Chapter 11
Reflections on the Application of a Gamified Environment to Foster Young Learners' Digital Competencies

Efi. A. Nisiforou and Charalambos Vrasidas

Introduction

The educational landscape has dramatically changed in times of global pandemic. This situation urges us to search for new solutions and new educational pathways for knowledge and skills development. Digital citizenship is a topic of growing concern, defined as "the norms of appropriate, responsible behavior about technology usage" (Ribble, 2012, p. 10). The global community is now endeavoring to cultivate students into digital citizens, capable of finding solutions for the world's most significant technological advances. Researchers and educational practitioners are increasingly turning their attention toward educational games' effects to support the development of digital skills in primary school students. Digital skills are essential for the next generation to act appropriately in the digitalized and rapidly evolving society. Schools need to extend and embed key skills and concepts into students' lives to ensure they can use digital technology effectively and responsibly both in and out of school context.

The goal of smart education is to foster learners' twenty-first-century skills (such as problem-solving ability) as a medium to confront the challenges encountered in the digitalized society. To keep up with the rapid digital transformation, smart pedagogy (smart teaching and smart learning) must turn its attention to learning how to employ the different digital technologies in a smart and meaningful way (Daniela, 2019). Considering this technological transformation, the idea of "smart pedagogy" was emerging as the driving force of technology-enhanced learning to promote synergy between technology and pedagogy (Daniela, 2018).

The research community lacks a summarized chapter that will introduce the connection between game-based learning and digital citizenship education to support young learners' acquisition of vital digital competencies. Based on these

E. A. Nisiforou (✉) · C. Vrasidas
CARDET - Department of Education, University of Nicosia, Nicosia, Cyprus

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prerequisites, integrating GBL in the context of digital citizenship education creates a challenge that must be addressed today. Therefore, this work's overarching goal is to promote smart pedagogy by supporting students and teachers to become members of a digital citizenry and responsible users of digital technologies.

Key Definitions

Smart learning environments are referred to as systems that aim to propose innovative practices of emerging pedagogical approaches and technologies to support effective learning experiences (Pesare, Roselli, Corriero & Rossano, 2016).

The need to establish Innovative Learning Environments (ILE) was also highlighted in the OECD report (OECD, 2017; Borawska-Kalbarczyk et al., 2019). Developing such modern learning environments based on smart pedagogy requires acquiring specific competencies such as digital skills. Smart educational environments can provide tailored and personalized learning (e.g., adaptive content, collaborative and interactive tools, real-time feedback, etc.) to increase student engagement and enhance meaningful learning (Zhu et al., 2016).

The development of an innovative and gamified DRC-Heroes application provides a unique opportunity and pedagogic innovation to teach the various topics related to digital citizenship. Reflections and recommendations are drawn based on the implementation and evaluation of the smart learning environment. In addition to the theoretical part, the chapter gives a practical tone by outlining the reflections and recommendations as emerged through user experience (UX) studies conducted in four different European countries with a sample of primary school teachers and K-12 students. Participant's reflections declare the potential of game-based learning and essential gamification elements to promote smart pedagogy by cultivating young learners' digital skills in the context of digital citizenship education.

The European Digital Competence Framework (DigComp)

To tackle the advanced digital skills gap and promote innovative learning environments, the European Commission's Joint Research Centre published coherent European frameworks such as the Digital Competence of citizens (DigComp), teachers (DigCompEdu), and organizations (DigCompOrg) (Beblavý et al., 2019). Precisely, the European Digital Competence Framework for Citizen (DigComp 2.0) is a reference framework that aims to support individuals' development of digital competence in Europe (Vuorikari et al., 2016; Kluzer & Priego, 2018, p. 12). The framework defines digital competence as using such digital technologies in a secure, critical, collaborative, creative, and responsible way (Vuorikari et al., 2016). Various editions of the DigComp were published since then. DigComp 2.1 is the advanced

version of DigComp and includes five digital competence areas, namely, (1) information and data literacy, (2) communication and collaboration, (3) digital content creation (including coding and programming), (4) safety (including digital well-being and competencies related to cybersecurity), and (5) problem-solving (Carretero et al., 2017; European Commission, 2018). The common European Framework for the Digital Competence of Educators (known as DigCompEdu) focuses on expanding the three initial proficiency levels to eight and providing examples of their use. This model was designed to help national authorities guide their policies to implement regional and national tools and training programs and provide a common language and approach, favoring the dialogue and exchange of best practices across borders.

Game-Based Learning (GBL), Gamification, and Educational Games

Game-based learning (GBL) refers to integrating games for educational purposes (All et al., 2016). GBL approach has gained considerable popularity in the last decades, and it remains a fertile area of research in education (Romero & Usart, 2013). GBL is actively driven by games, defined as the process of adapting an educational concept into a game-based structure with clear learning outcomes (Hasan, 2018; Hasan et al., 2018). A more recent term defined by teachers' views is that GBL is learning by having fun, learning by doing, and learning through activities (Avdiu, 2019). It was mentioned that game scenarios could enhance knowledge and competencies acquired through scenario-based, problem-solving, and decision-making processes by engaging students in active learning situations (Prensky, 2001; Klopfer & Yoon, 2005). A recent study declared that GBL implementation composes various teachers' competencies that need to be developed in advance. Understanding these GBL-related competencies supports teacher's professional development (Nousiainen et al., 2018).

Nowadays, the gamification approach has revealed the value of game-based mechanics to create meaningful learning experiences. Gamification is a more recent term than GBL, and although it was first coined by Nick Pelling back in 2003, it was commonly introduced in teaching and learning a decade ago (Jagušt et al., 2018). It has received enormous attention and is defined as a technique that implements game elements and mechanics into non-gamified environments, forcing learner-users to follow specific rules (Deterding et al., 2011). These fundamental elements are given at the beginning of a game, such as rules or progress elements (i.e., avatars, points, badges, leaderboards, achievements, levels, and content unlocking) and users' behaviors-emotions when they receive feedback, interact with others, and build relationships. There are significant research works that clearly illustrate the application of gamified components in education (Christy & Fox, 2014). These studies have introduced a gamified environment concept, which specifies an environment

where the gamification characteristics are organized to actively engage users in the learning process (Hasan, 2018; Khan, & Umair, S. (Eds.)., 2017).

Digital Educational Games

Digital games have gained popularity as a new paradigm in education. Games contribute to the active involvement of students in the learning process. The educational value of digital games has been of interest to many scholars (Allsop & Jessel, 2015; Spires et al., 2011; Robertson & Howells, 2008). More precisely, it was affirmed that games introduce students to self-directed learning and develop different skills such as problem-solving, active involvement, critical thinking, and collaboration (Whitton, 2012, 2014; Zsoldos-Marchis & Hari, 2020). Although significant research lies on the positive effects of games on students' twenty-first-century skills development, not much is known regarding how games may explicitly affect students' digital competencies. At this point, many digital games have been developed for educational purposes. However, their implementation into primary classrooms is still in its infancy.

Digital educational games have gained wide popularity over the years, bringing education to a new dimension, which conforms to the habits, needs (e.g., digital literacy level), and learners' interests. It is commonly known that by introducing entertainment in the learning process, a more attractive, pleasant, and engaging environment is stimulated for the learners (Prensky, 2002). When used appropriately, digital educational games can be classified as active learning environments that could enhance children learning and skills acquisition, thus effectively contributing to reforming the educational system (Kebritchi et al., 2010). Nevertheless, digital educational games can successfully enhance student participation and collaboration and foster problem-solving skills (Gros, 2007; Manesis, 2020).

The Context

Digital Citizenship Education to Support Smart Pedagogy

To confront the digital skills gap in Europe, digital citizenship education was introduced as a game-based learning and problem-based learning approach in primary schools within Europe (Cyprus, Greece, Italy, Ireland). These learning and teaching approaches are employed in the context of digital citizenship education to support the development of smart learning environments and further enhance smart pedagogy. Nevertheless, to the best of our knowledge, no case studies nor reviews of the literature exist on incorporating the European DigComp framework in K-12 classes to nurture young learners' digital competencies. To drive this, DigComp was

selected as the most appropriate framework to support digital skills initiatives (EU, 2016; Vuorikari et al., 2016).

For these reasons, following the five (5) digital competence areas described in the framework (information and data literacy, communication and collaboration, digital content creation, online safety, and problem-solving), we created an attractive, smart learning environment for students. Henceforth, GBL and essential gamification elements were employed as the most appropriate strategies for the instructional design of the Digital, Responsible Citizenship (DRC)-Heroes application which aimed to engage students in authentic and challenging problem-based scenarios. DRC-Heroes app proposes different game scenarios to master the future workforce's digital skills to meet the challenges of the digitalized society.

User Experience (UX) and Educational Design Research

According to Norman and Nielsen (1998), user experience (UX) encompasses all aspects of the end user's interaction with its services and products. UX research design incorporates a systematic educational design process with target users and their requirements to create products that provide realistic and relevant experiences to end users. On the other hand, educational design research is defined as "a series of approaches, with the intent of producing new theories, artifacts, and practices that account for and potentially impact learning and teaching in naturalistic setting" (Barab & Squire, 2004, p. 2). Design-based research and UX design joined forces to ground the methodology of this work. The educational design research methodology aimed "to increase educational research relevance for educational policy and practice" (van den Akker, Gravemeijer, McKenney & Nieveen 2006, p. 3). Therefore, user experience (UX) studies with end users (179 teachers and 99 students) from four different EU countries (Cyprus, Greece, Ireland, Italy) were conducted in order to evaluate the application, redesign, and produce the final product. Multiple data sources were used as part of the UX research to ensure triangulation of the collected qualitative and quantitative data. These methods include the following:

(a) Teacher training
(b) Student workshops and observations
(c) Questionnaires

Design, Development, and Evaluation

The DRC-Digital Heroes is a digital game (DRC stands for "Digital, Responsible Citizenship") which is specifically designed to engage and motivate students to acquire digital competencies as formed by the EU DigComp model. The adventurous smart learning environment teaches primary school students (K-12) of all grades

(first–sixth) the fundamentals of digital citizenship through a series of dilemmas that take the form of five mini-game-based scenarios. The application is widely available in three languages. It is offered in two formats,[1] as a web-based learning platform and an adventurous gamified application, freely and easily accessible for iOS and Android users. A description of the game elements embedded in the gamified application's construction is presented in a tabular form (see Table 11.1).

Grounded on the concepts of smart pedagogy, the content of the application offers a smart learning environment. The innovative gamified application's design and development were built as part of the "Digital, Responsible Citizenship in a Connected World" (DRC) Project funded under the Erasmus+ program, KA2. The application was developed based on the ADDIE instructional model (Molenda, 2003; Branson, 1978). The five stages of the development process include the *analysis* (i.e., target audience, needs, instructional goals), the *design* (i.e., prototypes, characters, graphics, scenes, and badges) following a design thinking approach (Martin, 2009), the *development* (i.e., instructional content such as rules and aims of the game, narratives structure, scenarios, articulates, level of interaction, usability testing tools, protocols, consent forms), the *implementation* (i.e., student workshops, teacher training, UX case studies), and *evaluation process* (i.e., quality of information, the visual design of the interface, user satisfaction, scoring, real-time feedback, ease of use, language).

Usability evaluations were conducted with primary school students and teachers during the delivery of workshops and training. The UX studies and evaluations were carried out by two researchers per country (a total of eight researchers) to establish the data's validity and reliability. Upon completion of the research process, participants were requested to evaluate the usability of the DRC-Digital Heroes app in terms of its usability (e.g., attributes such as easy to learn, efficient to use, pleasant, content, interface design, etc.). The evaluation tools were:

(a) Observation template
(b) Testimonial template
(c) Evaluation questionnaire

The detailed analysis of both quantitative and qualitative data is beyond the scope of this particular work. As noted earlier, the present chapter reflects on the lessons learned from the evaluation of a gamified application in GBL to promote smart learning and pedagogy. The open-ended questions of all research instruments were formulated to address a wide variety of issues related to UX as a result of users' interaction and overall experience with the application. Participant responses were then reviewed and presented as reflections and lessons learned to illuminate the way for future practices to follow to foster digital skills and promote smart education. Some indicative questions which were embedded in the evaluation templates include but are not limited to the following:

- Give three words that best describe digital citizenship for you?

[1] Web-based, App Store/Google Play

Table 11.1 The architecture of the DRC-Digital Heroes application

Game elements	Description
Language	User language selection (English, Italian, Greek).
Main scenes	Various scenes to cover all five digital competencies as distributed across the different scenes of the PBL scenarios.
Meet the heroes	Game storyboards and instructions related to all six heroes' missions.
Five games	Five mini-scenarios based on DigComp and GBL approach.
Characters	A total of eight (8) characters were designed to count gender equality.
Foxy and Puffy	The two (2) main player characters appear throughout the scenarios.
The creative hero	With the creative hero's guidance, young people learn how to create a digital frame by choosing the background and font and add copyright to an image.
The safeguard hero	With the safety hero's support, young learners acquire knowledge and basic skills on how to use the Internet, create accounts with strong and secure passwords, protect personal information, and decline invitations from unknown people.
The information hero	Together with the information hero, children learn how to evaluate source reliability during online searches.
The problem-solving hero	Children are motivated to use technology for solving an environmental issue and not just apply for active citizenship. The problem-solving hero will help them make the correct decisions.
The communication hero	With the help of the communication hero, children are engaged in producing text messages and comments on social media.
The wizard hero	The wizard hero is the online master of magic and helps young learners to ask a series of easy-to-answer questions to the relevant hero.
Five (5) mini-games	**Description of scenarios**
Puffy & Foxy surf the web	This game aims to help students understand, recognize, and manage e-safety issues in the digital world.
Puffy & Foxy design a birthday card	Through this game, students explore the varied and evolving environment(s) of digital content creation to support the acquisition of critical thinking, reflective and responsible doing and making.
Puffy & Foxy go to the library	In this game, students find useful information on how to use communication and collaboration tools responsively.
Puffy & Foxy research the elections	Through this game, young students acquire basic background knowledge related to information and data literacy.
Puffy & Foxy visit the river	This game presents the concept of problem-solving and aims to foster relevant competence in children.

- How did you navigate through the application? Give an example.
- Describe your experience on the usability and accessibility of the app.
- What have you learned through your interaction with the game "Puffy & Foxy research the elections"?
- How do you find the design of the interface?
- Would you recommend the application to other students?
- Which was the most exciting game for you and why?

- What have you learned from your interaction with the game "Puffy & Foxy surf the web"?
- How would you describe your overall experience with the application?
- What did you like the most?
- What did you like less?
- Is the interface of the app suitable for students? Please describe in terms of language, ease of use, content, feedback, scenarios, self-directed learning.
- Give one example of how to stay safe online?
- Give one example of how to protect your creative commons when creating a digital card.

As obtained through participants' reflections, the evaluation results reveal that students gained a basic level of knowledge on the concept of digital citizenship. Therefore, we assume that digital competencies were acquired at an optimum level through the interaction with the DRC-Heroes application. These initial views will be further examined through the data analytics logs in order to identify trends and accept or reject these assumptions. Both teachers and students found the app motivating to play, revealing a potential impact on learners' engagement and fostering of digital skills. The implications of these findings and the lessons learned are discussed. The application aims to break the illiteracy chain, allowing parents with the lowest literacy levels to explore stories with their children. An impressive result is that besides supporting the official spoken language (English) was also essential to provide a multilanguage system that supports the different local mother languages (English, Greek, Italian). A common outcome of these initiatives is that they demonstrated the value of applying mobile applications to teach children without access to schools. In addition each mini-game scenario embraces a specific learning content related to digital citizenship education (see Table 11.1), which can be horizontally integrated into all subjects areas as part of the school curricula.

Reflections and Recommendations

Game-based learning appears to support teachers in their effort to equip students with the fundamentals of digital citizenship education. The integration of the DRC-Heroes application in the teaching and learning process revealed its potential to cultivate learners' digital skills and acquire the fundamentals of digital citizenship, as these were reflected through their testimonials. The application is an engaging, interactive microcosm with customized, user-friendly, and gamified interactive educational scenarios that give space to the more engaging classroom and home discussions. Overall, students and teachers valued the user-friendly and stimulating environment of the DRC-Heroes app by reporting its ease of use, real time, continuous feedback, and authentic problem-based scenarios that stimulate learners' engagement.

Taking design research and UX approaches was iterative, with multiple feedback loops that informed the app design's subsequent phases. Our lessons learned and recommendations anticipate guiding teachers, and practitioners employ GBL practices to foster students' digital skills and promote smart learning environments.

These steps are based on our views and include the following:

- Review and apply the ADDIE model of instructional design in the teaching practices or other related models.
- Understand the needs of the target group.
- Focus on the required skills relevant to the learning objectives of the class audience.
- Dedicate time for planning the design of the GBL course.
- Use a friendly tone in the scenarios relevant to the target audience.
- Use authentic problem-based scenarios to cultivate problem-solving skills.
- Create a balance of engaging text and images.
- Employ gamification mechanisms to trigger students' participation, motivation, and engagement (such as rules, points, badges, unlocks, ranks, level up, leaderboard).
- Identify potential obstacles, and tackle challenges from a different angle or perspective on overcoming the difficulties and turning those into possible opportunities.
- Understand that a cohort of students requires an iterative education development process that involves planning, testing, and reflective practices.
- Take a student-centric approach, involving a multidiscipline team, to understand what was desirable from the student perspective.
- Redesign the smart learning environment based on the feedback received by teachers and end users (i.e., students).
- Flexibility is a crucial factor to accommodate game-based learning; subsequently, a more radical policy reform would be needed.
- Adjust the teaching content to country-specific curricula, pedagogy, methods, and practice when embedding digital games in the context of digital education.
- GBL needs an extra effort from teachers, and they also need skills in designing different games.
- Implement effective GBL by teaching through play.
- Design the GBL activities by starting building the teaching scenarios having in mind basic gamification mechanisms.
- Ensure that students are learning by assessing their knowledge progression throughout the session to allow the teacher to better-adjust their teaching activity.
- Design learning activities that enable students to uncover their prior knowledge and unfold their capabilities.

Future work will integrate voice-over narrations throughout the entire scenarios and run log analytics. Besides, the analysis of the application based on the TPACK model would reveal interesting research paths. Further UX studies will take place using a more significant number of participants to examine trends and draw conclusions on the application's usability. Finally, it would be interesting to measure the

level of interaction and cultivation of digital skills before and after the intervention of teaching and learning practices with the DRC-Heroes application. These data will confirm the application's potential to foster young learners' digital skills and support the development of smart pedagogy.

Conclusion

Our chapter reflects on the usability of the DRC-Heroes application as a smart learning environment in the context of digital citizenship to promote smart pedagogy. The UX evaluations in primary schools in Cyprus, Greece, Italy, and Ireland presented the DRC-Heroes gamified learning environment in primary school settings during the implementation of an Erasmus project. Reflections on its implementation encapsulate innovative ways on how the concept of digital citizenship in school curricula might tackle the digital skills gap.

Primary school teachers must be taught the relevance of game-based learning and training on applying basic gamification techniques in teaching practices to motivate students' knowledge and digital competencies development. Teachers must recognize the importance of game-based learning, digital citizenship, and new teaching and learning technologies. Adequate training on these concepts could support teachers adopt these recent trends.

Teachers' and students' experiences and views on integrating the DRC-Heroes games in the primary classroom call for a dynamic connection between curriculum design, learning culture, and practice when implementing game-based learning. We anticipate that this brief chapter will motivate teachers to embed digital games into their teaching practices and identify innovative pedagogies to teach fundamental digital citizenship concepts.

Transitioning students and teachers to digital citizen mindsets may require much more time and preparation than expected. Henceforth, there is an imminent need to understand how GBL can reinforce students' digital demands and keep up with societal trends. Finally, the chapter envisages guiding educators, students, policymakers, and other education professionals on designing, developing, and implementing digital citizenship pedagogies in the primary school curriculum.

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References

All, A., Castellar, E. P. N., & Van Looy, J. (2016). Assessing the effectiveness of digital game-based learning: Best practices. *Computers & Education, 92*, 90–103.

Allsop, Y., & Jessel, J. (2015). Teachers' experience and reflections on game-based learning in the primary classroom: Views from England and Italy. *International Journal of Game-Based Learning (IJGBL), 5*(1), 1–17.

Avdiu, E. (2019). Game-based learning practices in Austrian elementary schools. *Educational Process: International Journal (EDUPIJ), 8*(3), 196–206.

Barab, S., & Squire, K. (2004). Design-based research: Putting a stake in the ground. *The Journal of the Learning Sciences, 13*(1), 1–14.

Beblavý, M., Baiocco, S., Kilhoffer, Z., Akgüç, M, & Jacquot, M. (2019). *Index of readiness for digital lifelong learning: changing how Europeans upgrade their skills*. https://www.ceps.eu/wp-content/uploads/2019/11/Index-of-Readiness-for-Digital-Lifelong-Learning.pdf

Borawska-Kalbarczyk, K., Tołwińska, B., & Korzeniecka-Bondar, A. (2019). From smart teaching to smart learning in the fast-changing digital world. In *Didactics of smart pedagogy* (pp. 23–39). Springer.

Branson, R. K. (1978). The interservice procedures for instructional systems development. *Educational Technology, 18*(3), 11–14.

Carretero, S., Vuorikari, R., & Punie, Y. (2017). *DigComp 2.1: The Digital Competence Framework for Citizens with eight proficiency levels and examples of use* (No. JRC106281). Joint Research Centre (Seville site).

Christy, K. R., & Fox, J. (2014). Leaderboards in a virtual classroom: A test of stereotype threat and social comparison explanations for women's math performance. *Computers & Education, 78*, 66–77.

Daniela, L. (Ed.). (2018). *Didactics of smart pedagogy: Smart pedagogy for technology-enhanced learning*. Springer.

Daniela, L. (2019). Smart pedagogy for technology-enhanced learning. In *Didactics of smart pedagogy* (pp. 3–21). Springer.

Deterding, S., Sicart, M., Nacke, L., O'Hara, K., & Dixon, D. (2011). Gamification using game-design elements in non-gaming contexts. In *CHI'11 extended abstracts on human factors in computing systems* (pp. 2425–2428).

European Commission (2018). The Digital Competence Framework 2.0. Retrieved from https://ec.europa.eu/jrc/en/digcomp/digital-competence-framework

European Union (2016). The European Digital Competence Framework for citizens. Retrieved from https://ec.europa.eu/social/main.jsp?catId=738&furtherPubs=yes&pubId=7898&langId=en&

Gros, B. (2007). Digital games in education: The design of games-based learning environments. *Journal of Research on Technology in Education, 40*(1), 23–38.

Hasan, Ã., Kanbul, S., & Ozdamli, F. (2018). Effects of the gamification supported flipped classroom model on the attitudes and opinions regarding game-coding education. *International Journal of Emerging Technologies in Learning (iJET), 13*(1), 109–123.

Hasan, M. M. (2018). Design and implementation of gamified course contents. In *Handbook of research on mobile devices and smart gadgets in K-12 education* (pp. 32–44). IGI Global.

Jagušt, T., Botički, I., & So, H. J. (2018). Examining competitive, collaborative, and adaptive gamification in young learners' math learning. *Computers & Education, 125*, 444–457.

Kebritchi, M., Hirumi, A., & Bai, H. (2010). The effects of modern mathematics computer games on mathematics achievement and class motivation. *Computers & Education, 55*(2), 427–443.

Klopfer, E., & Yoon, S. (2005). Developing games and simulations for today and tomorrow's tech savvy youth. *TechTrends, 49*(3), 33–41.

Kluzer, S., & Priego, L. P. (2018). *DigComp into action: Get inspired, make it happen. A user guide to the European Digital Competence Framework* (No. JRC110624). Joint Research Centre (Seville site).

Khan, A. A., & Umair, S. (Eds.). (2017). *Handbook of research on mobile devices and smart gadgets in K-12 education*. IGI Global.

Manesis, D. (2020). Digital games in primary education. In *Game design and intelligent interaction*. IntechOpen. Available from: https://www.intechopen.com/books/game-design-and-intelligent-interaction/digital-games-in-primary-education

Martin, R. (2009). *The design of business: Why design thinking is the next competitive advantage*. Harvard Business School Press.

Molenda, M. (2003). In search of the elusive ADDIE model. *Performance improvement, 42*(5), 34–37.

Norman, D. A., & Nielsen, J. (1998). *The definition of user experience (UX)*. Nielsen Norman Group. Retrieved from https://www.nngroup.com/articles/definition-user-experience/

Nousiainen, T., Kangas, M., Rikala, J., & Vesisenaho, M. (2018). Teacher competencies in game-based pedagogy. *Teaching and Teacher Education, 74*, 85–97.

OECD. (2017). *The OECD handbook for innovative learning environments*. OECD, Publishing. http://dx.doi.org/9789264277274-en

Pesare, E., Roselli, T., Corriero, N., & Rossano, V. (2016). Game-based learning and gamification to promote engagement and motivation in medical learning contexts. *Smart Learning Environments, 3*(1), 1–21.

Prensky, M. (2002). The motivation of gameplay. *On the Horizon, 10*(1), 5–11.

Prensky, M. (2001). Digital natives, digital immigrants part 2: Do they really think differently?. On the horizon.

Ribble, M. (2012). Digital citizenship for educational change. *Kappa Delta Pi Record, 48*(4), 148–151.

Robertson, J., & Howells, C. (2008). Computer game design: Opportunities for successful learning. *Computers & Education, 50*(2), 559–578.

Romero, M., & Usart, M. (2013). Learning with the support of a digital game in the introduction to finance class: Analysis of the students' perception of the game's ease of use and usefulness. In *Cases on digital game-based learning: Methods, models, and strategies* (pp. 495–508). IGI Global.

Spires, H. A., Rowe, J. P., Mott, B. W., & Lester, J. C. (2011). Problem-solving and game-based learning: Effects of middle-grade students' hypothesis testing strategies on learning outcomes. *Journal of Educational Computing Research, 44*(4), 453–472.

Van den Akker, J., Gravemeijer, K., & McKenney, S. (2006). Introducing educational design research. In Educational design research (pp. 15–19). Routledge.

Vuorikari, R., Punie, Y., Gomez, S. C., & Van Den Brande, G. (2016). *DigComp 2.0: The digital competence framework for citizens. Update phase 1: The conceptual reference model* (No. JRC101254). Joint Research Centre (Seville site).

Whitton, N. (2012). The place of game-based learning in an age of austerity. *Electronic Journal of e-Learning, 10*(2), 249–256.

Whitton, N. (2014). *Digital games and learning: Research and theory*. Routledge.

Zhu, Z. T., Yu, M. H., & Riezebos, P. (2016). A research framework of smart education. *Smart Learning Environments, 3*(1), 1–17.

Zsoldos-Marchis, I., & Hari, T. H. (2020, July). Game-based learning (GBL) in primary schools from Romania. In *Proceedings of EDULEARN20 Conference* (Vol. 6, p. 7th).