

# Student Centred Learning Through Serious Games

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## Abstract

This research explores the rationale behind the utilisation of electronic games in education. A qualitative research sheds light on the students' opinions and perceptions toward the use of serious games in-class. Semi-structured, face-to-face interview sessions among secondary school students suggest that they are acquiring relevant academic knowledge and competences, as they reap motivational and emotional benefits from these learning games. The students reported that their engagement with these games has improved their critical thinking and helped them make evaluative decisions to solve problems. Generally, students were capable of developing their interpersonal skills as they have actively collaborated in teams. On the other hand, there were a few students who were not perceiving the usefulness and the ease of use of playing serious games at school. This study postulates that the research participants possessed different skillsets as they exhibited different learning abilities. In conclusion, this paper opens-up some avenues for future research in this field of study.

**Keywords:** Serious Games, Technology in Education, Digital Games, Digital Game-Based Learning, Games, Simulation Games, Storytelling.

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## 1. INTRODUCTION

Today's teenagers and adolescents are spending a considerable amount of their leisure time online [1]. Very often, they play games on mobile devices, including; tablets or smartphones. These developments have inevitably led to a new paradigm shift; as learning-via-play, or the use of serious games in education have changed the way how students think and process information [2]. Very often, games provide an immersive, voluntary and enjoyable activity as challenging goals are pursued according to agreed-upon rules ([3] [4]). At the same time, serious games are increasingly satisfying the basic requirements of the schools' educational programmes as they strive to provide an engaging learning environment for their students ([5], [6], [7], [8]). Serious games may usually refer to games that are utilised outside the context of entertainment; and are considered as part of a thoughtful progress toward discovery-based learning ([9], [10]). The serious games are digital games that are not created with the primary purpose of pure entertainment, but with the intention for serious use in education and training [11]. These games have defined learning outcomes that are designed to balance subject matter with gameplay [12]. Previous studies have reported that serious games in education can enhance the learning interests of students [13] and could further increase their motivation ([14], [15]). Researchers have also indicated that games are becoming an integral part of the children's cognitive development as they support them in their learning journey ([16], [17]). Consequently, the serious games hold great potential as students can improve their knowledge, skills and learning performance in an informal manner (through communication technologies, including; mobile applications (apps) ([3], [18], [19])). However, the use of serious games is still far from mainstream. Therefore, this research investigates the costs and benefits of using serious games in the realms of education ([3], [6], [20]). Recent academic literature suggests that there is potential for further development of game-based learning, across a broad range of educational programmes. The schools' interactive environments that incorporate serious games

with highly engaging experiences are already having a positive effect on students, as they enhance their visual, selective attention among other cognitive, motivational and emotional benefits ([2], [5], [7], [21]).

In this light, this contribution provides a critical review of relevant theoretical underpinnings on serious games (and digital game-based learning). It also explores the students' opinions, beliefs and perceptions on the use and ease of use of serious games in the secondary educational level. Hence, this study adds value to the extant academic literature as it evaluates the effectiveness and motivational appeal of two serious games, from the students' perspectives. It explains how, where and when these games can be considered as relevant teaching and learning resources. In addition, it provides a good insight on how serious games could (not) improve the students' achievement and learning performance.

## **2. LITERATURE REVIEW**

### **2.1 Defining Serious Games**

There are several definitions for "Serious Games". The first formal definition of the concept was probably introduced by Clark C. Abt in 1970. In his book, the author presents simulations and games that are intended to improve education, both in and outside of the classroom [22]. At the time, the author made reference to "mainframe computer" or "pen-and-paper" games, as the video game industry was not yet established. Subsequently, Donald R. Jansiewicz in 1973 invented a game to teach the basics of US politics [23]. In fact, the serious games, including video games and simulations were introduced in different industries, including; politics, education, scientific exploration, health care, emergency management, city planning, engineering, and defence, among other areas. Such games were utilised outside the context of entertainment, where the narration is part of a thoughtful progress [9], but explicitly emphasises the added pedagogical value of fun and competition. Therefore, the designers of the serious

games will try to capture the players' attention for a variety of purposes that go beyond pure entertainment. For this reason, serious games are teaching resources that could support learning [18]. In this case, serious games combine both "serious" and "game" dimensions. This kind of "purpose-shifting" is very common in education where teachers may be intrigued to use entertainment video games, also known as commercial-off-the-shelf games as teaching materials [24]. Previously, other contributions have provided some comprehensive examples of how games were utilised in education ([25], [26]). Nevertheless, the video games that were used for "purpose-shifting" were not designed to serve a serious purpose. However, teachers may use entertaining video games for their lessons, and could they create their own "serious scenario" for their students. This "serious" dimension is not always directly embedded in the entertainment games; but the teachers could use them to influence the way their students play. Hence, the "serious" and the "game" dimensions are evidenced in the educators' "purpose-shifting" approaches [27]. The teachers may take cues from the game scenarios and adapt them to their "serious" goals in their student-centred teaching methodology ([8], [17]).

## **2.2 A Cost-Benefit Analysis on the Use of Serious Games in Education**

### *2.2.1 Benefits*

Both teachers and students are increasingly using their own computers to access course content online. Whether learning happens through formal or informal routes, it is very likely that tomorrow's students will have to continue using technology in their future employment. Therefore, it would make a lot of sense if educators use virtual learning environments including serious games, stories and simulations as a vehicle to instil knowledge, skills and competencies among their students [28]. This reasoning suggests that there is an opportunity for those students who would like to learn theory and concepts through digital media. They can acquire tacit knowledge through relevant experience of performing certain tasks [11]. Students can enhance

their skills over time, particularly if goal-directed, in response to some demand in the external environment [28]. As a result, they become competent in their tasks as they capture skills and dispositions beyond cognitive ability.

The competencies that are acquired through digital technologies are fundamentally behavioural in nature, as they are susceptible to self-awareness, self-regulation and social skills. Digital games promote collaboration, problem-solving and communication, experimentation and the exploration of identities ([11], [29]). The use of digital games in education necessitates standardised curricula that promotes competition, achievement and reward structures [1]. The students' desire to win or complete games could motivate them to study course-related materials. Their efforts are rewarded when they win rounds of the game. At the same time, they achieve learning outcomes as the digital environment comprises (i) a set of rules and constraints, (ii) a set of dynamic responses to the learners' actions, (iii) appropriate challenges enabling learners to experience a feeling of self-efficacy, and (iv) gradual, learning outcome-oriented increases in difficulty [30].

Arguably, it is in the interest of all stakeholders and educators to develop meaningful pedagogies that integrate digital teaching resources, including serious games with traditional teaching methods ([18], [31], [32]). Without play, education becomes a force of compliance, not intelligence [33]. Video games may help kids develop adaptive emotion regulation [34]. Moreover, they can increase the children's positive mood after playing the violent game as relevant studies indicated that there was no significant increase in aggressive mood scores for either boys or girls after playing violent games [35]. Other research has indicated that gamers are able to translate the prosocial skills that they learn from co-playing (or from multi-player gameplay) with their peers and family members beyond the gaming environment [36]. Very

often, students are usually motivated to review their knowledge and understanding of something that they have just learned [37]. They may do so by exchanging their knowledge with one another. Hence, the gaming environment may usually provide the right setting for student-centred learning; that allows two-way communication through instant feedback between instructors and students ([8] [17]). Moreover, game-based learning (and the use of serious games) may be accompanied by insightful discussions and social activities. The provision of quality learning and instruction within preschool environments has considerable potential to add digital capital through gamification [1].

### *2.2.2 Costs*

Only nine studies have reported an improvement in learning quality when compared to the delivery of conventional lessons [35]. Just four out of 16 studies concluded that this medium increases motivational investment [35]. Other studies suggested that they were not in a position to conclude that educational games can have a positive effect on the students' learning and motivation [38].

Therefore, the legitimacy of digital game-based learning, including the use of serious games in education ought to be critically analysed and re-examined in different settings [2]. A few researchers suggested that a range of different factors, including; individual learner characteristics ([11], [39]); the learning situation and the specificity of certain subject areas [32] could have an impact on the effective implementation of digital games in education. Generally, they argued that there may be students who will not engage or respond to extrinsic, technical games as they may not regard them as play. Moreover, it may be irresponsible to postulate that children with different abilities will readily embrace the digital culture that is being transcended to them through educational programmes.

Apparently, some academics have reported contradictory results that were essentially ascribed by different methodologies [30]. In fact, many researchers have often adopted media comparison approaches by measuring the learning outcomes of those students who played educational games against the learning outcomes of other students who learned through conventional media [40]. Evidently, such methodologies were vulnerable to many confounding factors including; the format of educational content and the teachers' social presence, among other variables. To avoid these methodological limitations, other researchers have adopted the value-added approach which essentially involved a critical analysis of the learning outcomes of educational (narrative) games [41].

Some researchers argue that digital games can make hyperactive, violent, stupid and anti-social children ([42], [43]). Moreover, there may be educators who may still prefer "old teaching" methodologies rather than using the latest, interactive learning resources ([18], [44]). The digital game-based learning environment can impose considerable constraints that make it extremely difficult to integrate deep content, strategies, and skills [20]. The players' failure adds content by making them see new nuances in a game, as there may be negative connotations of failing in games [45].

Many individuals (including teachers) are still wary of electronic innovations in a context where serious games are continuously evolving at the speed of technology. In the past, there were instances where early childhood instructors were averse toward the digital culture as they resorted to outdated pedagogical and developmental standpoints [33]. In the event that the classroom practitioners would exhibit an intrinsic personal interest in digital gaming, they may still face limited opportunities to develop their digital literacy. Alternatively, their school may not possess sufficient scarce resources to incorporate interactive games into their lessons.

Notwithstanding, Educational leaders may not realise that their teachers will require adequate investments in infrastructure as well as appropriate training and development for the successful implementation of digital learning resources, including serious games in education. The policy and funding constraints were also cited as barriers to the integration of technology in early childhood learning centres [33]. However, they went on to suggest that these problems are often considered as a peripheral priority for many educators and policy makers.

### **3. THE RESEARCH METHOD**

#### **3.1. The Qualitative Methodology**

This study involved the systematic generation of theory from qualitative data that relied on the researcher's inductive, expansionist thinking. A phenomenological approach has been used to discover the secondary school students' attitudes and perceptions toward serious games. The researchers relied on the grounded theory methodological perspective as they were concerned with understanding the participants' reactions and intrinsic behaviours. Therefore, the gathering of deep data was obtained through organised, face-to-face interview meetings with fifty-four students who were between 13 and 15 years of age. They attended a secondary school in a small European country. During the fieldwork, the researchers noticed the school's organisational culture and background, its management styles, as well as the teachers' attitudes toward educational technologies, among other issues. These attributes were clearly evidenced before and after gathering the data.

#### **3.2 The Interview Administration**

Generally, the interviews were executed in less than 30 minutes. The researchers conducted face-to-face, semi-structured interview sessions in a classroom during the school's breaks. The



personal interviews' non-verbal cues have helped the interviewers to better understand the participants' verbal responses. An effort has been made to induce the informants to talk freely and openly to gain a good understanding of their perspectives of serious games [5]. This allowed the researchers to refine their enquiry; follow-up interesting leads; and to investigate the students' detailed responses. The interview with the students was conversational in nature, and have also encouraged the research participants to share their views and experiences about the issues being discussed. This qualitative research method has facilitated the exploration of complexities and has led to plausible interpretations of the findings. A degree of flexibility was necessary to fully exploit the emerging issues, especially when the participants themselves were keen to elaborate further. Therefore, a few questions were added during the interviewing process; as well as after the students' intervention. Generally, the questions were planned well in advance and were formulated in such a way to adapt to the secondary school students' context. Due credit was given to the informants as they allowed us to cover specific topics in depth and breadth.

### **3.3 Capturing the Data**

The semi-structured interviews were characterised by their pre-determined list of themes and questions. Following a brief introduction, the students were invited to give details of how they were using digital resources in their classroom. The aim of the interview was to discover whether the use of serious games in education were considered as a strategic tool that could entice the students' motivation and curiosity in academic subjects [21]. At the same time the interviews have revealed the students' access, perceived use, ease of use, and usage intensity of the digital game-based learning in education. Four students were expected to describe their experiences with their use of serious games in different subjects. They discussed about the costs and benefits (in their own words) of using such games in education. The interviewer made

reference to a marketing simulation game and a digital story that were used among Form 4 students. The interviewer's guiding questions are reported in Appendix A.

The researchers investigated whether the serious games were leading to any cognitive, motivational and emotional benefits for the students. Hence, this study explains how, where and when serious games can (not) be considered as relevant educational resources to improve the students' learning experience. The interviews gave the opportunity to obtain the students' opinions, perceptions and experiences and practices in the form of transcripts. During the interview sessions, the participants' views and opinions were annotated [46] and / or recorded on tape; with the interviewees' and their parents' prior consent. At times, the students were encouraged to expand on issues and to clarify their argumentation.

Following each and every interview, the researchers annotated details of the place, time and duration. Whenever necessary, descriptive memos were jotted down to summarise the key points. The gathered data had lent itself to a systematic content analysis that involved open and axial coding. The NVivo (v8) qualitative software was chosen for its functionality and ease of use. This software has enabled the coding and analysis of text, image and audio data.

## **4. RESULTS**

### **4.1 The Perceived Use of Serious Games**

The students maintained that they have utilised different digital (serious) games at school. Serious games were used by the Marketing and English Language educators during their formative assessment involving; group-learning tasks, and team-work activities. The interviewees declared that they played different types of entertaining, digital games at home. They claimed that they played; action, sports, role-play, adventure, detective, strategy, simulation, building (or construction), reflex, puzzles and concentration games, among others.

Many participants admitted that they usually played digital games without seeking closer contact with other individuals. However, a few participants contended that they often engaged with other gamers through online social networks that necessitated multiplayer interaction. These students argued that the members of these communities typically shared similar interests in online gaming. They reported that multiplayer interaction games may either be based on competition between players; or they involved closer collaborations among players, as a prerequisite for making progress in the game. The students themselves suggested that the digital (entertainment) games often fostered social interaction among gamers. These games have led to the players' engagement with other individuals, groups and communities. The majority of interviewees suggested that they also "enjoyed" playing the school's (serious) games. Therefore, they were requested to describe the school's digital games that they used in their Marketing and English Language classes.

#### *4.1.1 The Marketing Simulation Game (Serious Game #1)*

The students held that the simulation game provided them with a conceptual understanding of the marketing strategy, product positioning, pricing, consumer behaviour, customer relationship management, distribution methods, advertising and promotions, as it explained the latest digital marketing tactics, among other topics. This serious game prepared them for real-life scenarios, in different contextual settings where they were expected to test theories and make marketing decisions. However, they were also given rewards (and results) during their game play.

Generally, the students maintained that the simulation game helped them improve their social skills as they shared their insights and with their peers. The players themselves suggested that they were motivated and engaged [12] as the gameplay demanded them to take important actions to meet relevant challenges [47]. The students were divided into small groups of two or three, where they had to collaborate together and work in tandem on a round-by-round basis.

The teams' actions had direct consequences on the market, as the students had analyse their competitive environment. Hence, the competitors' actions and reactions, their product launches, sales and distribution strategies could affect how the individual teams manage their own product portfolio, research and development, projects, positioning, pricing and distribution channels.

The students held that they achieved their simulation game's strategic goals and objectives by: reviewing cases, experimenting at making choices; asking questions, and through ongoing feedback, among other learning activities. There were different reactions from students when they were asked to communicate their opinions and perceptions on how the simulation game has improved their knowledge and understanding of the subject. The students felt a sense of accomplishment and intellectual stimulation as they completed the game's levels. However, there were students who indicated that they were concerned by the intrinsic cognitive load of their simulation game [48]. They claimed that their instructor broke down the games' schemas into individual "sub-schemas" and explained each and every one of them in isolation. This enabled them to better understand how to construct schemas. In plain words, the learning material of this game consisted of numerous elements that were related to one another. Most of the students felt that intrinsic cognitive load was high. In contrast, there were a few students who argued that the material was simple for them.

In the main, the students reported that the subject and its extraneous cognitive load, was well-presented to them. They held that the design of the instructional materials was appropriate for their level of education. There were students who hinted that their team work has helped them improve their individual processing and the construction of schemas. Some of the students believed that they were applying their theoretical knowledge during the simulation game. A few of them declared that the digital game has also developed their analytical skills and prepared them for future employment. Evidently, some of the students have recognised that the

rationale of the marketing simulation game was to enhance their cognitive, social and transferable skills. The students admitted that digital games have enabled them to actively engage with their peers during the marketing simulation game as they were expected to support the members of their group. Therefore, this serious game's formative activities have effectively resulted in a cohesive class where individuals were increasingly valuing each other's involvement in the generation of ideas, as they worked as a team.

#### *4.1.2 The Digital Story App (Serious Game #2)*

The same students who played the marketing simulation game, were also using a digital story app during their English language lesson. The interviewees reported that they were seeing both benefits and challenges in developing and sharing their personal narrative through visual stories. Evidently, the students suggested that their teacher has also created a short stories for them by combining recorded narratives with moving images, that included easy-to-read fonts, colours, magazine-style designs, music and / or sounds. These stories were usually narrated in less than 5 minutes, and typically involved individuals, places, events or other topics. Afterwards, the students were instructed to work in small groups. They were expected to write the script of their story and to use digital media to create animations and sounds. The students had to create a story with a clear purpose. They were instructed to feature the key elements of storytelling as the digital story had to be structured in a logical manner. The narrative usually comprised an introduction, body, conclusion, point of view, descriptive language, metaphors, characters, action, settings, et cetera. The students worked in groups as they shared feedback on how to develop and improve their story. Eventually, all members of the group were expected to communicate their digital story to other students. Following the group's presentation of the story they engaged in a critical discussion with the audience (of students).

The purpose of the digital story was to encourage students to communicate with other course participants, who were chosen at random by the teacher. This activity demanded the students to use cues from the digital story and to share their own insights and experiences about life. A few participants reported that they felt uncomfortable working with individuals who were not familiar with them. The students suggested that they were expected to share their individual and emotional experiences with others. Three interviewees declared that they did not want to work with other individuals that they did not know well. Evidently, these were some of issues that may have stretched the interviewees' personal boundaries.

Many interviewees reported that the sessions that followed the digital story were valuable for the storytellers and for their audience. The students suggested that this activity has taught them about the importance of listening patiently to one another. They argued that this exercise has provided a good space for the storytellers to engage in public speaking. Moreover, the students reported that after this activity they appreciated how their peers see, hear, and perceive the world in different ways.

The students claimed that the digital storytelling was challenging for them as they were expected to step outside of their comfort zone and to communicate their story in front of an audience. A few of these students contended that this activity allowed them to improve relationships with their classmates as they composed a digital story together. An interviewee suggested that the digital story game has helped her to become critical and reflective as she learned how to evaluate high quality content. On the other hand, there were few interviewees who reported some technical issues. They held that they encountered some difficulty in getting acquainted with the game's technology. Other informants declared that they did not perceive the usefulness and the ease of use of playing digital games at school. The researchers noticed that these particular students exhibited dissimilar learning abilities, when compared to the other

interviewees. These students admitted that they were not keeping up with the pace of their peers. However, many other interviewees argued that the digital story app has helped them enhance their digital skills as well as their proficiency levels in designing visual stories with moving images and sounds; by using online media and mobile technologies.

The use of the marketing simulation game and the digital story app have educated students as they immersed them in the game play. Relevant literature suggests that children learn through experimenting through playing games, as they actively construct ideas and relationships with their own minds ([1], [11], [29]). Very often the students were learning how to work out the solutions for themselves rather than by being “spoon-fed” by their teacher. This finding is also consonant with the discovery-based learning and other constructivist approaches ([9], [10], [41]).

## **5. CONCLUSIONS**

This research examined how, where and when the use of games could lead to favourable learning outcomes for students. Firstly, it has provided a critical review of the extant academic literature on the use serious games in education. Secondly, it has presented the findings from a qualitative research that investigated the utilisation of serious games in secondary education. Generally, the students declared that their active engagement in a marketing simulation game and in a digital story app has led them to enhance their academic knowledge, skills and competencies. The results suggest that both games have improved the cognitive skills of the learners. At the same time, they indicated that these games motivated them and provided emotional benefits as they engaged with other individuals. Therefore, the use of the serious games led to the delivery of quality education that is congruent with the student-centred learning approaches ([1], [8], [17], [49]) and constructivist theories [9]. Evidently, the research participants revealed that the serious games have incentivised them to achieve the respective

courses' learning outcomes as they applied their theoretical knowledge and understanding. The students argued that they have constructed ideas and relationships as a group; as they experimented together, rather than by being told what to do by their instructor. Individuals learn in an effective manner when they are engaged in constructing personally meaningful physical artefacts [1]. The interviewees also reported that they strived to find solutions to complex problems as they used the school's marketing simulation game. This immersive game involved the use of questions to test whether its users have understood the games' instructions. The questions explored the players' tacit knowledge of the marketing concepts, theories, and principles as it provided them a well-defined problem space, obvious solution paths, and accurate answers. The game demanded that the players collaborate together to solve problems as they were presented realistic scenarios of the marketing environment. In such a context, the students were immersing themselves in challenging situations. Therefore, they were linking what they have learned in the classroom with what was required outside of the classroom.

On the other hand, the digital storytelling app has helped students to improve their interpersonal, social and communicative skills as they gained relevant experience in public speaking and listening to others. In this case, the students received constructive feedback. Before and after the game play, the students have received dynamic feedback. Moreover, they collaborated together with the members of their group and with their teacher as they experimented and explored the game in real-time. Therefore, the game included learning features such as experimentation, exploration, task selection and creation.

The students were using the language skills that they learned through traditional instruction and applied them in the digital storytelling game; as they experimented and received constructive feedback from their peers. The positive reinforcement they received provided the students a gratifying sense of reward and achievement. The students admitted that the digital story app



motivated them as it helped them build their self-confidence, particularly when they communicated their story to an audience.

This contribution and its empirical findings are consonant with relevant theoretical underpinnings. Other academics have also reported that electronic games can bring positive effects to students ([20], [44], [50]). Nevertheless, this research reported that the students had to use their relational skills as they worked in collaboration with their peers. The serious games that were used here, have helped the students to improve their communication and transferable skills, that may be used in their future employment prospects. In conclusion, the researchers suggest that the combination of traditional and digital learning resources, including the use of serious games, could provide the right arena for the advancement of student-centred, quality education.

### **5.1 Research Limitations and Future Research**

This research was conducted among secondary school students who were the children of the middle-class and high-income parents, in small European country. Therefore, the findings of this study ought to be supported by further research in other contexts. Other research may consider different sampling frames, research designs, methodologies and analyses which could produce different outcomes. Nevertheless, this qualitative research has opened-up some important avenues for further research. A recent review on the subject reported that serious games are increasingly being utilised in different educational levels. These games are not a novelty anymore. Perhaps, future research can specifically investigate the motivational appeal of these games in supporting the educational outcomes of specific subjects. The researchers believe that there is scope in analysing the designs of serious games, as well as other commercial off-the-shelf games that could possibly lead to significant improvements in the

student's learning experience. Future studies may reveal that there may be other motivations among different demographics, on the use of digital game-based learning. The individual students' gender, age as well as their position in the social strata may affect their disposition to using digital games to learn academic or vocational subjects.

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## REFERENCES

- [1] K.M. Kapp, "The gamification of learning and instruction: game-based methods and strategies for training and education," John Wiley & Sons, 2012.
- [2] X. Ge, and D. Ifenthaler, "Designing engaging educational games and assessing engagement in game-based learning" In *Gamification in Education: Breakthroughs in Research and Practice*, pp. 1-19, Hershey, USA: IGI Global, 2018.
- [3] G.J. Hwang, and P.H. Wu, "Advancements and trends in digital game-based learning research: a review of publications in selected journals from 2001 to 2010," *British Journal of Educational Technology*; vol. 43, no. 1, pp. E6-E10, 2012
- [4] M.B. Kinzie, and D.R. Joseph, "Gender differences in game activity preferences of middle school children: implications for educational game design," *Educational Technology Research and Development*. vol. 56, nos 5-6, pp. 643-663, 2008.
- [5] M.B. Carvalho, F. Bellotti, R. Berta, A. De Gloria, C.I. Sedano, H.B. Hauge, J. Hu, and M. Rauterberg, "An activity theory-based model for serious games analysis and conceptual design," *Computers & Education*. vol. 87, pp. 166-181, 2015
- [6] T.M. Connolly, E.A. Boyle, E. MacArthur, T. Hainey, and J.M. Boyle, "A systematic literature review of empirical evidence on computer games and serious games," *Computers & Education*, vol. 59, no. 2, pp. 661-86, 2012.
- [7] D. Crookall, "Serious games, debriefing, and simulation/gaming as a discipline," *Simulation & Gaming*, vol. 41, no. 6, pp. 898-920, 2010.
- [8] J.H. Sandholtz, *Teaching with technology: Creating student-centered classrooms*. Teachers College Press, New York, USA, 1997.
- [9] A. Lugmayr, E. Sutinen, J. Suhonen, C.I. Sedano, H. Hlavacs C.S. Montero, "Serious storytelling—a first definition and review," *Multimedia Tools and Applications*, Vol. 76, No. 14, pp. 15707-15733, 2017.
- [10] P. Wouters, C. Van Nimwegen, H. Van Oostendorp, and E.D. Van Der Spek, "A meta-analysis of the cognitive and motivational effects of serious games," *Journal of Educational Psychology*, vol. 105, no. 2, pp. 249-266, 2013.

- [11] C.S. Loh, Y. Sheng, and D. Ifenthaler, "Serious games analytics: Theoretical framework" In *Serious Games Analytics*, Cham, Switzerland: Springer, 2015.
- [12] K. Kiili, "Digital game-based learning: Towards an experiential gaming model," *The Internet and Higher Education*. Vol. 8, no. 1, pp.13-24, 2005.
- [13] M. Ebner, and A. Holzinger, "Successful implementation of user-centered game-based learning in higher education: An example from civil engineering," *Computers & Education*, vol. 49, no. 3, pp. 873-890, 2007.
- [14] J.C. Burguillo, "Using game theory and competition-based learning to stimulate student motivation and performance," *Computers & Education*, vol. 55, no. 2, pp. 566-575, 2010.
- [15] M.D. Dickey, "Murder on Grimm Isle: The impact of game narrative design in an educational game-based learning environment," *British Journal of Educational Technology*. vol. 42, no. 3, pp. 456-69, 2011.
- [16] W.H. Huang, W.Y. Huang, and J. Tschopp, "Sustaining iterative game playing processes in DGBL: The relationship between motivational processing and outcome processing," *Computers & Education*, vol. 55, no. 2, pp. 789-97, 2010.
- [17] J. Harris, P. Mishra, and M. Koehler, "Teachers' technological pedagogical content knowledge and learning activity types: Curriculum-based technology integration reframed," *Journal of Research on Technology in Education*, vol. 41, no. 4, pp. 393-416, 2009.
- [18] M.A. Camilleri, and A.C. Camilleri, "Digital learning resources and ubiquitous technologies in education," *Technology, Knowledge and Learning*, vol. 22, no. 1, pp. 65-82, 2017.
- [19] K. Ciampa, "Learning in a mobile age: an investigation of student motivation," *Journal of Computer Assisted Learning*, vol. 30, no. 1, pp. 82-96, 2014.
- [20] A. Graesser, P. Chipman, F. Leeming, and S. Biedenbach, "Deep learning and emotion in serious games," *Serious games: Mechanisms and Effects*, pp. 81-100, 2009.
- [21] P. Wouters and H. Van Oostendorp (Eds), *Instructional techniques to facilitate learning and motivation of serious games*. Cham, Switzerland: Springer International Publishing; 2017.
- [22] C.C. Abt, *Serious games: The art and science of games that simulate life*. New York, USA: New York's Viking, 1970.
- [23] D.R. Jansiewicz, *The New Alexandria simulation: a serious game of state and local politics*. San Francisco, CA: Canfield Press; 1973.
- [24] J.P. Gee, *Good video games+ good learning: Collected essays on video games, learning, and literacy*. New York, USA: Peter Lang; 2007.
- [25] J.P. Gee, "What video games have to teach us about learning and literacy," *Computers in Entertainment (CIE)*, vol. 1, no. 1, pp. 20-21, 2003.
- [26] D.W. Shaffer, "Epistemic frames for epistemic games," *Computers & Education*, vol. 46, no. 3, pp. 223-34, 2006.
- [27] D. Djaouti, J. Alvarez, J.P. Jessel, and O. Rampnoux, "Origins of serious games" In *Serious games and edutainment applications*, London, UK: Springer, 2011.

- [28] J. Winterton, F. Delamare-Le Deist, and E. Stringfellow, *Typology of knowledge, skills and competences: clarification of the concept and prototype*. Luxembourg: Office for Official Publications of the European Communities; 2006.
- [29] L. Plowman, J. McPake, and C. Stephen “The technologisation of childhood? Young children and technology in the home,” *Children & Society*, vol. 24, no. 1, pp. 63-74, 2010.
- [30] C.I. Johnson, and R.E. Mayer, “Applying the self-explanation principle to multimedia learning in a computer-based game-like environment,” *Computers in Human Behavior*. Vol. 26, no. 6, pp. 1246-1252, 2010.
- [31] S. Erhel, and E. Jamet, “Digital game-based learning: Impact of instructions and feedback on motivation and learning effectiveness,” *Computers & Education*, vol. 67, pp. 156-167, 2013.
- [32] M.A. Camilleri, and A.C Camilleri, The Technology Acceptance of Mobile Applications in Education. In Sánchez, I.A. & Isaias, P. (Eds) 13th International Conference on Mobile Learning (Budapest, April 10th). Proceedings, International Association for Development of the Information Society (IADIS).
- [33] J. Nolan, and M. McBride, “Beyond gamification: reconceptualizing game-based learning in early childhood environments,” *Information, Communication & Society*, vol. 17, no. 5, pp. 594-608, 2014.
- [34] I. Granic, A. Lobel, and R.C. Engels, “The benefits of playing video games,” *American Psychologist*, vol. 69, no. 1, pp. 66-78, 2014.
- [35] M.J. Fleming, and D.J. Rick Wood, “Effects of violent versus nonviolent video games on children's arousal, aggressive mood, and positive mood,” *Journal of Applied Social Psychology*. vol. 31, no. 10, pp. 2047-2071, 2001.
- [36] M. Ventura, V. Shute, and Y.J. Kim, “Video gameplay, personality and academic performance,” *Computers & Education*, vol. 58, no. 4, pp. 1260-1266, 2012.
- [37] L. Shulman, “Knowledge and teaching: Foundations of the new reform,” *Harvard Educational Review*. vol. 57, no. 1, pp.1-23, 1987.
- [38] C. Girard, J. Ecalle, and A. Magnan, “Serious games as new educational tools: how effective are they? A meta-analysis of recent studies,” *Journal of Computer Assisted Learning*, vol. 29, no. 3, pp. 207-219, 2013.
- [39] J.J. Vogel, D.S. Vogel, J. Cannon-Bowers, C.A. Bowers, K. Muse, and M. Wright, “Computer gaming and interactive simulations for learning: A meta-analysis,” *Journal of Educational Computing Research*, vol. 34, no. 3, pp. 229-243, 2006.
- [40] D. Oblinger, The next generation of educational engagement,” *Journal of Interactive Media in Education*. (1), p.Art. 10. DOI: <http://doi.org/10.5334/2004-8-oblinger>, 2014.
- [41] D.M. Adams, R.E. Mayer, A. MacNamara, A. Koenig, and R. Wainess, “Narrative games for learning: Testing the discovery and narrative hypotheses,” *Journal of Educational Psychology*, vol. 104, no. 1, pp. 235-249, 2012
- [42] C.J. Ferguson, “Video games and youth violence: A prospective analysis in adolescents,” *Journal of Youth and Adolescence*, vol. 40, no. 4, pp. 377-391, 2011.
- [43] M.D. Griffiths, “Amusement machine playing in childhood and adolescence: A comparative analysis of video games and fruit machines,” *Journal of Adolescence*, vol. 14, no. 1, pp. 53-73, 1991.

- [44] N. Yee, "Motivations for play in online games," *CyberPsychology & Behavior*, vol. 9, no. 6, pp.772-775, 2006.
- [45] J. Juul, "Fear of failing? the many meanings of difficulty in video games," *The video game theory reader*, vol. 2, pp. 237-252, 2009.
- [46] J.W. Creswell, *Research designs: Qualitative, quantitative, and mixed methods approaches*, Thousand Oaks, CA, USA: Sage, 2009.
- [47] A. Rollings, and E. Adams, "Andrew Rollings and Ernest Adams on game design", San Francisco, CA, USA: New Riders; 2003.
- [48] J. Sweller, J.J. Van Merriënboer, and F.G. Paas, "Cognitive architecture and instructional design," *Educational Psychology Review*, vol. 10, no. 3, pp. 251-296, 1998.
- [49] M.A. Camilleri, and A.C. Camilleri, "Measuring the educators' behavioural intention, perceived use and ease of use of mobile technologies," British Academy of Management Conference 2017 (BAM2017) : Reconnecting Management Research with the Disciplines. Shaping the Research with the Social Sciences, Warwick, 2017.
- [50] M. Papastergiou, "Digital game-based learning in high school computer science education: Impact on educational effectiveness and student motivation," *Computers & Education*, vol. 52, no. 1, pp.1-12, 2009.

## Appendix A - Interview Guiding Questions

- Do you like digital games?
- What kind of games do you like to play?
- Can you please describe them?
- Are there any games that you dislike?
- Can you please describe them?
- Do you play digital games at home?
- How often do you play digital games, at home?
- How often do you play digital games, at school?
- Can you describe the games that you use at school?
- Which digital games do you like most? Why?
- Are the school games supporting you? How?
- Are there any things that you like in the school games?
- Are there any things that you do not like in the school games?
- Should your teacher use digital games at school? Why?
- Do you think that your school is using good or bad games? Why?