

Mobile Learning via Educational Apps: An Interpretative Study

By **Adriana Caterina Camilleri¹** and **Mark Anthony Camilleri²**

How to Cite: Camilleri, A.C. & Camilleri, M.A. (2019). Mobile Learning via Educational Apps: An Interpretative Study. In Shun-Wing N.G., Fun, T.S. & Shi, Y. (Eds.) 5th International Conference on Education and Training Technologies (ICETT 2019). Seoul, South Korea (May, 2019). International Economics Development and Research Center (IEDRC).

ABSTRACT

This research explains the rationale behind the utilisation of mobile learning technologies. It involves a qualitative study among children to better understand their opinions and perceptions toward the use of educational applications (apps) that are available on their mobile devices, including smartphones and tablets. The researchers organised semi-structured, face-to-face interview sessions with primary school students who were using mobile technologies at their institution. The students reported that their engagement with the educational apps has improved their competencies. They acquired relational and communicative skills as they collaborated together in teams. On the other hand, there were a few students who were not perceiving the usefulness and the ease of use of the educational apps on their mobile device. This study indicates that the research participants had different skill-sets as they exhibited different learning abilities. In conclusion, this contribution opens-up avenues for future research in this promising field of study.

CCS Concepts

• **Applied Computing** → **Education** → **Computer Assisted Instruction** • **Human-**

Centered → **Collaborative and Social Computing**

Keywords

Mobile Learning, Technology in Education, Mobile Learning Technologies, Educational Apps, Simulation Games, Storytelling.

1. INTRODUCTION

Today's children 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 mobile technologies in education have changed the way how students think and process information [2]. Very often, technologies, including games provide an immersive, voluntary and enjoyable activity as challenging goals are pursued according to agreed-upon rules ([3] [4]). At the same time, these innovations are increasingly satisfying the basic requirements of the schools' educational programs as they strive to provide an engaging learning environment for their students ([5], [6], [7], [8]). Ubiquitous technologies may be utilized outside the context of entertainment; and are considered as part of a thoughtful progress toward discovery-based learning ([9], [10]). For instance, serious

¹ Malta College of Arts, Sciences and Technology, Institute of Community Services, Korradino Road, Paola, PLA9032 MALTA
Tel: +356 2398 7100 Email: adriana.camilleri@mcast.edu.mt

²University of Malta, Dept. of Corporate Communication, Faculty of Media and Knowledge Sciences, MAK5 Building, Msida, MSD2080, MALTA Tel: +356 23403742 Email: mark.a.camilleri@um.edu.mt

games are not created with the primary purpose of pure entertainment, but with the intention for 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 such technologies in education can enhance the learning interests of students [13] and could further increase their motivation ([14], [15]). Researchers have also indicated that the digital games and other educational apps are becoming an integral part of the children's cognitive development as they support them in their learning journey ([16], [17]). Consequently, the mobile learning technologies hold great potential as students can improve their knowledge, skills and learning performance in an informal manner (through communication technologies ([3], [18], [19])).

However, the use of mobile learning is still far from mainstream. Therefore, this research investigates the costs and benefits of using educational apps ([3], [6], [20]). Recent academic literature suggests that there is potential for further development of game-based learning, across a broad range of educational programs. 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 mobile learning via serious games. It also explores the students' opinions, beliefs and perceptions on the use and ease of use of serious games in the primary 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

2.2 A Cost-Benefit Analysis on the Use of Mobile Learning Technologies

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 instill 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 behavioral 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 standardized 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 analyzed 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 programs.

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.

THE RESEARCH METHOD

3.1. The Qualitative Methodology

This research involved the systematic generation of theory from qualitative data that relied on the researchers' inductive, expansionist thinking. This study explored the participants' reactions and intrinsic behaviours. Therefore, the gathering of the interpretative data was obtained through organised, face-to-face interview meetings with fifty-four students who were between 6-8 years of age. They attended a primary 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 educational apps on their school tablets [5].

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 the mobile learning technologies 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 educational technologies. The interviewer's guiding questions are reported in Appendix A.

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. 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. This software has enabled the coding and analysis of text, image and audio data.

4. RESULTS

4.1 The Perceived Use of the Serious Games

The mobile learning technologies were used during their Math and English Language lessons. The majority of interviewees suggested that they "enjoyed" playing the school's (serious) games. Therefore, they were requested to describe the school's games.

The students held that they practiced their Math skills when they played the educational app on their tablet. They were also incentivized to 'compete' against their peers, as they were given rewards (and results) during their game play. Generally, the students agreed that the Math game helped them improve their social skills as they shared their scores with their class mates. The players themselves suggested that they were motivated and engaged [12] as the gameplay offered relevant challenges [47]. The students were divided into small groups of two or three, where they had to collaborate together and work in tandem to solve problems. The students felt a sense of accomplishment and intellectual stimulation as they completed the game's levels. Generally, they 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. A few of them declared that this game has also developed their analytical skills. Evidently, some of the students have recognized that the rationale of the math game was to enhance their cognitive and social skills. The students admitted that their engagement in this educational app formative activities has effectively resulted in a cohesive class where they worked in teams to compete against their peers.

The same students who played the math game, were also using a digital story app during their English language lesson. The interviewees reported that they were seeing benefits as well as 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, colors, 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 communicate about the script of their story. They were instructed to pay attention on the key elements of the story. 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 story to other students. Following the group's presentation of the story they engaged in a discussion with other students.

The purpose of the digital story was to encourage students to communicate with their peers, 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 students indicated that they felt uncomfortable working with individuals who were not familiar with them. Three students declared that they did not want to work with other children that they did not know well. Evidently, these were some of issues that may have stretched the interviewees' personal boundaries. In the main, 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 opportunity for them to improve relationships with their classmates. 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.

5. CONCLUSIONS

This research has provided a critical review of the extant academic literature on the use serious games in education. It suggests that children learn through mobile learning technologies and by engaging with serious games ([1], [11], [29]). The findings from this qualitative research indicated that 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]).

The results suggest that both the math and the story-telling apps have improved the students' cognitive skills. At the same time, these games motivated them and provided emotional benefits as they engaged with other individuals. Therefore, this contribution and its empirical findings are consonant with relevant theoretical underpinnings. It has proved that the use of the mobile learning technologies can improve the delivery of quality, student-centered education. This study has shown that the students have improved their relational and communication skills. In conclusion, the researchers suggest that the combination of traditional and digital learning resources would improve the learning outcomes in primary education.

5.1 Research Limitations and Future Research

This research was conducted among primary 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. Future research can analyze the designs of serious games. Further studies may reveal that there may be other motivations among different demographics, on the use of digital game-based learning.

ACKNOWLEDGMENTS

We thank the department of education, the school's principal and her members of staff who have provided their invaluable support during the data gathering process.

3. REFERENCES

- [1] Kapp, K.M. 2012. *The gamification of learning and instruction: game-based methods and strategies for training and education*, John Wiley & Sons, Hoboken, NJ, USA.
- [2] Ge, X. and Ifenthaler, D. 2018. Designing engaging educational games and assessing engagement in game-based learning” In *Gamification in Education: Breakthroughs in Research and Practice*, 1-19, IGI Global, Hershey, USA.
- [3] Hwang, G.J. and Wu, P.H. 2012. Advancements and trends in digital game-based learning research: a review of publications in selected journals from 2001 to 2010,” *Brit. J. of Educ. Tech.* 43(1), E6-E10.
- [4] Kinzie, M.B. and Joseph, D.R. 2008. Gender differences in game activity preferences of middle school children: implications for educational game design, *Educ. Tech. Res. and Dev.* 56(5-6), 643-663.
- [5] Carvalho, M.B., Bellotti, F., Berta, R., De Gloria, A., Sedano, C.I., Hauge, H.B., Hu, J. and Rauterberg, M. 2015. An activity theory-based model for serious games analysis and conceptual design,” *Computers & Education.* 87, 166-181.
- [6] Connolly, T.M., Boyle, E.A., MacArthur, E. Hainey, T. and Boyle, J.M. 2012. A systematic literature review of empirical evidence on computer games and serious games,” *Comp. & Educ.* 59(2), 661-686.
- [7] Crookall, D. 2010. Serious games, debriefing, and simulation/gaming as a discipline, *Sim. & Gaming.* 41(6), 898-920.
- [8] Sandholtz, J.H. 1997. *Teaching with technology: Creating student-centered classrooms*. Teachers College Press, New York, USA.
- [9] Lugmayr, A., Sutinen, E., Suhonen, J., Sedano, C.I., Hlavacs, H., and Montero, C.S. 2017. Serious storytelling—a first definition and review, *Multimedia Tools and Applic.* 76(14), 15707-15733.
- [10] Wouters, P. Van Nimwegen, C. Van Oostendorp, H. and Van Der Spek, E.D. 2013. A meta-analysis of the cognitive and

- motivational effects of serious games, *J. of Educ. Psych.* 105(2), 249-266.
- [11] Loh, C.S. Sheng, Y. and Ifenthaler, D. 2015. Serious games analytics: Theoretical framework, In *Serious Games Analytics*, Springer, Cham, Switzerland.
- [12] Kiili, K. 2005. Digital game-based learning: Towards an experiential gaming model, *The Int. and Higher Educ.* 8 (1), 13-24.
- [13] Ebner, M. and Holzinger, A. 2007. Successful implementation of user-centered game-based learning in higher education: An example from civil engineering, *Comp. & Educ.* 49(3), 873-890.
- [14] Burguillo, J.C. 2010. Using game theory and competition-based learning to stimulate student motivation and performance, *Comp. & Educ.* 55(2), 566-575.
- [15] Dickey, M.D. 2011. Murder on Grimm Isle: The impact of game narrative design in an educational game-based learning environment, *Brit. J. of Educ. Tech.* 42(3), 456-469.
- [16] Huang, W.H., Huang, W.Y. and Tschopp, J. 2010. Sustaining iterative game playing processes in DGBL: The relationship between motivational processing and outcome processing. *Comp. & Educ.* 55(2), 789-97.
- [17] Harris, J. Mishra, P. and Koehler, M. 2009. Teachers' technological pedagogical content knowledge and learning activity types: Curriculum-based technology integration reframed. *J. of Res. on Tech. in Educ.* 41(4), 393-416, 2009.
- [18] Camilleri, M.A. and Camilleri, A.C. 2017. Digital learning resources and ubiquitous technologies in education. *Tech., Knowl. and Learning*, 22(1), 65-82.
- [19] Ciampa, K. 2014. Learning in a mobile age: an investigation of student motivation, *J. of Comp. Assisted Learning*, 30(1), 82-96.
- [20] Graesser, A. Chipman, P., Leeming, F. and Biedenbach, S. 2009. Deep learning and emotion in serious games, *Serious Games: Mechanisms and Effects*, 81-100.
- [21] Wouters, P. and Van Oostendorp, H. (Eds) 2017. Instructional techniques to facilitate learning and motivation of serious games. Springer, Cham, Switzerland.
- [22] Winterton, J. Delamare-Le Deist, F. and Stringfellow, E. 2006. *Typology of knowledge, skills and competences: clarification of the concept and prototype*. Office for Official Publications of the European Communities, Luxembourg.
- [23] Plowman, L. McPake, J. and Stephen, C. 2010. The technologisation of childhood? Young children and technology in the home. *Children & Society*, 24(1), 63-74.
- [24] Johnson, C.I. and Mayer, R.E. 2010. Applying the self-explanation principle to multimedia learning in a computer-based game-like environment. *Computers in Human Behavior*. 26(6), 1246-1252.
- [25] Erhel, S. and Jamet, E. 2013. Digital game-based learning: Impact of instructions and feedback on motivation and learning effectiveness. *Computers & Education*, 67, 156-167.
- [26] Camilleri, M.A. and Camilleri, A.C. 2017. 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).
- [27] Nolan, J. and McBride, M. 2014. Beyond gamification: reconceptualizing game-based learning in early childhood environments. *Information, Communication & Society*, 17(5), 594-608.
- [28] Granic, I., Lobel, A. and Engels, R.C. 2014. The benefits of playing video games. *American Psychologist*, 69(1), 66-78.

- [29] Fleming, M.J. and Wood, D.J.R. 2001. Effects of violent versus nonviolent video games on children's arousal, aggressive mood, and positive mood. *Journal of Applied Social Psychology*. 31(10), 2047-2071.
- [30] Ventura, M. Shute, V. and Kim, Y.J. 2012. Video gameplay, personality and academic performance. *Computers & Education*, 58(4), 1260-1266.
- [31] Shulman, L. 1987. Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review*. 57(1), 1-23.
- [32] Girard, C., Ecalle, J. and Magnan, A. 2013. Serious games as new educational tools: how effective are they? A meta-analysis of recent studies. *Journal of Computer Assisted Learning*, 29(3), 207-219.
- [33] Vogel, J.J., Vogel, D.S., Cannon-Bowers, J., Bowers, C.A. Muse, K. and Wright, M. 2006. Computer gaming and interactive simulations for learning: A meta-analysis. *Journal of Educational Computing Research*, 34(3), 229-243.
- [34] Oblinger, D. 2014. The next generation of educational engagement. *Journal of Interactive Media in Education*. 1, Art. 10. DOI: <http://doi.org/10.5334/2004-8-oblinger>.
- [35] Adams, D.M., Mayer, R.E., MacNamara, A., Koenig, A. and Wainess, R. 2012. Narrative games for learning: Testing the discovery and narrative hypotheses. *Journal of Educational Psychology*, 104(1), 235-249.
- [36] Ferguson, C.J. 2011. Video games and youth violence: A prospective analysis in adolescents. *Journal of Youth and Adolescence*, 40(4), 377-391.
- [37] Griffiths, M.D. 1991. Amusement machine playing in childhood and adolescence: A comparative analysis of video games and fruit machines. *Journal of Adolescence*, 14(1), 53-73.
- [38] Yee, N. 2006. Motivations for play in online games. *CyberPsychology & Behavior*, 9(6), 772-775.
- [39] Juul, J. 2009. Fear of failing? the many meanings of difficulty in video games. *The video game theory reader*, 2, 237-252.
- [40] Creswell, J.W. 2009. Research designs: Qualitative, quantitative, and mixed methods approaches, Sage. Thousand Oaks, CA, USA.
- [41] Rollings, A. and Adams, E. 2003. Andrew Rollings and Ernest Adams on game design, New Riders, San Francisco, CA, USA.
- [42] Sweller, J., Van Merriënboer, J.J. and Paas, F.G. 1998. Cognitive architecture and instructional design. *Educational Psychology Review*, 10(3), 251-296.
- [43] Camilleri, M.A. and Camilleri, A.C. 2017. Measuring the educators' behavioural intention, perceived use and ease of use of mobile technologies, British Academy of Management Conference (BAM2017) : Reconnecting Management Research with the Disciplines. Shaping the Research with the Social Sciences, Warwick, UK.
- [44] Papastergiou, M. 2009. Digital game-based learning in high school computer science education: Impact on educational effectiveness and student motivation, *Computers & Education*, 52(1), 1-12, 200.

Authors' background

Your Name	Title*	Research Field	Personal website
-----------	--------	----------------	------------------

Adriana Camilleri	Senior Lecturer at the Malta College of Arts, Sciences and Technology and a PhD Candidate	Education Technologies	https://www.linkedin.com/in/adriana-camilleri-b98748bb
Mark Anthony Camilleri	Senior Lecturer at the University of Malta	Digital Media and Corporate Communication	https://www.um.edu.mt/profile/markacamilleri