changed. Additionally, these students handle digital information on a daily basis, are connected to each other through mobile technologies, work interactively, often perform several tasks simultaneously and not only do they play games to a greater extent than previous generations [13], [14], but also find them more interesting and enjoyable. Moreover, traditional games in education have a long-standing tradition and they always used to be part of the human learning experience in both formal and informal settings [11]. Furthermore, it is apparent that students seem to concentrate more while absorbed in computer-based learning than in conventional school tasks [15]. In addition, games enable educators to attract students’ attention and interest and engage them in educational experiences with a view to achieving specific learning goals and outcomes [16]. According to Cheng et al. (2013), serious games render students capable of easily absorbing knowledge through role plays [16]. Thus, an increasing number of educators are experimenting with alternative ways to incorporate serious games for educational purposes in their classrooms.

Based on [4], [17], [18], games that are designed to include educational objectives and subject matter have the potential to render learning of academic subjects more student-centered, engrossing, enjoyable, interesting and thus, more effective and efficient. Kinzie and Joseph (2008) defined games as “an immersive, voluntary and enjoyable activity in which a challenging goal is pursued according to agreed-upon rules” [19]. Nowadays, educational games are considered to be the new field in which serious games have been applied. In our case, educational games can be considered as computer-assisted instructional tools and techniques in which skills and chance are combined and implemented on previously acquired information and gained experiences [20]. According to Sauv   et al. (2005), educational games are defined as an artificially and fancifully created situation in which students are placed in a position of conflict and confrontation as they often have to compete or cooperate with each other [21]. According to Rossiou and Papadakis (2007), educational games are often social in their nature, are based on preset rules and have several levels of varying degrees of difficulty through which students gain new skills and learn new strategies in order to overcome obstacles and become victorious, all while learning [20]. Moreover, Maragos and Grigoriadou (2005) quoted that educational games are games which promote logic and skills development and knowledge acquisition in an interesting and pleasant way [22]. Besides that, they allow students to learn new things while at the same time being engaged in an entertaining situation [17]. DeKanter (2005) conducted a study whose results showcased that educational games can be regarded as a constructivist learning environment in which the vital and interdependent ingredients for productive learning are woven together [23]. Moreover, Kiili (2005) supported that games can satisfy the basic requirements of a learning environment and provide engaging learning experiences for students [24].

## **3. CHARACTERISTICS AND FEATURES OF SERIOUS GAMES**

According to Protopsaltis et al. (2011), one of the main characteristics of serious games is the fact that instructional content is presented in combination with entertaining, interesting and engrossing elements [11]. Moreover, he quoted that while in a motivating game, students are encouraged to become involved in the game in a personal, emotional and cognitive way. Concurrently, it seems that their attention and motivation are enhanced, assisting thus their learning procedure.

By utilizing serious games in education, students’ overall learning experience can become more entertaining and engaging. According to Prensky (2002), by adding this element into the learning process, there is no doubt that not only does learning become more enjoyable, compelling and engaging, but also more effective and efficient [25]. According to [3], [6], [7], [12], [18], [26], games promote excitement, stimulation, engagement and the feeling of accomplishment and as such, they are widely considered as a great means to facilitate learning and combine meaningful learning with fun. In addition, they could enhance students’ learning motivation, interest and engagement [27], [28], [29]. It cannot be denied that utilizing serious games could create a more interesting and interactive learning environment in which students could acquire and share thoughts, knowledge and experiences [4], [29]. Moreover, all things considered, serious games promote innovative thinking and are believed to be an excellent tool to facilitate situated learning and support students’ learning experiences [12], [18], [30].

Based on Ronimus et al. (2014), students' feeling of interest and curiosity is typically triggered when they are introduced to game-based learning or game activities [15]. Moreover, according to [26], [31], [32], it is widely accepted that games also have a positive effect on creativity, problem solving skills, critical thinking, spatial ability, collaboration, conceptual understanding, automaticity and a host of other higher order thinking skills. All these promote tranquil state of mind and maintain social contact and interaction. Hsiao et al. (2014) quoted that although creativity is not an innate quality, it can be inculcated, encouraged, trained and cultivated by educational or training programs [33]. According to Huang and Johnson (2008), in order to efficiently enhance and reinforce students' interest and instructional effect, games typically implement multimodal presentations [34]. In addition, they integrate auditory, visual and textual displays so as to enrich students' experience and cognitive success [35]. Furthermore, according to Hsiao et al. (2014), utilizing games as a teaching and learning tool can a) promote students' learning motivation and eagerness, b) enhance their academic accomplishments and social attainments and c) improve their higher order thinking skills and improve critical and cooperative behavior [33].

There is no doubt that the characteristics and merits of serious games are what make them engaging [18] and what attract students. Based on the study conducted by Dabbagh et al. (2016) [32], the key features of games are their keen motivation [36] and engagement [37], their experiential [38], feedback driven [31] and contextual [26] learning, as well as their interactive learning environments [39] and student-centered learning approaches [30]. According to [17], [18], [34], [35], some of the main game features that influence students' engagement and enjoyment include: curiosity, fantasy, role-playing tasks, rules, goals, challenges, competition, control, fun, motivation, interaction, adaptability, feedback and multimodal presentation.

#### **4. MOTIVATION SIGNIFICANCE**

Li and Tsai (2013) quoted that the best way to create well-designed serious games is by utilizing effective and efficient learning principles and methods in combination with the above-mentioned characteristics and merits [7]. One commonly held view is that serious games can promote effective learning and motivate students by offering them opportunities to actively and critically experience, practice and express their ideas in a problem-based situated and low-risk content [3], [6], [7]. According to [5], [40], the proper direction which should be followed in order to influence students' direction, vigor and persistence is to offer them motivation which responds to a specific set of physiological processes. Moreover, serious games have an intrinsic motivational factor that encourages curiosity and makes students believe that they are in control of their own learning [27]. Motivation is considered to be a key factor in captivating students' interest and enhancing their learning ability and performances. Furthermore, according to Erhel and Jamet (2013), the motivational and engaging benefits that serious games provide are often put down to their entertainment value and lay the groundwork for educational and social interaction [5]. Additionally, Yee (2006) defined Achievement, Social and Immersion as the three main components that enhance students' motivational aspect when utilizing games in education. These main components include some subcomponents which are referred as follows: Achievement (advancement, mechanics and competition), Social (socializing, relationship and teamwork) and Immersion components (discovery, role-playing, customization and escapism) [41].

#### **5. DIGITAL GAME-BASED LEARNING**

The pedagogical approach of utilizing games in education is called game-based learning. Thanks to the motivational psychology involved in game-based learning, students are capable of being involved in educational material and subjects in a dynamic, enjoyable and playful way. Spire (2015) quoted that game-based learning is not simply the act of developing games for students to play but the act of designing interactive learning activities that can gradually convey concepts and guide students towards an end goal [42]. Game-based learning can be considered as a teaching method that allows students to explore different parts of games as a form of learning to help them enhance their set of skills or achieve specific learning outcomes. For all those reasons, Prensky's (2001) assertion that the design of educational software to be used in schools should be formed and based on game design methods and techniques is increasingly gaining acceptance within the educational technology research community [4], [18].

In order to promote motivation, Prensky (2001) presented a new game-based learning approach, named digital game-based learning, in which he incorporated digital games in combination with curricular contents. Moreover, Prensky (2001) defined the key characteristic of digital game-based learning as the "coming together" of interactive entertainment and serious learning through digital games [18]. Digital game-based learning is a student-centered learning approach that utilizes digital games so as to support educational purposes such as teaching and learning [43]. Erhel and Jamet (2013) described digital game-based learning as a competitive activity in which educational goals are set with the aim of promoting students' knowledge acquisition [5]. After being designed in a way that promotes the development of cognitive and soft skills, these games, which may also take the form of simulations, allow students to practice their skills in a virtual and safe environment. Furthermore, according to [5], [44], digital game-based learning environments should include preset rules and goals, prompt feedback to students' actions and progressively changing difficulty level. They should also promote students' self-efficacy through challenging experiences in a social and collaborative environment. Based on Cheng et al. (2013), digital game-based learning combines educational content and digital games to stimulate students' interest and provide them with the opportunity to enhance their learning effectiveness [16]. As a consequence, students view knowledge and education positively throughout their life. Perrotta et al. (2013), in their study, defined intrinsic motivation, learning through intense enjoyment and fun, authenticity, self-reliance and autonomy, as well as experiential learning as the key principles involved in digital game-based learning [43]. Moreover, they determined set rules and goals,

fictional settings, progressive difficulty levels, high control and interaction, prompt and constructive feedback and social involvement as the key mechanisms of this approach.

## **6. BENEFITS OF DIGITAL GAME-BASED LEARNING**

Digital game-based learning and serious games, in general, offer a lot of benefits, enhance education and have a dramatic impact on modern life so they can be considered to be a positive direction for education and society to move in. It is widely accepted that over the past few years, several studies have aimed at defining and highlighting the benefits of this approach. Additionally, relevant studies have indicated that digital game-based learning possesses significant potentials for increasing students' learning motivation and engagement [4], [45] and cultivates their minds and spirits, enhancing thus their learning efficiency [35]. Thanks to its entertaining and appealing teaching way, students become eager to try their hand at them.

Moreover, digital game-based learning offers more benefits to enhance students' learning experience and improve learning and teaching procedures while also promoting active interaction and communication between students and educators. Based on all the above-mentioned facts, some more benefits that digital game-based learning promotes and offers to students are:

- Cognitive growth and digital literacy;
- Social-emotional growth and soft skills development;
- Enhanced decision making and problem-solving skills, as well as critical thinking;
- Improved collaboration and communication environment;
- Positively competitive environment;
- High self-esteem and autonomy;
- Progressive learning through experience;
- Rewarding feeling of progression and achievement;
- Feedback driven and student-centered learning.

Finally, with the aim of further enhancing and enriching students' learning experience and increasing the benefits they provide, digital game-based learning can be combined with other learning methodologies and approaches such as cooperative learning [46], project-based learning [47] and problem-based learning [48].

## **6. CONCLUSION**

Education has another role but to teach fundamental knowledge and that is to prepare students for their life ahead. Much too much emphasis is placed on factual education and not enough on teaching students how to get along with each other as members of society and how to interact with others through cooperation and compromise by cultivating friendships and the feeling of belonging to a peer group. Students feel the need to engage in a recreational activity which will provide them with the much-needed break from their mundane routines. Moreover, due to the rapid development of technology and digitalization of everyday life, students' new needs and requirements for more interactive and engaging learning experiences have arisen. As education should not simply stick to traditional forms but should be reformed and utilize contemporary techniques, methods and technologies so as to satisfy and fulfill these new needs and requirements and reinforce students' learning procedure.

Digital game-based learning approach and serious games in general can be utilized as an educational tool which can boost students' wellbeing and self-esteem, help them improve their soft skills, develop their critical thinking, decision-making and problem-solving skills, as well as maintain a healthy mental and psychological balance. With that view, we presented and analyzed the concept of serious games in education and described the characteristics and features of educational games. We also pointed out the significance of students' motivation and engagement. Finally, we analyzed the digital game-based learning approach and presented some of its benefits.

In conclusion, when applied in education properly and in a student-centered way, digital game-based learning approach and serious games can be considered as an effective educational tool that can facilitate and enhance students' learning procedure, as a means through which interaction, cooperation and communication can be promoted and improved and as an educational process which can instill interest in educational issues, promote learning motivation and engagement, as well as induce eager and active participation in lessons.

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