Experiences and perceptions of pedagogical practices with Game-Based Learning & Gamification

Edited by: Bento Duarte da Silva, José Alberto Lencastre, Marco Bento, António J. Osório

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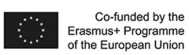

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Editorial Note
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The European Commission support for the production of this publication does not constitute an endorsement of the content, which are the sole responsibility of authors and editors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

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Editors' Introduction

The book **Experiences and perceptions of pedagogical practices with Game-Based Learning & Gamification** is an intellectual output of the Erasmus+ Games2Learn&Gamification2Engage project funded by the Portuguese National Agency for the Erasmus Plus Programme. The *Agupamento de Escolas da Maia* (Portugal), the *Istituto Comprensivo di Sestu* (Italy) and *Szkola Podstawowa nr 41* (Poland) participated in this European project, with the partnership of researchers from the Research Centre on Education of the University of Minho (Portugal).

For the completion of the book, we invited experts who have been studying the use of games and gamification in education, and they have prepared papers with unquestionable merit. Thus, the book has fifteen chapters, including a preface by Nelson Zagalo, from the University of Aveiro (Portugal) who has ample research on videogame sciences and arts. Zagalo's preface reports the social relevance of games for learning, because, as he states: "bringing the game to the centre of education has become not only current but fundamental because it is from collaboration, cooperation and even competition that the learning social matrix needs".

Following the preface, there are five chapters by researchers and teachers directly involved in the project. The first chapter, written by researchers from the Research Centre on Education of the University of Minho - Bento Silva, José Alberto Lencastre, Marco Bento and António Osório - aimed to identify the perceptions and knowledge of the teachers involved in the project, regarding game-based learning (GBL) and gamification and their use as pedagogical innovation scenarios. The second chapter, authored by teachers of the Maia School Cluster (Portugal) - Luís Coutinho, Aline Santos, Sónia Lopes, Sónia Pinheiro and Helena Baptista - address teachers' perceptions on the training provided during the project implementation on the use of games and gamification in education. The third chapter, written by two teachers from the *Istituto Comprensivo di Sestu* (Italy) - Alessandra Patti and Flavio Orrù - presents experiences, in GBL and gamification learning strategies, at their school, a school strongly keen on digital technologies. The fourth chapter, written by teachers from the same

Italian school - Rossana Manca, Silvia Callai, Rita Concas, Sonia Maria Dessì and Luisa Fadda - discusses the Italian experiences with GBL and gamification to improve student learning and teacher skills. Finally, the fifth chapter, presented by the teachers of *Szkola Podstawowa nr 4*1 (Poland) - Aneta Brzezińska, Konrad Gonera, Ewa Mospinek, Katarzyna Pawlak and Zofia Cieślak-Pietrzak - addresses gamification at school, from the perspective of assessment tools, age of students and everyday work.

The next three chapters have used systematic reviews or meta-analysis strategies to give an overview of recent research on GBL and gamification. Thus, in the sixth chapter, Luís Coutinho and José Alberto Lencastre, authors already mentioned in this introduction, performed a systematic review using the ERIC (Education Resources Information Centre) database. In the seventh chapter Teresa Cardoso, from the Portuguese Open University, has guided herself by a multimodal meta-analytical strategy and, based on publications from RCAAP (Scientific Repository of Open Access of Portugal), researched on games and gamification from the student's perspective. In chapter eighth Julio Cabero-Almenara and María del Carmen Llorente Cejudo (from the University of Seville, Spain) and Rubicelia Valencia Ortiz (from Macmillan Education, Mexico), also using a meta-analysis strategy, researched on videogames and gamification in Spanish scientific journals of education and social sciences.

In the ninth chapter, authored by Juline Santos and Dulce Cruz from the Federal University of Santa Catarina (Brazil), who followed a Design-Based Research methodology instead of a systematic review or meta-analysis, bring a perception of Brazilian pre-service teachers concerning pedagogical practices based on gamification.

Following are five chapters that refer to pedagogical experiences using GBL and gamification. In this group of manuscripts, the tenth chapter was written by Lynn Alves (Federal University of Bahia, Brazil), Jessica Vieira, Maria de Fátima Dórea and Larissa Cerqueira (Estate University of Bahia, Brazil), and presents a case study using the Gamebook Guardians of the Forest. The eleventh chapter, written by Edméa Santos (Federal Rural University of Rio de Janeiro, Brazil) and

Vivian Martins (State University of Rio de Janeiro, Brazil), brings a contribution about the mediation of the COMENIUS game in Online Education, reflecting on the teachers training to use games in cyberculture. The twelfth chapter, written by Adelina Moura (member of the Games, Interaction and Learning Technologies Research Group and teacher at Carlos Amarante Secondary School, Portugal) and Idalina Santos (teacher at Dr. Joaquim Gomes Ferreira Alves Secondary School, Portugal), bring results from pedagogical experiences with the "Escape Room" game to engage and improve students' learning in Mathematics and Language subjects. The thirteenth chapter was written by Maria João Ferreira and Fernando Moreira (Portucalense University, Portugal) and David Fonseca Escudero (Ramon Llull University, Spain) and discusses the learning of gamification in higher education, and the potential of gamification experiences within the Moodle Learning Platform. Concluding the texts of this group of pedagogical experiences, in the fourteenth chapter Carlos Santos, Joana Beja and Ana Raquel Carvalho from the University of Aveiro (Portugal) bring the results of an experience with the game "El DeCA de Papel", based on the television series "La Casa de Papel". The authors focus the advantages to pedagogical innovation when students assume the role of mentors, guiding other students in the learning process. The last chapter of the book - the fifteenth chapter - is authored by Fernando Albuquerque Costa from the University of Lisbon (Portugal) and reflects on the pedagogical value of gamification. This author considers that gamification represents an excellent opportunity for exploration as an object of study under curriculum theory.

At the back of the book, the reader can find a set of author biographies that identify the experience that each of them brings to this book through their contributions.

As well as thanking everyone who has contributed to this book, we would like to add some special acknowledgement for the additional support we have received.

First, from our colleagues within the Games2Learn&Gamification2Engage project. Among the contributors, Aline Santos, Luis Coutinho, Sónia Lopes, Sónia Pinheiro and Helena Baptista from Portugal, Alessandra Patti, Flavio Orrù, Rossana Manca, Silvia Callai, Rita Concas, Sonia Maria Dessì and Luisa Fadda

from Italy, as well as Marzanna Topolska, Tomasz Piotrowski, Aneta Brzezińska, Konrad Gonera, Ewa Mospinek, Katarzyna Pawlak and Zofia Cieślak-Pietrzak from Poland, have all been a part of the Games2Learn&Gamification2Engage project. We want to acknowledge their work in the project as well as thanking them for their contributions here.

Then, to Maia School Cluster (Portugal), to its Director - Rui Manuel Oliveira Duarte – and to the coordinator of this European project - Aline Santos - for the unrestricted support in the production of the book. Without them, this would not have been possible, and we want to express our gratitude.

We also want to thank the Portuguese National Agency for their assistance throughout the Games2Learn&Gamification2Engage project, and the European Commission for their sponsorship of the Erasmus Plus Programme 2017–2019.

As final words of this introduction, we would like to highlight the importance of the possibility of disseminating these reflections and experiences for the consolidation of pedagogical practices with Game-Based Learning & Gamification committed to quality education, in tune with contemporary challenges. We believe that this book, although intended primarily for teachers and researchers, may also please the general public interested in reflecting on the potential and pedagogical value of Games and Gamification in education. This book, for its themes and narratives of pedagogical experiences, can be an estimable source of inspiration for teachers to make innovative use of Games and Gamification in the educational process.

The editors:

Bento Duarte da Silva
José Alberto Lencastre
Marco Bento
António J. Osório

PREFACE

THE SOCIAL RELEVANCE OF GAME-BASED LEARNING

Nelson Zagalo
University of Aveiro (Portugal)

We live in a time of incessant search for innovation, in need of the comfort of applying the new instead of the old, because if the new one gives problems it is because it has not yet been sufficiently tested, while the old one has no cure. It moves us the progress, the feeling of moving forward in the work we do and we produce every day, the eagerness to do better, respond to challenges, respect those who believe in us, and always present approaches never before presented that go beyond, who are able to do more, never forgetting to do it with less. In this sense, digital games have emerged in the last decade as one of the greatest hopes of Education, starting to be used in all learning activities from compulsory education to professional training, or in simple learning of any activity or use of a system or tool.

Digital games allow the injection of the new, but above all allow the feeling of surprise that amazes and gives pleasure. This is partly due to the technological and digital components, but these are only the surface, in fact the surprise arises from the essence of the game, the agency capability put to work in the educative gamified activities. This capacity determined by the need for constant feedback cycles, stimulated by rewards and punishments, builds something very particular, immensely relevant to the learning process: engagement. In this sense, we can not say that games are mere education make-up, to offer some brightness and creative dazzle capable of sustaining all current adepts of innovation. There is something else here, which justifies the continued investment in them over the last decade.

However, having reached the essence of knowledge about the properties of the game, we must recognize that the game itself and gamification have always been present in the applied systems of teaching. Just look at the behavioral mode made of learning mechanics grounded in rewards and punishments, in merit and recognition. Which also explains the acceptance and the easy success of games in these recent years, since everything is only a recognition of the way social

reality works. Yet this recognition had an immensely positive effect, which was the recognition of the existence of the game within learning, and as such a greater focus on the activity itself, not only give us greater awareness but above all more effective control of the game properties, which we hitherto used for mere instinct. In this sense, the innovation of the use of games and gamification in teaching should not be seen by its external aspects, that we know to dazzle many, but how much more deep these models have allowed us to take knowledge of the learning processes and also improved them. Because in truth, talking about games is talking about learning, we cannot play without learning about what we are playing, such as not learning without playing, not responding to the demands and complexities, finding the concrete patterns to respond to the requested, which we must learn to master and exercise in different situations. Therefore, playing is learning, and vice versa.

In other words, bringing digital games to schools is nothing new, and this should not make us sad, but it should make us rejoice to understand that this late introduction is, after all, much more than mere fashion, or mere mode of capturing students' interest, or even a way of reaching the so-called hyperactivity of the 21st century. The game is the basis of the design of the engagement with the other, and it is in this engagement that the learning activity works best, because we learn better with the other than with mere artefacts. The game has always been a social activity, and will continue to be, even if we have immense technology, computers or smartphones, internet or social network, what counts in the game is the construction of relationship with the other, getting from the other what I alone I cannot have or get.

And so bringing the game to the centre of education has become not only up-to-date but fundamental because it is of the collaborative, cooperative and even competitive that the social matrix of learning needs, because it is from the social interaction that the best learning emerges. We live in a world continually moving towards individualism, but the more we progress along this path, the more conscious we are of the collective need, without which, as mere individuals we are irrelevant. In this sense, the game became the most relevant method of learning, not only for the so-called direct learning properties, but for the way in which it simultaneously produces context and social matrixes, which turns out to be the major determinant of learning.

Chapter 1

STATE OF THE ART OF EACH PARTNER COUNTRY ON EXPERIENCES IN GAME-BASED LEARNING AND GAMIFICATION

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Introduction

Digital games are becoming increasingly popular among young people, and the games market has an estimated growth of 16.38% by 2020 (Anon, 2015). The popularity of digital games can still be illustrated by the growing number of companies, conferences and publications devoted to the theme (Breuer & Bente, 2010). At the same time, the continuous evolution of information and communication technologies (ICT) is leading to incread sophistication and potential of these games and to the development of games for mobile devices. For instance, advances in computer graphics hardware have contributed to an increase of graphical quality of digital games, allowing its growing realism (Anderson, McLoughlin, Liarokapis, Peters, Petridis, & De Freitas, 2010). Educational games for mobile devices are also becoming popular and their sales have surpassed non-mobile games (SGA, 2012). Mobile devices "seem to give their users a very strong sense of control and ownership which has been highlighted in research on motivation as a key motivational factor" (Jones, Issroff, Scanlon, Clough, & Mcandrew, 2006, p. 252). The idea of control has often been discussed in the context of the use of technology in learning. Ideally students should perceive themselves as being in control of their learning process. Thus, the importance of freedom to define the tasks in which the students want to be involved is supported by the emphasis on control and motivation for learning. There is also an increasing recognition on the need to integrate all students (with and without special educational needs) into regular education, as well as the importance of

doing it properly (Osório, 2011). According to Hersh and Leporini (2018, p. 587) all this context "gives a need for the development of learning approaches based on the media actually used by learners, which very definitely include games, while not excluding learners who prefer more traditional approaches". The use of digital games as learning tools is known as Game-Based Learning (GBL). A concept related to GBL is gamification. Gamification applies elements associated with video games (game mechanics and game dynamics) in non-game applications (Simões et al., 2013, p. 2) to engage the student in the learning process.

This article, written under the scope of the Erasmus+ project «Games2Learn & Gamification2Engage», sought to identify the teachers' perceptions from the three countries (Portugal, Italy and Poland) involved in the project on GBL and Gamification. The goals were to find out what these teachers know about GBL and Gamification, and its use as pedagogical innovation scenarios. To achieve these goals, a survey was distributed to 15 teachers participating in the training organised under the project.

Game-Based Learning & Gamification

Informal evidence supports an argument that using mobile devices for informal learning can be motivating (Jones, et al., 2006). The same motivation argument is noted in some empirical studies on digital games (De Freitas & Oliver, 2006; Linehan, Kirman, Lawson, & Chan, 2011). However, there are also indicators that digital games bring more than just motivation and can be very powerful learning tools (Girard, Ecalle, & Magnan, 2013; Chang, Wu, Weng e Sung, 2012; Virvou, Katsionis, & Manos, 2005). James Paul Gee (2003) has long highlighted the potential of video games in learning processes, taking advantages of the fact that students are spending more time playing videogames than reading. Furthermore, ICT is an integral part of their lives (Deshpande & Huang, 2011).

Papert (2008), quoted by Bento & Lencastre (2014, p. 454), considers that digital games, when adequately planned, can serve as mobilising elements in the teaching and learning processes, as they enable: (i) to absorb the student intensely; (ii) emotional involvement; (iii) an atmosphere of spontaneity and creativity; (iv) a clear

notion of time and space limits; (v) the possibility of repetition and recovery from an error; (vi) the existence of clear and objective rules; (vii) imagination, self-expression and autonomy; and (viii) cooperative work and group work. The 21st Century literacy skills involved in GBL allow ICT to become increasingly social and user-centric, with Internet users no longer sole consumers of information but also producers of information (Simões, Redondo, & Vilas, 2013).

Most existing digital games have strong visual elements (Annetta & Bronack, 2008), making them suitable for almost all types of students. Many digital games require quick responses that represent a focus for many students, making the game more interesting and exciting. The best digital games allow users to accomplish the task(s) or achieve the learning goals, with effectiveness and satisfaction.

According to Bunchball (2010), and as shown in Table 1, in game mechanics, we consider the mechanisms used to "gamify" an activity defined with the intention of evoking certain emotions in the student/player. In turn, the game dynamics are the motivations that lead the player to these emotions.

Table 1 - Game elements (adapted from Bunchball, 2010)

Game mechanics	**Game dynamics**
Points	Reward
Levels	Status
Challenges	Achievement
Virtual goods and spaces	Self-expression
Leaderboards	Competition
Gifts and charity	Altruism

Gamification may involve the teacher gamifying an activity or teaching a concept by including mechanics, such as missions, milestones, points, levels, and feedback (Lencastre, Bento, & Magalhães, 2016), increasing student engagement without linking to any particular game. Thus, students learn, not by playing specific games but they learn as if they were playing a game (Simões et al., 2013).

Education is an area with high potential for applying gamification, as it seeks to promote student motivation and involvement. Students are, therefore, learning content as if they were playing a game, making the educational experience both challenging and fun (Vassileva, 2008). So, gamification offers the opportunity to combine content, teaching, digital literacy and 21st Century learning skills in a surrounding learning environment (Kingley & Grabner-Hagen, 2015). Intuitively, gamification has a great potential to motivate students and make school more attractive (Lee & Hammer, 2011). The teacher will be able to provide specific content with a process of gamification adapted to a learning context and the students' profiles. According to Simões, et al. (2013), gamification will help teachers to: (i) Create challenges tailored to the student's level of knowledge, increasing the difficulty of these challenges as the student acquires new skills; (ii) Set up multiple ways to successfully achieve an objective, allowing students to overcome intermediate goals; (iii) Set goals with simple objectives, providing feed-back or an immediate reward that allows progress to a new task, usually with a higher degree of difficulty; (iv) Choose the proper game mechanics to be applied in specific activities, projects or learning processes; (v) Consider the failure as part of the learning process: a task can be completed successfully after several failed attempts without penalizing the student; (vi) Enable students to assume different identities and different roles allowing them to explore other aspects of their personality in a controlled environment; (vii) Enable recognition of the student's progress by peers, teachers and parents promoting student's social status; (viii) Use competition to promote valuable behaviours.

However, using digital games for learning is not an easy task, as they have to be successful both as enjoyable and exciting games and in supporting learning. The main approaches seem to be: (1) starting with educational content and adding game elements; (2) starting with a game and adding educational content; and (3) trying to include an effective balance between design for engagement and motivation and design for learning from the start (Moreno-Ger, Burgos, Martínez-Ortiz, Sierra, e Fernández-Manjón, 2008).

And for the success of the exploitation of games potential, it is relevant to consider

the teachers' training needs, since many still face considerable strains, and it is indispensable to ensure more personal and professional investment in this area. However, there are issues of the extent to which nowadays students are adequately educated and the availability of resources to do this.

This brief overview presents GBL and gamification as valuable resources for innovating pedagogies which may foster the quality of learning. Therefore, it is imperative that games for learning are used considering the students' expectations to gain added value. Doing so will contribute to improving the learning and educational opportunities. Not doing so will widen the digital divide between school and the outside world.

Method

We used the survey research method to gather data directly from the 15 teachers involved. The survey is used when the researcher intends to describe, compare, and explain the individuals' knowledge about a given subject (Fox, 1981). The survey was self-administered to teachers from the three schools participating in the project, from the three partner countries. With this survey we intended:

- To understand teacher's knowledge regarding GBL and gamification;
- To understand the use of these scenarios of pedagogical innovation in their learning contexts;
- To identify teacher's positioning in relation to the pedagogical use of GBL and gamification.

The survey was divided into six sections and consisted of 21 closed-ended questions and two open-ended questions, taking approximately eight minutes to complete.

Validation of the data collection tool

The survey was validated based on the premise that the data collection is a process that serves the purpose of the study (De Ketele & Roegiers, 1993). Then, the survey was designed and prepared for a pilot study, which resulted in a detailed analysis until the construction of the final version.

Firstly, the survey was reviewed by an expert with the following profile: 53 years old, Male, PhD in Education, lecturer of Educational Technology in a public university, 27 years of experience. The expert reflected on all the questions, and the questions 5, 6, 7, 9, 16, 17, and 18 were modified.

The usability pilot-test was applied to a user, similar to the target audience, with the following profile: 48 years old, female teacher with 25 years of teaching experience. The user answered the survey under the same conditions as the target audience. The survey took about six minutes to complete. After the respondent completed the survey, the following questions were asked (in this order):

1. How long did it take to complete the questionnaire?
2. Were the instructions clear?
3. Did you find any ambiguous question? If so, what and why?
4. Does the list of closed questions cover all the options?
5. Does any question influence the answer?
6. Did you deny to answer any questions?
7. In your opinion, was an important topic omitted?
8. Did you consider the format of the questionnaire clear/attractive?
9. Would you like to add any comments?

In the end, some small changes were made, as questions 10, 11, 12, 15 were amended in their final wording mainly to brighten up English. The final version of the survey can be viewed in this link:

https://docs.google.com/forms/d/1Vb4Ebc5ON4EECn-GR3hsMj21nwwSsX-ZM3QK4TZMKWPw

Participants

The 15 participants are all Primary School teachers. Regarding the age group of the students they teach, the majority teach students aged between 8 and 9 (9 teachers, corresponding to 60%). There are then six teachers (40%) who work with students aged 10 and 11. It is also verified that three teachers (20%) work with students aged 6-7 and another three teachers (20%) who work with students over 11 years old. Finally, it is verified that no teachers are working with students under six years of age (Figure 1). These numbers point to a total of 21 responses, higher than the number of participants (15), which translates into something common in these levels of schooling, in which a teacher ensures all fields of the different curricular areas, working with more than one year of education.

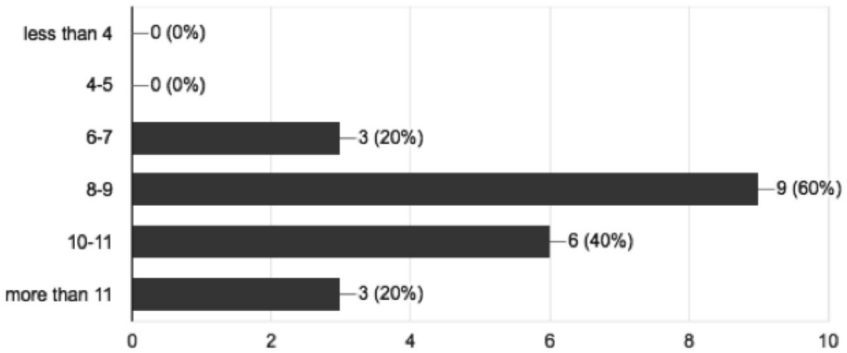

Figure 1: What is the age range of the children you teach?

Results

Game-Based Learning

When asked ***Do you know what game-based learning is****?* 14 teachers responded affirmatively, representing 93.3% of respondents, and 1 responded negatively (6.7% of respondents). (Figure 2).

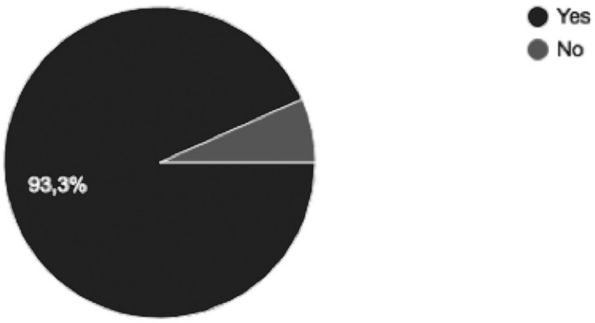

Figure 2: Do you know what game-based learning is?

(n= 15)

Also, in question 4. ***Do you know what gamification is?*** 13 teachers answered affirmatively (86,7%) and two said NO (13,3%). (Figure 3).

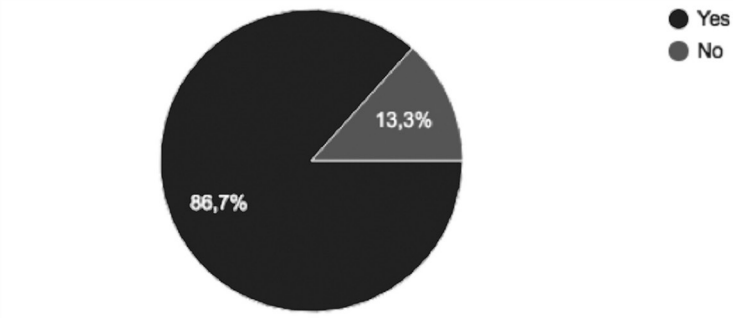

Figure 3: Do you know what gamification is?

(n= 15)

It turns out that most teachers report that they know what GBL is and gamification. It was verified that one teacher knows what GBL is, but could not define gamification, not establishing a relationship between the two concepts. The last question of the survey approaches the relation between GBL and gamification, reason why we will occupy more ahead on this subject.

The frequency of gaming in leisure time

Regarding the frequency in which teachers play (using video games or mobile phones) during their leisure time, 46.6% (7 teachers) state that they do it frequently or occasionally, while 33.3% (5 teachers) say that they do it rarely and 20% (3 teachers) never do it (Figure 4). It can be seen that 80% of the teachers have playing habits, whether video games or on the mobile phone, although with different frequency.

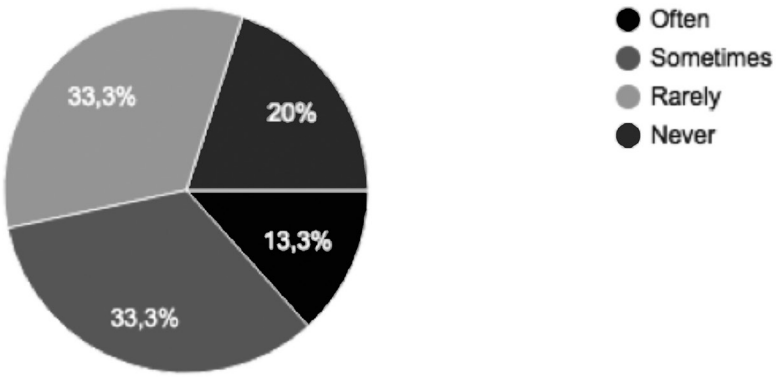

Figure 4: How often do you play video/mobile phone games in your leisure time (n= 15)

Using games in the learning process

Regarding the use of games in the learning process, 40% of respondents (6 teachers) considered that they should be incorporated "most of the time" and 60% (9 teachers) "sometimes". No teacher answered negatively. (Figure 5). It is verified, therefore, that all teachers have a favourable opinion to gaming integration in learning.

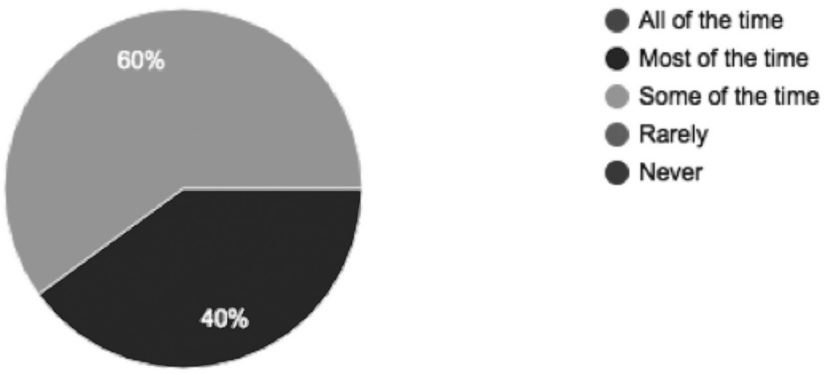

Figure 5: How often do you think games should be incorporated in the learning process?

(n= 15)

On the regularity of the use of games in their teaching and learning processes, most teachers (60%, corresponding to nine teachers) choose to say "sometimes", but there are 20% (three teachers) who answered "most of the time", and another 20% (three teachers) with less frequency ("rarely"). (Figure 6).

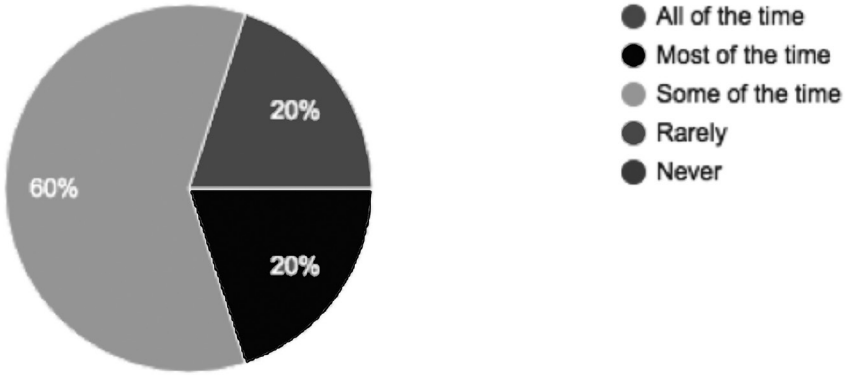

Figure 6: How often do you incorporate games into your teaching?

(n= 15)

When asked if they have already integrated games in the learning process that were specially designed for educational use, all teachers (15) answered affirmatively (Figure 7). According to the responses in figure 7, a teacher (6.7%) also used commercial video games (such as Minecraft), and 13.3% of teachers (two) went beyond games because they used software for children to build their own games.

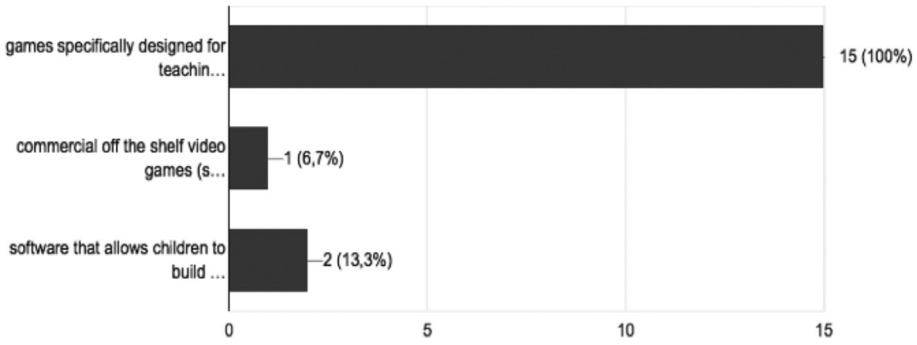

Figure 7: Have you ever integrated games into the learning process through the use of...(check all that apply)

Relevant aspects to learning

This section addresses some relevant aspects of GBL concerning student learning, involvement and assessment.

Regarding the aspects of GBL that are most effective for learning, according to the results obtained in the survey were (Figure 8):

- Games specifically designed for learning (66,7% = 10 teachers);
- Having the students create and play their own games (20% = 3 teachers);
- They would each have a similar impact (13,3% = 2 teachers)

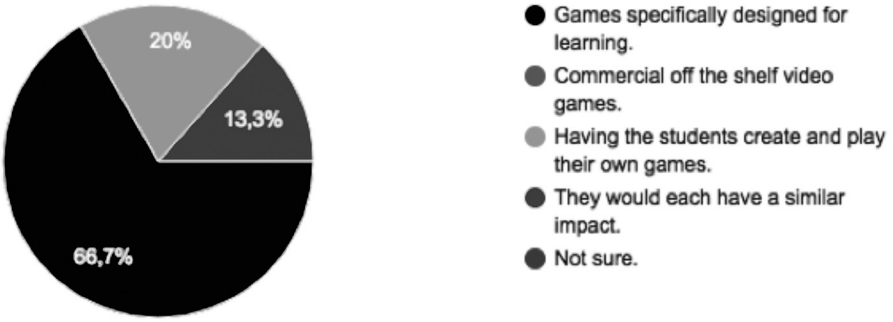

Figure 8: In your opinion, which of these three aspects of game-based learning would be most effective in terms of learning?

(n= 15)

Regarding student involvement, the answers are almost identical to the previous question, but three teachers are not sure about this issue. Teachers highlighted the following aspects (Figure 9):

- Games specifically designed for learning (40% = 6 teachers);
- Having the students create and play their own games (33,3% = 5 teachers);
- They would each have a similar impact (13,3% = 2 teachers)
  No sure (13,3% = 2 teachers)

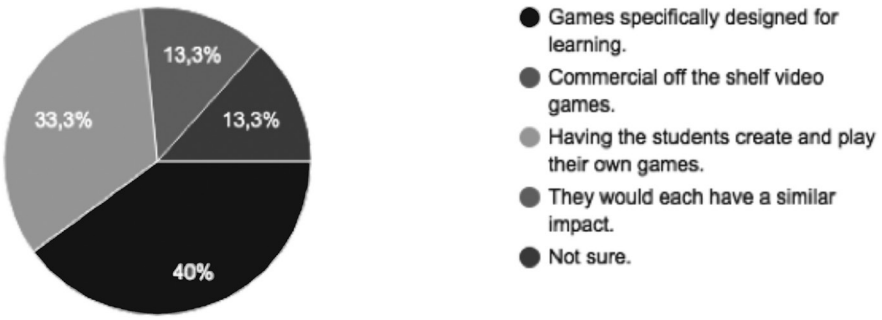

Figure 9: In your opinion, which of these three aspects of game-based learning would be most effective in terms of engagement?

(n= 15)

Regarding student evaluation, the answers were as follows (Figure 10):

- Games specifically designed for learning (53,3% = 8 teachers); No sure (20% = 3 teachers)
- Having the students create and play their own games (13,3% = 2 teachers);
- They would each have a similar impact (6,7% = 1 teachers); Commercial off the shelf video games ((6,7 = 1 teachers).

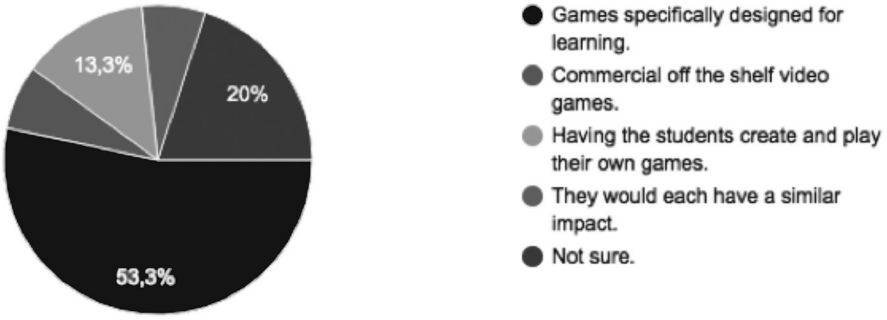

Figure 10: In your opinion, which of these three aspects of game-based learning would be most effective in terms of assessment?

(n= 15)

In all three dimensions - student learning, student involvement, and student assessment - there is a definite option for the use of games designed for educational and learning purposes since these are the ones that best support learning, involvement and assessment. It is also worth mentioning the use of software for students to create their games. Concerning evaluation, there is uncertainty, or lack of knowledge, about how games can contribute to this educational dimension.

Assessing the effectiveness of gaming-based learning

The survey proceeded with a request to rate the effectiveness of GBL in the following statements: encouraging pupils to take a responsible attitude to their own work and study (Q12); helping teachers to be aware of pupils' capabilities (Q13); helping teachers to be aware of pupils' prior knowledge (Q14); guiding

pupils to reflect on the progress they have made (Q15); guiding pupils to reflect on their emerging needs (Q16); supporting pupils' education at different stages of development (Q17); engaging and motivating pupils (Q18); being used to make accurate assessment (Q19); being used to make a productive use of assessment (Q20).

The evaluation was done to measuring attitudes on a Likert Rating Scale of five points, considering that 1 represents low effectiveness and 5 great effectiveness (or very effective).

The results to these nine questions are in table 2 (and Figure 11), with teachers answers by question, and by level. Figure 12 presents the average evaluation in each question.

Data analysis allows us to attest:

- All teachers in each of the nine questions assess with level 3 or higher. Therefore, levels of 1 or 2 were never considered;
- The best scores, with nine teachers choosing level 5 (maximum), and with a mean of 4.6 (in 5 points), are related to the students' involvement and motivation. (Q18 - engaging and motivating pupils) and its use to make an accurate assessment (Q19- being used to make accurate assessment).
- There are four statements with levels equal or higher than 4 (=>4), so, with a tendency towards great effectiveness. They are:
    - Q17 - supporting pupils' education at different stages of development (average = 4,3);
    - Q14 - helping teachers to be aware of pupils' prior knowledge (average = 4,1);
    - Q15 - guiding pupils to reflect on the progress they have made (average = 4,1);
    - Q12 - encouraging pupils to take a responsible attitude to their own work and study (average = 4,1).

In summary, the teachers' evaluation of the effectiveness of the games for the students' learning reveals very positive visions. Several benefits are identified for

different aspects of teaching and learning processes. Some contributions include the students' involvement and motivation by encouraging them to study, supporting learning, and helping teachers to balance students' prior knowledge and practice a more accurate assessment.

Table 2: Teachers' responses assessing the effectiveness of GBL

Questions	Level 1	Level 2	Level 3	Level 4	Level 5	Average
Q12 – encouraging pupils to take a responsible attitude to their own work and study	0	0	5 (33,3%)	5 (33,3%)	5 (33,3%)	4,0
Q13- helping teachers to be aware of pupils' capabilities	0	0	4 (26,7%)	9 (60%)	2 (13,3%)	3,9
Q14- helping teachers to be aware of pupils' prior knowledge	0	0	1 (6,7%)	11 (73,3%)	3 (20%)	4,1
Q15- guiding pupils to reflect on the progress they have made	0	0	4 (26,7%)	6 (40%)	5 (33,3%)	4,1
Q16- guiding pupils to reflect on their emerging needs	0	0	5 (33,3%)	8 (53,3%)	2 (13,3%)	3,8
Q17- supporting pupils' education at different stages of development	0	0	1 (6,7%)	9 (60%)	5 (33,3%)	4,3
Q18 - engaging and motivating pupils	0	0	0	6 (40%)	9 (60%)	4,6
Q19- being used to make accurate assessment	0	0	0	6 (40%)	9 (60%)	4,6
Q20-being used to make a productive use of assessment	0	0	6 (40%)	7 (46,7%)	2 (13,3%)	3,7

Note: 1 represents low effectiveness and 5 great effectiveness

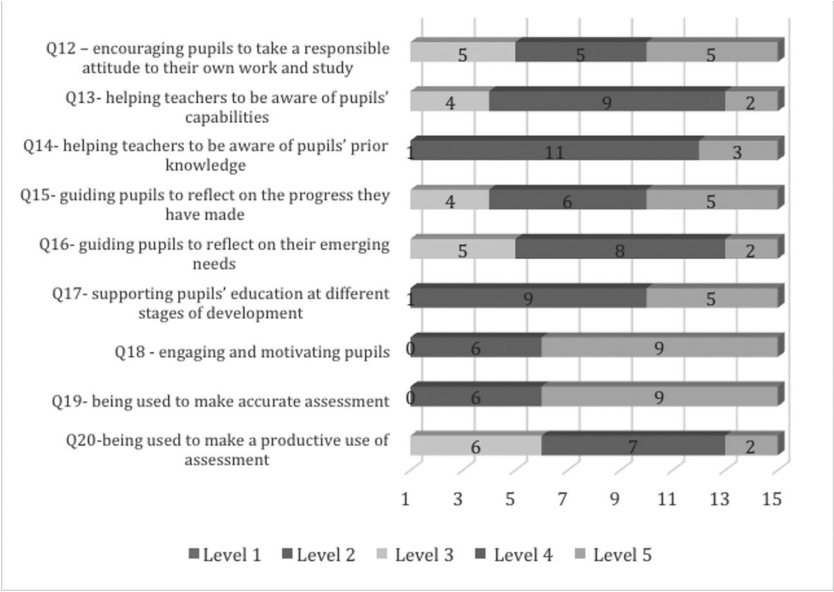

Figure 11: Teachers' responses assessing the effectiveness of GBL

Note: 1 represents low effectiveness and 5 great effectiveness

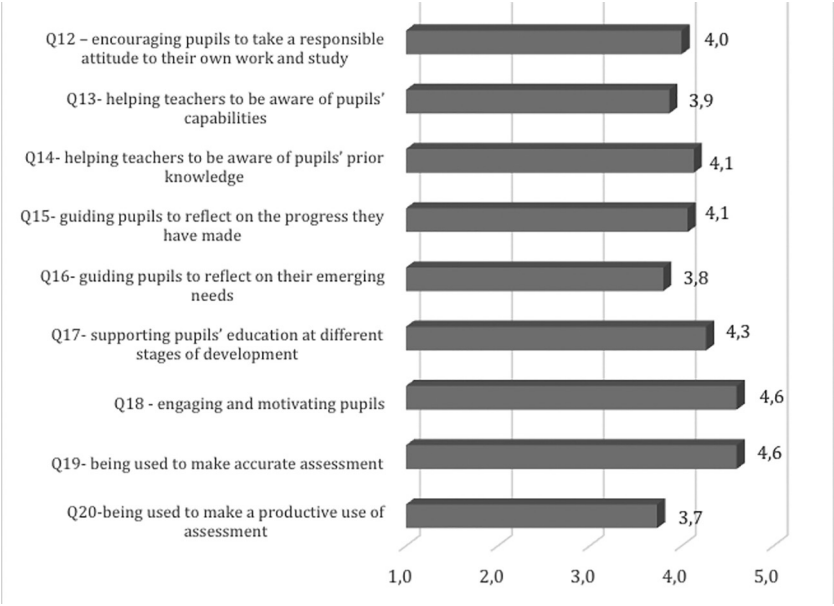

Figure 12: The average on the teachers' responses on the effectiveness of GBL

Note: 1 represents low effectiveness and 5 great effectiveness

Gaming-based learning and gamification

In section 5 of the survey, it was asked whether teachers attribute the same meaning to GBL and gamification. By the analysis of the answers (Figure 13), it is verified that ten teachers (66.7%) consider "No"; four teachers (26.7%) "Do not know" and one teacher (6.6%) considers "Yes".

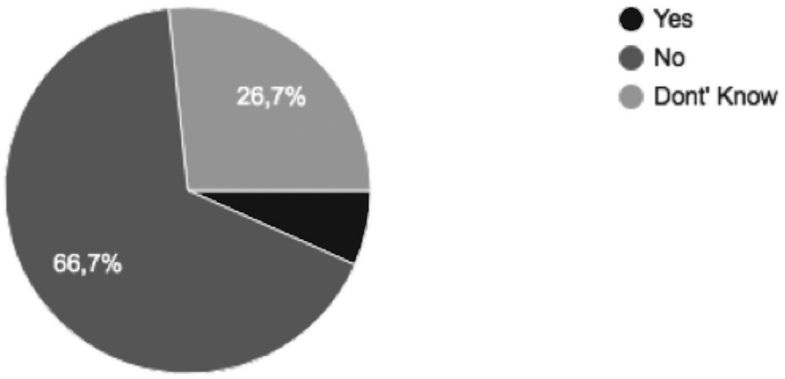

Figure 13: 21. Do you think that game-based learning and gamification have the same meaning?

(n= 15)

It can be observed that teachers know that there are two methodologies, but a reasonable number of these teachers (26.7%) do not know if there are differences between these methodologies. To clarify this issue, teachers were asked to mention some differences or similarities about GBL and Gamification. The responses of the 15 teachers were very similar and focused on the following aspects:

Regarding the **differences**, we gathered nine responses. All of them saying that "*GBL is related to the use of games in teaching while Gamification has to do with the principles of gaming, i.e., rules, instant feedback and points*" to "*engage*" to "*achieve a goal*". One teacher underlined that GBL "*is a type of gameplay that has defined learning outcomes; it immerses the learner in a training experience that feels like a game, and teaches real-life skills in a risk-free setting*".

Concerning similarities, two teachers say that both GBL and gamification use "*the rules of a typical game in the educational process*" and they involve "*the use of modern technologies, student's cooperation and non-traditional teaching*".

In addition, an open-ended question asked the teachers to express their views on GBL and Gamification freely.

We only got three answers, and in them teachers say that they expect "*to learn in this project how to use gamification in the classroom*", considering it an "*innovative methodology*", "*very engaging for pupils*" and an "*added value for the success of learning*".

Final remarks

This paper addresses the views of a small group of 15 teachers on Game-Based Learning and Gamification. The group was composed by Primary School teachers equally divided by the countries (Portugal, Italy and Poland) that are partners in the Erasmus+ project «Games2Learn & Gamification2Engage», a project on GBL and Gamification aiming to enrich school practices by introducing innovative pedagogical scenarios based on digital games. Although small, the group is still relevant because it includes all teachers involved in the project's training sessions.

It was shown that most of the teachers have habits of using games in the leisure time, since only three teachers (20%) never used it. All teachers considered that games should be part of the teaching and learning processes, with 40% (6 teachers) saying that this integration should occur quite frequently. Most teachers considered that the use of games has many benefits for learning, either through the involvement and motivation of students in school activities or to help teachers to know students' prior knowledge about a subject.

Most teachers could distinguish methodologies of game use, that is, the difference between Game-Based Learning and Gamification. However, it was found that there is a considerable number of teachers who could not make any differentiation or specification of each of the methodologies. Thus, it was assumed crucial that during the project this should be an aspect to be clarified by the training team.

Acknowledgements

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References

Anderson, E. F., McLoughlin, L., Liarokapis, F., Peters, C., Petridis, P., & De Freitas, S. (2010). Developing serious games for cultural heritage: A state-of-the-art review. Virtual Reality, 14, 255–275.

Annetta, L. A., & Bronack, S. (2008). Serious educational games: From theory to practice. Amsterdam: Sense Publishers.

Anon. (2015). Serious Game Market by Vertical (Education, Corporate, Healthcare, Retail, Media and Advertising), Application (Training, Sales, Human Resource, Marketing), Platform, End-User (Enterprise, Consumer), and Region - Forecast to 2020. https://www.marketsandmarkets.com/Market-Reports/serious-game-market-67640395.html

Bento, M., & Lencastre, J. A. (2014). Computador vs. Tablet: estudo comparativo de um jogo multimédia. In 2.º Encontro sobre Jogos e Mobile Learning (pp. 452–465). Braga: Universidade do Minho. CIEd.

Breuer, J. S., & Bente, G. (2010). Why so serious? On the relation of serious games and learning. Eludamos. Journal for Computer Game Culture, 4, 7–24.

Bunchball, Inc. (2010). Gamification 101: An introduction to the use of game dynamics to influence behavior.http://jndglobal.com/wpcontent/uploads/2011/05/gamification1011.pdf

Chang, K.-E., Wu, L.-J., Weng, S.-E., & Sung, Y.-T. (2012). Embedding game- based problem- solving phase into problemposing system for mathematics learning. Computers & Education, 58 (2), 775 – 786 . doi: 10.1016/j.compedu.2011.10.002

De Freitas, S., & Oliver, M. (2006). How can exploratory learning with games and simulations within the curriculum be most effectively evaluated? Computers and Education Special Issue on Gaming, 46(2006), 249–264.

De Ketele, J-M., & Roegiers, X. (1993). Metodologia de recolha de dados. Lisboa: Instituto Piaget.

Deshpande, A. A., & Huang, S. H. (2011). Simulation games in engineering education: A state of the art review. Computer Applications in Engineering Education, 19, 399–410.

Fox, D. (1981[1969]). El processo de investigación em educación. Pamplona: Ediciones UNiversitad de Navarra.

Gee, J. P. (2003). What video games have to teach US about learning and literacy. Palgrave Macmillan.

Girard, C., Ecalle, J., & 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, 207–219.

Hersh, M., & Leporini, B. (2018). Editorial. British Journal of Educational Technology, Vol 49 N.º 4, 587-595 doi:10.1111/bjet.12650

Jones, A., Issroff, K., Scanlon, E., Clough, G., & Mcandrew, P. (2006). Using mobile devices for learning in informal settings: is it motivating? IADIS International Conference Mobile Learning 2006, (pp. 251-255). Dublin: IADIS Press.

Kingsley, T., & Grabner-Hagen, M. (2015). Gamification: questing to integrate content knowledge, literacy, and 21st-century learning, Journal of Adolescent & Adult Literacy, 59(1), 51–61.

Lee, J., & Hammer, J. (2011). Gamification in education: What, how, why bother? Academic Exchange Quarterly, 15(2), 1-5.

Lencastre, J. A., Bento, M., & Magalhães, C. (2016). MOBILE LEARNING: potencial de inovação pedagógica. In Tânia Maria Hetkowski & Maria Altina Ramos (orgs.), Tecnologias e processos inovadores na educação (pp. 159-176). Curitiba: Editora CRV.

Linehan, C., Kirman, B., Lawson, S., & Chan, G. (2011). Pratical, appropriate, empirically-validated guidelines for designing educational games. In Proceedings of CHI ‘11.

Moreno-Ger, P., Burgos, D., Martınez-Ortiz, I., Sierra, J. L., & Fernández-Manjon, B. (2008). Educational game design for online education. Computers in Human Behaviour, 24, 2530–2540.

Osório, A. J. (2011). Tecnologias de informação e comunicação e educação inclusiva de todas as crianças. Cadernos SAUCASEF, n.º 6 (11), 19-31. http://repositorium.sdum.uminho.pt/handle/1822/18081

SGA (2012). Serious games now $2 to $10 billion industry. http://www.hypergridbusiness.com/2012/08/serious-games-now-a-multi-billion-dollar-industry/

Simões, J., Redondo, R.D., & Vilas, A.F. (2013). A social gamification framework for a K–6 learning platform. Computers in Human Behavior, 29 (2), 345 – 353.

Vassileva, J. (2008). Toward social learning environments. IEEE Transactions on Learning Technologies, 1(4), 199–213.

Virvou, M., Katsionis, G., & Manos, K. (2005). Combining software games with education: Evaluation of its educational effectiveness. Journal of Educational Technology & Society, 8 (2), 54 – 65.

Chapter 2

TEACHERS' PERCEPTIONS OF TRAINING RECEIVED ON GAME-BASED LEARNING AND GAMIFICATION: DATA FROM AN ERASMUS+ PROJECT

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Introduction

In the 21st century, teachers are often confronted with comments about how their pedagogical practice has remained unchanged over the decades. When asked, some teachers refer to constraints that require them to keep lectures essentially expositive, or in a model that values exposure, comprehension, and application of learning more formally. As Andreas Schleicher (Director of the OECD Department of Education and Skills, Responsible for the PISA tests, 2016) said: "A generation ago, teachers expected that what they taught students would be valid throughout life. Today, schools have to prepare students to a faster socio-economic change than it ever was, for jobs that have not even been created, to use technologies that still do not exist and solve problems that we do not yet know will arise. The successful education no longer resides mainly in the reproduction of contents, but in the extrapolation of what we know and in its creative application to new situations. The world no longer rewards people just for what they know – Google knows everything - but for what they can do with it. That is why education has more and more to do with the development of creativity, critical thinking, problem-solving and decision-making".

To prepare all the students for what is to come, we need them to focus on the school, and the school must be up to the requirements of the world of work and

the society that is expecting them. We want innovative pedagogical scenarios that allow students to use their learning tools, where they experience practical situations and utilize their strategies while building their knowledge and acquire experience, motivation, producing a self-reflection that is fundamental to the process of learning. Most of the times, students of disadvantaged cultural, economic, and family backgrounds tend to reveal more academic difficulties, and those are accentuated over the years. We believe that the innovative pedagogical scenario that underlies the Game-Based Learning and Gamification is what it takes to face the new challenges and also involve these students to answer their needs.

Games2Learn&Gamification2Engage is an Erasmus+ Cooperation for Innovation and the Exchange of Good Practices´ project. It has the participation of schools from three countries (Portugal, Italy, and Poland) directly touching three hundred students and fifteen teachers. In the project, teachers are expected to use innovative pedagogical scenarios based on games and gamification, and also mobile devices in the classroom. At a time when it is increasingly challenging to engage students in learning, it is urgent to innovate pedagogically in scenarios that allow students to use their learning tools, experience virtual situations, and use different strategies to develop knowledge — also gaining experience, motivation, producing a fundamental self-reflection about the learning process.

The design, development, and implementation of the training course for teachers involved in the project were of the responsibility of a team from the University of Minho but done collaboratively among the partnership. This university team also developed a continuous online monitoring process for the teachers involved.

Game-Based Learning & Gamification

It is widely recognized that the game-based approach makes the learning process more relaxed, more student-centred, stimulating, and educationally productive (Papastergiou 2009; Rosas et al., 2003; Prensky 2001). Several researches have investigated the reasons that make games such a great learning environment. Papastergiou (2009) argues that games are successful since they support multisensory, active, experimental, problem-based learning. Burgersa et al. (2015) explain that games promote the use of prior knowledge because players must

use previously learned information - and learn new facts - to improve their in-game performance and provide immediate feedback that allows players to test different hypotheses and learn from it. According to DiCerbo (2017), games are excellent self-assessment tools, with scoring mechanisms and conquest of different levels. In addition to acquiring knowledge, the game promotes logical-mathematical and critical thinking and the development of personal and social skills, language skills, communication and collaboration skills, creativity, and problem-solving skills (McFarlane et al. 2002). Also, Oblinger (2004) states that the games support pedagogical principles, such as:

- Active learning: the game engages the student in dynamic discovery.
- Assessment: the student can assess the acquired knowledge or skill with the other students.
- Feedback: immediate feedback is provided during the game on the student's progress.
- Motivation: the students are involved in pursuing a goal.
- Scaffolding: students are gradually challenged among the game levels.
- Social: games are often social environments - the game is often multi-player.
- Transfer: the game fosters the ability to transfer learning from the game context to a real setting.

In recent years, interest is growing in gamification, defined as the use of game mechanics and dynamics in non-gaming contexts to increase students' engagement and stimulate their active participation in the learning activities (Simões, Redondo & Vilas, 2013). Gamification has been widely used in e-commerce to drive online engagement (Epps, 2009) because it allows (i) involvement (gameplay requires participation), (ii) interaction (gameplay ensures interactivity), (iii) intimacy (gameplay stimulates familiarity with the game), (iv) influence (the game allows the spread of the brand). These purposes are also a goal in education to engage students in the learning process. However, to implement gamification in school, it is necessary to study the mechanics and dynamics of the game and

how they can support the learning process. According to Simões et al. (2012), the core elements of the game that can be used in the context of learning are:

- Competition: comparing students' performances is a motivational element that can be achieved by allowing the class to see results and winners.
- Levels: collecting points will allow access to higher levels, defining the degree of skills gained.
- Ranks: the measurement of all students' progress can be used to encourage other students to do better, driven by the desire to improve their position.
- Results: the use of points and levels to keep track progress is useful to maintain interest and encourage a more significant commitment to higher goals.
- Reward: the reward for the results obtained can be used to value the student for having accomplished the goal or to motivate her/him to reach new and more ambitious goals.
- Scores: scores can be used as rewards for students' progress and for achieving the learning objectives.
- Social: gamification initiatives must be able to promote a sense of community.

All of these elements can contribute to improving students' involvement in learning activities and their motivation to learn.

The Training Course

The training course was designed (Intellectual Output 2) by the University of Minho team based on data obtained in the initial project survey (Intellectual Output 1). It consisted of a training plan designed to provide the teachers with pedagogical skills to use mobile devices in flipped learning approaches with game-based learning and gamification. The staff training events were distributed into four face-to-face weeks and online activity at a distance between these sessions. The training weeks lasted 5 days and included 15 hours of training:

in Portugal (Braga, University of Minho) from the 26th of February to the 2nd of March 2018; in Poland (Łódź, Szkola Podstawowa Nr 41 im.) from the 7th to the 11th of May 2018; in Italy (Sestu, Istituto Comprensivo di Sestu) from the 22nd to the 26th of October 2018; in Portugal (Maia, Agrupamento de Escolas da Maia) from the 6th to the 10th of May 2019.

At first, the training focused on the introduction of the flipped learning model: definition, characteristics, and potentialities. It has also been approached, with practical examples, its applicability in educational settings. Teachers have worked on mobile applications, such as quizzes, collaborative writing, augmented reality, video, storytelling, web tools, and interactive platforms. The tools served the purpose of exploring creativity, critical thinking, autonomy, vocabulary, research, and collaboration. For each topic covered in each training session, teachers developed a peer collaboration process, some pedagogical resources, and lesson plans. Between face-to-face sessions, each teacher individually applied the lesson plan with their students. In the face-to-face meetings, the first moment comprised of a collective reflection between colleagues, writing down the experiences shared. Slowly, some teachers have shifted from punctual innovative experiences and developed narratives in which they used the curriculum flexible.

Method

To data were collect through a survey (Thayer-Hart et al., 2010). The survey is a process in which the objective is to collect information through answers to a set of questions on a specific topic (Solomon, 2001). With this survey, we searched:

- To know what activity teachers showed the most interest in.
- To know which activity teachers showed the least interest in.
- To estimate the gains teachers feel they have attained through training.
- To assess the overall training: strengths, weaknesses, pedagogical changes, resistance to change and personal performance throughout the training process.

For this purpose, one prepared a survey with four open-ended questions to gather the teachers' perceptions of training received on game-based learning and gamification.

Validation of the data collection tool

The validation of the questions was previously performed by a specialist in Education and by two teachers with characteristics similar to those of the target group, knowledgeable about the subject but not participants in the project. They were required to read the goals carefully and to indicate if the questions were ambiguous or unclear and, if they considered it appropriate, to suggest other items.

Participants

Regarding the participants, the questioning was applied to the fifteen teachers involved in the project, after the last week of training, to assess their perceptions about the developmental process.

Five teachers from Portugal, aged between 37 and 45 years old, all from the same school cluster. One teacher with a degree, two with specialization and two with a master's degree in education.

Five teachers from Poland, aged between 33 and 57, all teachers working in the same public school. Four with a master's degree and one with a bachelor's degree in education.

Five Italian teachers aged between 44 and 65, all from the same school cluster. Four of them with a master's degree and one with a degree in education.

Data analysis

For data analysis, a content analysis was performed (Bardin, 2012). The data analysis aimed to compile the info in a way that would allow getting answers on how the training moments influenced the teachers in their pedagogical practices.

Results And Discussion

The content analysis allowed one to create four dimensions: **(a) significant activity** (activity considered more significant for teachers); **(b) non-significant activity** (activity considered to be less significant for teachers); **(c) added value** (training gains); **(d) appraisal** (training evaluation). The dimension (d) appraisal was split into two subcategories: (d.1) training strengths and (d.2) training weaknesses.

The table presents the categories created, examples of evidence that support those categories, and frequency ("frequency" is the number of times an answer is repeated in a given question). For the creation and classification of coherent categories of analysis we used five fundamental rules (Bardin, 2012): 1) use of clear rules of inclusion and exclusion; 2) categories must be mutually exclusive; 3) categories cannot be extensive, and its content must be homogeneous; 4) categories must contemplate all possible contents; 5) the classification must be objective, i.e., it cannot be codified differently by different interpretation of the researcher.

Thus, in the first dimension, (a) ***significant activity***, the data were categorized as follows:

	***(a)* significant activity**	
Frequency	**Category**	**Evidence (example)**
10	Augmented and virtual reality	"The last activity about Apps (Apps connected with augmented reality)" "The activity about virtual reality." "The activity that I found most interesting for my practice was virtual reality."
2	Cooperative and collaborative activities	"The collaboration and cooperation activity in Sestu."
1	Job shadowing	"It was equally interesting to observe lessons taught by teachers taking part in the project."
1	Educational games	"knowing different educational games and new cultural realities"
1	Exchange of good practices	"Exchange of good practices"

Table 1 - dimension: (a) significant activity

We see here that 10 in 15 teachers preferred the activity with virtual and augmented reality, mentioning "Quiver", "Cromville" and "Augmented reality 3D" as the apps teachers enjoyed learning about, the most. It is one´s opinion that this activity was the most referred by teachers given the inherent potential of the applications themselves and the impact they have on students. Teachers understand that with virtual and augmented reality teaching methods are improved. In addition, they consider that this type of APP allows greater proximity of the content to reality. In this way, students can enjoy images that escape the two-dimensional pattern of objects, just like videos and textbooks. In addition, virtual reality facilitates the memorization and understanding of content, leads to greater involvement and creativity of students by its visual, dynamic and interactive impact, enriches activities with audiovisual content and aggregates digital content to the real world.

Two teachers mentioned the activities related to cooperative and collaborative learning. These answers highlight the importance that collaborative-cooperative activities play in teaching-learning contexts since they serve as important "facilitators" in promoting meaningful and effective learning and problem-solving skills among their participants. It is concluded, therefore, that both the cooperative model and the collaborative model are considered to constitute important approaches to the pedagogical work.

One teacher highlighted as meaningful the Job Shadowing activity (lesson´s observation) from project colleagues who would apply the innovative pedagogical scenarios of game-based learning and gamification, during staff training weeks. Some of the colleague, with their class of students, showed how they were changing his practices. Another teacher referred to the exchange of good practice as a preferred activity. From the answers of these two last teachers, we can infer that the transnationality issue has had a positive impact because, faced with different scenarios, realities, and different target audiences, teachers reinforced their knowledge while perceiving other ways of approaching the same methodologies, thus enriching their pedagogical experiences.

	***(b)* non-significant activity**	
Frequency	Activity	Evidence (example)
6	Job shadowing	"The job shadowing in general." "The activities that involved job shadowing"
5	apps	"Even though the main focus were not the apps I believe more of them should have been presented" "The Socrative app" "Mentimeter app"
3	The session with non-participants in Portuguese	"The activity I least enjoyed was the training event (in the school of Maia) conducted with other Portuguese teachers from the school cluster because the training was held in Portuguese."
1	language barriers	"The English language used in the project was a difficulty that did not allow me to learn satisfactorily."

Table 2 - dimension: (b) non-significant activity

By the analysis of the results to this question, 6 teachers pointed out the job shadowing sessions as the less meaningful activity, the opposite of what has been referred by a teacher as a strong point in the previous question. Given that most teachers were having the first contacts with innovative pedagogical scenarios (different strategies, methodologies, apps ...) and being at the beginning of this transformative process, they could have been so involved in the use of the applications / games that put the focus more in the ludic aspect, not exploring the pedagogical aspect, losing here the potential use that the applications could have in educational context.

Regarding the Apps subcategory, 3 teachers referred to the Socrative app as the least significant, 1 teacher referred the Mentimeter application and 1 other teacher reported that what he/she considered less significant in the training was the fact that there were few apps. The apps are the most visual and appealing part of the training so it is understandable that teachers focus on the usability and the number of apps that were worked although there were many others presented but not used.

3 teachers reported the training activity performed in Portuguese as less preferred. This activity happened on the first day of the last week of training in Portugal (6th of May 2019). It consisted of short-term training and involved the 15 teachers of the project and 10 teachers from Maia´s Cluster of Schools (various areas and teaching levels). This action was intended to share what was being done in the project within the teachers from the Cluster of Schools, by presenting some innovative pedagogical scenarios related to GBL and gamification already done in the partner schools. The action was mostly in Portuguese which was conceived as a language barrier for the non-native partner teachers.

1 teacher considered the English language as an obstacle. Recurrently, in the analysis of the answers, the language barriers were mentioned. Although the official language of the project is English, we can conclude that taking part in a training entirely in a language other than the native language is considered as an obstacle to full understanding, especially when technical and conceptual issues are addressed.

	***(c)* added value**	
Frequency	**Activity**	**Evidence (example)**
11	change of practices	"the changes in pedagogical practices" "Knowledge and skills that are used while working with the students. " "Knowledge and skills that I used while working with my students"
4	knowledge of new methodologies and practices	"learning about new practices" "I changed my methods during the lessons."

Table 3 - dimension:(c) added value

As gains resulted of the training, 11 teachers mentioned the changes in their teaching practice and 4 teachers mentioned the acquisition of knowledge regarding new teaching practices and methodologies. It is significant that 11

colleagues report that they began to change their practices introducing innovative pedagogical scenarios that they did not know or would not be prepared to apply in an educational context, before the training. It is also significant that 4 point out the knowledge of new methodologies and practices. We consider these to be the major benefits of this type of project: changes in the teachers´ practices (referred by 11 teachers) and knowledge of new methodologies and other practices (referred by 4 teachers) that will be the driving forces for changes in their pedagogical practice.

Professional development and the consequent changes in school daily life continue to be the main focus of this type of cooperation projects between strategic partnerships, for innovation and exchange of good practices, and in this dimension the full fulfilment of the general objective of the Erasmus + KA201 projects.

	***(d)* appraisal**	
Answers	***(d1)* training strengths**	***Evidence***
6	changes in pedagogical practices	"Changed my pedagogical practice." "thanks to the project, a change in my thinking and way of working. "
5	Professional growth	"The whole process was stimulant and promoter of personal and professional growth" "Before the project, I was afraid of using technology on my lessons"
2	Knowledge of new apps	"I learn new applications and I used them with my students"
2	Personal growth (human relations)	"The strong point was the atmosphere of trust and kindness prevailing throughout the training"

Table 4 - dimension:(d) appraisal (d1) training strengths

Regarding the general evaluation of the training, six teachers refer to the change in pedagogical practices as the biggest gain obtained in the whole training process and another five teachers refer to professional growth as a maximum exponent. It appears evident that teachers recognize that the main strengths of the project are the fact

that the training gave them the necessary knowledge and skills for them to be able to transform their pedagogical practices as a consequence of their professional development, here reinforcing the pedagogical dimension of the training.

The knowledge of new applications is highlighted by two teachers, valuing their use in an educational context, which one can also relate with the development of knowledge and skills but now in a more technical dimension.

Two teachers refer to the cooperation and the human relations established as the strongest point of the training. The fact of meeting new colleagues from other countries, new cultural realities, new schools, and new educational practices proves to be a significant element for these teachers. It is believed that the strengthening of bounds not only between different teams but within the same team that during a week are together, day and night, increases the knowledge about each other and the ability to cooperate/collaborate.

It is significant that the focus in the overall assessment of the entire training process is the change in the pedagogical practices and professional development rather than the focus on the use of the apps.

	(d) **appraisal**	
Answers	***(d2)*** training weaknesses	***Evidence***
4	Language barriers	"difficulties in understanding the language"
4	No answer	
3	Technical problems	"I had problems in using apps because of the internet or the device that didn't work very well"
3	Time dedicated to training	"The time spent on training was less than what I expected." "We should have learned to use more apps"
1	Resistance to change	Change-resistance

Table 5 - dimension: (d) appraisal (d2) training weaknesses

Four teachers presented as the most significant weaknesses of the training the "language barriers". In fact, any teacher who joins an international project whose official language is English should have a satisfactory level of it in order to be able to understand what is being worked on and to be able to communicate with colleagues/partners, but some teachers found it a considerable constraint. At least four teachers found understanding and communication difficult because they did not satisfactorily master the language, which, in one´s opinion, would have hampered their involvement and benefit of the project.

Three teachers refer to technical problems (related to the use of mobile devices) as weaknesses. It is believed that this reference concerns their teaching practices when applying what was learned in training, technical problems sometimes tricky to solve (related to BYOD) that did not always work as expected or found some constraints associated with the use of wifi), which will have harmed the implementation and the effectiveness of knowledge.

Three teachers refer to the little time devoted to training as a weakness. In each mobility week, teachers had 15 hours of training, 3 hours a day, usually during the morning. It is believed that these teachers would like to have more training time to learn new contents or to visit innovative educational contexts so they could learn more.

One teacher refers to the resistance to change as an obstacle. Thus, it is believed, that this teacher is aware of the inherent difficulties of the process, revealing perhaps the clear notion that it is not only a question of using new applications in a classroom context but instead changing methodologies and even mentalities regarding the implementation of new practices in an educational setting.

A significant fact is that four teachers did not answer the question, perhaps refusing to identify the weaknesses or assuming that the project was largely significant believing that weaknesses weren´t worth to be identified.

Final Remarks

The main objectives of the project, regarding teachers, were having: "acquired

knowledge, experience, skills and competencies (specifically technical language acquisition related to Game-Based Learning and Gamification innovative pedagogical scenarios, teaching skills in terms of digital literacy and creation of educational resources used for teaching like apps, games...); benefit from the shared practices, the reflections; improve the quality of lessons through the use of innovative pedagogical scenarios; to use effectively the English language for communication within the project and its activities; to develop professional and personally" (p. 27 of the application form).

It is believed that all those aims were somehow accomplished, as it is proven by the data presented: all the teachers consider that the main gain of the training was the change of their pedagogical practices and knowledge of new methodologies and practices. It was also valued as the training strengths the changes occurred in their educational practices, their professional growth, the understanding of new apps and the personal growth (human relations). The teachers also pointed out as the most significant moment of the training the learning about augmented and virtual reality, the training on cooperative and collaborative activities, the job shadowing, all the educational games learned and the exchange of good practices. It is considered that the job shadowing is a fundamental training activity, and when the observation of classes is done at a time when teachers are already more imbued and trained in the methodologies under study, the moment can be productive and meaningful.

Regarding the non-significant moments and weaknesses of the training, it is necessary to reflect on what was pointed out to improve future projects based on this model (training and practice) to allow all teachers involved to benefit the most of it. Therefore, it was mentioned as non-significant moment: the lack of experience during some job shadowings, the reduced number of apps introduced in the training and the language barriers due to the lack of proficiency in the official language of the project. The weaknesses presented were related to the same language barriers just pointed out, technical problems, the time dedicated to training and resistance to change. Regarding the language barriers, it is suggested that in future projects, the linguistic level of the teachers involved should be considered previously so that their participation can be more relevant and meaningful.

It is one´s point of view that projects of this nature, cooperation for innovation and exchange of good practices, between European educational institutions aim to bring innovation to our schools, in a world in constant change. This project brought innovative pedagogical scenarios related to GBL&Gamification, bringing within different teaching strategies and digital apps or resources. It provided to a group of teachers from 3 schools from different countries a set of knowledge, experience, skills and competencies that are expected to capacitate them to be able to produce changes in the dynamics of their schools. Furthermore, to provide more meaningful and relevant learning to their students according to the 21st-century skills and competencies for new millennium learners in OECD countries.

It is considered pertinent that these teachers, who currently possess the know-how of implementing the methodologies of game-based learning and gamification, having gone through the positive and negative points of the whole process, being able to produce relevant inputs, can share this knowledge with other colleagues who wish to apply these same methodologies. This knowledge sharing could take the form of accredited training actions, training in the framework of Erasmus + KA1 projects or even in a new KA201 project, where new partners enter the project and benefit from the training given by these teachers that were already trained and applied what they have learned in their educational context.

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References

Bardin, L. (1979) *Análise de conteúdo*. Lisboa: Edições 70.

Bunchball, I. (2010). Gamification 101: An Introduction to the Use of Game Dynamics to Influence Behavior. http://www.csh.rit.edu/~ajman/summer2012/gamification101.pdf.

Burgersa, C. Edena,A., van Engelenburga, M. D., & Buningh, S. (2015). How feedback boosts motivation and play in a brain-training game. *Computers in Human Behavior*, Volume 48,(7), 94-103.

DiCerbo, K. E. (2017). Building the Evidentiary Argument in Game-Based Assessment. *Journal of Applied Testing Technology*, Vol 18(S1), 7-18.

Epps, S. R. (2009). *What Engagement Means for Media Companies*. New York: Forrester.

McFarlane, A., Sparrowhawk, A., Heald, Y. (2002). *Report on the Educational Use of Games*. Cambridge: TEEM - Teachers Evaluating Educational Multimedia.

Oblinger, D. G. (2004). The Next Generation of Educational Engagement. *Journal of Interactive Media in Education*, 2004 (8).

Papastergiou, M. (2009). *Computers & Education*, 52 (1).

Prensky, M. (2001). Chapter 1: The Digital Game-Based Learning Revolution. *Digital game-based learning*. New York: McGraw-Hill.

Quivy, R. & Campenhoudt L. V. (1998). *Manual de Investigação em Ciências Soci*ais. Lisboa: Gradiva Publicações.

Rosas, R., Nussbaum, M., Cumsille, P., Marianov, V., Correa, M., Flores, P., Grau, V., Lagos, F., López, X., López, V., Rodriguez, P., & Salinas, M. (2003). Beyond Nintendo: Design and assessment of educational video games for first and second grade students. *Computers & Education*, 40 (71).

Simões, J., Redondo, R.D., & Vilas, A.F. (2013). A social gamification framework for a K–6 learning platform. *Computers in Human Behavior*, 29 (2), 345 – 353.

Solomon, D. J. (2001). Conducting web-based surveys. *Practical Assessment, Research & Evaluation* 7(19).

Thayer-Hart, N., Dykema, J., Elver, K., Schaeffer, N. C. & Stevenson J. (2010). Survey Fundamentals - A guide to designing and implementing surveys, *Office of Quality Improvement,* 20.

Chapter 3

GAME BASED LEARNING AND GAMIFICATION STRATEGIES INTO A DIGITALLY-INCLINED SCHOOL

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Introduction

The Comprehensive Institute of Sestu was born in September 2013; currently it is composed of two kindergartens, a primary school and a lower secondary school, for a total of about 1000 students. Immediately it is characterized by a strong innovative value, promoting over time initiatives of methodological experimentation and educational innovation. All classrooms are networked via LAN and wi-fi, and equipped with interactive whiteboard or interactive display. The environments of learning oriented towards collaborative teaching, cooperative learning and learning by doing; there are lively colored modular desks and innovative school chairs. The Institute also has numerous laboratories for students of all school levels: a standard computer room, with desktop PCs and laptops, interactive board, scanner and printers; a classroom performed for virtual reality and augmented reality, equipped with 3D smart curved TV, active panels, tablets and charging station for multiple devices; a digital fabrication laboratory (a FabLab, inaugurated in 2015, the first in Italy among compulsory schools) equipped with educational tools and many equipments; a LEGO Education Innovation Study with suitable equipment for providing sustainable digital education for students of all ages; a library with carpets and soft corner, tablets and tablet charging station for multiple devices suitable for digital lending.

The aim that we have set ourselves is to offer a way to make school more in line with the expectations of students and their families, able to offer a varied, attractive, flexible and meaningful school curriculum in the digital era. The space becomes the driving force to implement the motivation of the students in the learning

activities, to which they actively participate also proposing original initiatives and/or integrations to the path proposed by the teacher (see the YouTube channel *https://www.youtube.com/user/icgrodarisestu/videos?view_as=subscriber*).

Discussion

We have dared to rethink the classroom; accepting the school people's opinion, school indoor and outdoor spaces have been organized appropriately to support both teaching and learning. Many spaces have been furnished with care and actually are characterized by colorful classrooms with advanced technological equipment and creative learning corners. We have eliminated rows of tables and we have found a form of interior design that seem to support the teaching we believe in. Beyond financial issues, it has been observed that it is not useful to equip all environments with materials and instruments; instead, it is functional for students to move and change their spaces based on what they intend to discover, experiment, study and value. Furthermore, this particular type of use facilitates the rooting of students and teachers in the school community, favoring a sense of belonging. The virtuous circle is completed further as the pride of being part of a pleasant, cheerful and rich context develops respect for the spaces used and the objects they contain. In recent years, in fact, the acts of vandalism against the school are considerably reduced, limited to a few episodes caused by external people. Thus, education for beauty becomes civic education and the exercise of participatory citizenship.

The active participation of all the actors of the school community for the planning of the school idea (as reported in the institute's framework plan) was constantly encouraged. Idea contests among students have been conducted, for example to assign an name to the classrooms, to design the school logo; co-planning and reimagining of spaces has been developed in agreement with the Municipality.

After years of continuous evolution and growth, the results are decidedly positive: in addition to the re-evaluation of the physical space of the school buildings, to the satisfaction expressed by parents and students as emerged from the outcomes of questionnaires annually filled by them, to the sharing of intentions and projects

with the territory - firstly the local authority -, the most appreciable result is related to the pride of belonging to a community that works to grow in harmony.

We have observed such an increase in the number of pupils attending secondary school who are now forced to refuse new enrollments; IC Sestu recovers the number of primary school pupils who, although living in the municipal area of Sestu, preferred to attend "prestigious schools" in the nearby capital (Cagliari).

The merit of developing an increasingly rich digital curriculum is recognized at our school. The experience gained and consolidated include coding and educational robotics, easy-to-use electronic building blocks, the practice of BYODs, the use of apps to create digital educational content, quizzes and tests, the recycling and reuse of PC components. We want to dedicate a few words to the description of the birth of the FabLab as many other activities (that have inspired teachers and have attracted students) have originated from that initiative. Everything originated from a reflection following an idea developed by some 12-year-old students: to replicate the creation of a simple interactive board with recycled material (i.e. remote control of a well-known video game and a video projector). One of the students asked the principal to be able to assemble this educational tool and make it available for use at school (*https://youtu.be/_9lgkMPOkS0*). It had come about that the classroom space and the ordinary school time were not sufficient for what the students could have accomplished in an appropriate context. With the help of two experts (a maker and a video maker) a laboratory - which was almost at no cost - was set up in which RepRap 3D printers were built, and the first tutorials to support and document the activities were carried out (*https://youtu.be/p4b-7ZQXoQ5k*) (*https://youtu.be/Dm-big52WPc*) (*https://youtu.be/k8bVcvApRm4*). The following school year, FabLab was called "Make@School" and became an integral part of the school time for all our students, including kindergarten pupils. The room, located in one of the buildings of the secondary school, began to be equipped with professional equipment and suitable furniture. In addition to the five 3D printers built by the pioneer students, today there are laptops, workshop tools (i.e. hammers, screwdrivers, pliers, etc.), kits for electronics and educational robotics, a lots of tools for coding activities, an all-in-one PC with a 3D scanner, a heat press machine, a laser cutting machine, a multi-function scanner,

a professional 3D printer. Teachers have free access to the FabLab room, and can carry out activities with pupils after booking with an online platform. Training in the digital fabrication laboratory is based on doing projects, peer learning and game-based learning. It is a place open to all citizens in which many innovative activities have taken place that have involved the territory.

From year to year, school strategies characterized by innovative methodologies have multiplied and spread, and today over 70% of the classes regularly conduct interactive lessons with the use of diversified digital and technological tools. Coding activities are carried out on a regular basis with great interest by learners (*https://youtu.be/rAMzJia9Wjc*) (*https://youtu.be/h9X8hQRgOjc*). Flexibility has become the watchword for managing the school curriculum.

Initially used in a spontaneous and unstructured way, game-based learning (GBL) and gamification strategies are assuming a meaningful and articulated educational function within a compatible school that has adopted a series of changes: main positive in the last five years concerns more engaging, creative and collaborative learning environments. The decision to transform the traditional classroom - with white walls, equipped with a desk, a slate blackboard and the benches arranged in rows - in a new learning environment in which the spatial dimension becomes an essential component, from the perspective to configure a modern and effective learning setting, has characterized the innovation path currently underway in our school. The founding idea was to revolutionize furniture and spaces by creating more effective and functional environments for students who learn and socialize to go beyond the frontal lesson as a unique or prevalent way of teaching. Thanks to pedagogical choices shared between management, staff and teachers, in a broader and more modern vision of the quality of the school service offered, the opportunities provided by public funding were best exploited. A great deal of effort was put into developing projects that led to the creation of effective learning environments and flexible spaces of coexistence and confrontation where, even beyond the formal moments of teaching, it is now possible to meet, read, relax context of comfort and functionality. Innovative classrooms include the use of educational robots and mobile wireless devices that allow for overcoming the same physical size of the classroom and access

to virtual work environments. So we wanted to make available technologies of various kinds that have become a valid element of interaction between teachers and students to encourage innovative teaching, which privileges laboratory and collaborative approaches.

Teaching is a varied experience, successfully conducted only by combining the textbook with all the opportunities that digital education offers. We consider each teacher of our school as a professional at the service of a constantly evolving society. The development of one's own professionalism and method of relating to learners is today one of the essential elements of the teacher's work. Knowledge grows, technological resources evolve, learning methods, skills and needs change. The teacher has a duty and right to fully reflect the current cultural dynamism and to respond to the needs of his students by mastering a range of teaching strategies as broad as possible. For years there has been a wide gap between teacher and learner: today it is more necessary than ever for the teacher to go back to being an updated reference point and ready to face the challenges of the present. It is essential that the teacher progressively develops his professionalism and takes the means to achieve it. Continuous and gradual training on ICT is one of the training needs most frequently reported by teachers, and it is fundamental to increase the quality of teaching and guarantee an effective education, within the framework of a necessary organizational, structural and methodological renewal whole school system.

For some years IC Sestu has been, for its teachers, a place of training, orientation, tutoring, discussion, and expansion of its skills. Trainers inside and outside the school take care of constant and periodic events with and among teachers characterized by learning and growth opportunities in the field of digital technologies and in their use applied to teaching. Training courses and workshops are organized so as to initially involve a small group of teachers with sufficient basic knowledge to feel interest; then these are the ones who subsequently transmit the acquired knowledge and skills to the broader group of colleagues. All teachers can learn about innovative teaching tools able to guarantee a strong and continuous relationship with disciplinary and extracurricular knowledge, with their evolution and their use in the classroom. In general, it is noted that the more

they know an "argument", the more interesting it becomes, that is, as knowledge increases, a certain interest also grows. In this sense, new information increases the likelihood of conflict, that is, facts or ideas (that do not match what is already known) emerge; teachers feel motivated to resolve this conflict and therefore learn something new. More learning generates more questions, which in turn generate further learning.

The interests vary widely from teacher to teacher, so we believe it is right to offer those who learn a wide range of content, in the hope that some of them will leave their mark. To be interesting, a topic must be new, complex and understandable. IC Sestu teachers are confronted with teaching tools and methods never known before, or with new aspects of family strategies; the complexity of the training path is calibrated so that the novelty is neither too easy nor too difficult to understand. Understandability is fundamental: new and complex contents are interesting if the teachers feel able to decode them and face the challenges they pose. Many interested, motivated and available teachers can master teaching and communication techniques with new learners (digital natives) with greater confidence: new tools for teachers to produce innovative contents and take care of their teaching, new resources that support game-based learning, more effective instruction for pupils with different learning abilities, more focused training forums for teacher professional development built around a school community that we consider "open", thank to the opportunity offered to everyone to join and actively contribute to the collaborative effort.

Regardless of age or length of service, teachers are increasingly positive in the use of newer multimedia content (such as Web interactive games, podcasts and lesson plans, usually created and/or accessed on digital devices, including computers and mobile devices), technological tools and social networking. A majority of teachers are using digital media with applications mainly including instruction, lesson planning and communication.

Teachers who best use GBL and gamification strategies believe that it can really helps them to be more professional effective; their students seem to be able of dealing with activities with greater involvement. Since a few years, teachers

have started to select many different types of digital media, with regarding to activities and games for student use. Teachers increasingly access digital games: they are quickly becoming more strategic in the digital tool use and capable integrating it into their collection of instructional strategies and resources. The coming of online communities and the sudden increase of social networking sites among adults seem to be capturing teachers' interest as well: increasing numbers of teachers are joining virtual professional communities, and many of them are comfortable using social networking tools in their personal and professional lives.

Conclusion

When embedded within the curriculum into a digitally-inclined school, game-based learning and gamification are preferred by students over other types of teaching activities. For example, the use of formative assessment digital tools to give out quizzes or surveys, that helps teachers to be more effective, to support their own creativity and to assess learning and progress, increases motivation and stimulates discussions.

Interest is generated and it is associated with positive feelings, infuses energy and strength, captivates and fascinates. Also in the context of the activities of the FabLab, it was observed that when students are interested in something, they have been more attentive, have better elaborated the information and have implemented better learning strategies, such as critical thinking, the connection between old knowledge and new. The pupil who is interested in something thinks with greater clarity, deepens understanding and remembers more: interest has the power to improve low performance and to bring already excellent results to even higher levels. When carrying out a task based on gamification interests, the student works more intensely and for longer, bringing into play all his ability to give his best. Since they are interesting strategies for the students, GBL and gamification cause an "impulse to get closer" contrary to the "impulse to avoid", stimulate student creativity, directly increase student achievement.

Chapter 4

ITALIAN EXPERIENCES IN GAME-BASED LEARNING AND GAMIFICATION METHODOLOGIES IN ORDER TO ENHANCE STUDENT LEARNING AND TEACHER PROFESSIONAL SKILLS

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Introduction

Numerous studies on the game/learning relationship show that game is a fundamental element for the child's growth and cognitive and educational development; it should therefore be the common thread connecting all types of learning, be it spontaneous or structured like the school one.

Thus, the school cannot fail to consider the potential of the game in its educational mission: the game must become a tool for developing cognitive, affective, emotional and social knowledge aimed at stimulating the child's serene growth and the acquisition of knowledge and skills transverse.

Although we do not intend to do a pedagogical analysis of the game as a tool for learning here, it becomes indispensable to consider how even the game scenarios have undergone the charm of the unstoppable technological progress and how they imply new pedagogical scenarios for the educational success of the students. It is necessary to overcome frontal teaching and implement activities closer to the world of students, shifting the focus from "what" we learn to "how" we learn. Digital electronic devices and applications become a valid aid in the learning process and this is why digital innovation deserves the right space in the educational educational context: gamification and game-based learning enter the educational scenario precisely to respond to these new needs.

It is worth remembering the differences between the two methodologies that offer extraordinary opportunities for involvement and learning: game-based learning methodologies use games and video games as a tool to learn; the use of gamification involves the application of typical game mechanisms to situations that are not in play; in order to encourage the performance of an activity or the acquisition of a behavior, challenges, points, bonuses and prizes are used.

Participation in the Erasmus + "Games2Learn & Gamification2Engage" Project in partnership with Portugal and Poland, proved to be an important opportunity for professional and personal growth for all participants: students and teachers were able to confront themselves with different school realities identifying strengths and weakness. The five Italian teachers in training were able to experience first-hand that it is possible and desirable to use gamification in everyday teaching; they have thus initiated a process of self-training also involving other teachers from their primary school.

Taking inspiration from the ideas presented during the training activities, various applications were used in the classroom to create quizzes, tests, surveys, visual learning experiences and documentation.

Personal reflections and significant experiences

Aware that digital technologies are producing significant changes in the way we teach, communicate and learn, today I believe that those who work in schools must know how to design and plan a new teaching, a new educational-training dimension in order to foster the development of knowledge processes and learning adapted to our technological age.

In recent years I have started to relate to the digital dimension in teaching in order to discover and exploit its potential. I have always used the game as a means to teach but I wanted to acquire more knowledge about gamification and game-based learning strategies.

The objective of active teaching is never the tool you use but the skills that kids can acquire; and this is why I try to create effective disciplinary paths aimed at merging not only multidisciplinary knowledge but also transversal and citizenship skills.

During the training courses I was able to compare myself with colleagues from

other countries; I knew the scholastic reality of other places and some digital educational applications that allowed me to integrate digital tools and strategies in my work to encourage student involvement and collaboration among them.
I started using the Kahoot, Mentimeter and Socrative applications to create individual and group tests and the involvement and interest of the learners has always been high. The pressing background music, the simple interface, the intuitive controls and the game modes of Kahoot turned out to be more appropriate for primary school students and my needs than the other two applications.
My class worked on Padlet (an online virtual "bulletin" board) for the creation of a digital educational content on a broad theme: Great Britain. The work, carried out by grouping the pupils in small groups, has allowed us to improve communication, interpersonal skills, the search for collective solutions to problems, and a good team feeling has been consolidated. Initially the students carried out a search of the contents on the web with the tablets, then they created and collaboratively wrote the texts linked to the images; a subsequent critical analysis and re-elaboration of the information enabled the development of debates and collaborative learning. Technology has facilitated the participation of all the students, placed them in front of a challenge and offered them the opportunity to express their innate creativity and to be authors and protagonists of an original digital content
The Padlet project was also an opportunity to learn about and use other web-based applications such as "Animoto" and "Thinglink". In fact, my students and I wanted to insert a video on a Padlet virtual board to tell about our journey, and a game that enriched the digital product. Animoto has allowed us to create a video, and Thinglink has given the possibility to insert tags (which link to other multimedia content, photos and videos) within a picture of Great Britain. The performance of school activities carried out on online platforms requires a good and strong internet connection to be able to work quickly and with many devices at the same time.
In addition to the aforementioned applications, today I propose to my students coding activities, which stimulate an approach aimed at solving more or less complex problems and develop computational thinking. Pupils are no longer passive subjects in front of a tablet or a robot, but they can animate, move virtual characters and above all they learn to achieve a goal by gaming.

Thanks to these experiences, I can affirm that a stimulating didactic approach leads to the participation of all the students, favors the acquisition of transversal skills such as critical thinking, creativity, communication and collaboration. Even children with learning difficulties interact more serenely, and actively participate. Integrating active learning scenarios in my teaching means offering children the opportunity to build knowledge in a meaningful way for themselves, and to internalize content in a deeper way, without underestimating the emotional aspect as a substantial part of the learning process (S.M. Dessì).

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In my teaching activity I have always made use of the elements of the game in order to improve pupils' involvement in learning processes. Transforming a game into something that it is not playing, applying its fundamental elements, stimulates active behaviors in children, which make them real protagonists of the learning process.

Music is my teaching subject, and it is very compatible with the use of the game and its strategies to optimize the learning of the elements that constitute it, helping to create an atmosphere of serenity and good humor that stimulates creativity and motivation of all the students. Thanks to the participation in the Erasmus + Project, I was able to approach the gamification and game-based learning strategies in a more systematic way, and to use it in teaching.

The application that proved to be the most responsive to my teaching needs was "Thinglink". I immediately understood its potential, so I wanted to experiment with it in a fourth class, made up of 16 nine-year-old students. I chose "the symphony orchestra" as a topic and set a path of collaborative and cooperative learning (lasting about 6 hours) which took place entirely in a multimedia classroom equipped with desktop computers, tablets and interactive boards. The class was divided into 4 groups each formed by 4 children; each group was assigned a specific task: group A was to seek general news on the topic (what is a symphony orchestra, when and where was it born, the instrumental formation, what role does the director have, etc.) and images on the arrangement of the instruments; group B had to search for information on the *woodwinds* family; group C on the *strings* family; group D on the *brass* and *percussion* families. Furthermore, all four groups of students had to create drawings concerning their specific

task. Pupils, already able to work in this way, interacted in a very positive way, "fielding" their personal skills and knowledge and their individual responsibility to achieve the assigned goal. In a second phase, new groups of 4 children were organized, each from one of the previous groups and each pupil in turn told the other members of the group about his work. After selecting the information with the help of the teacher, the final product was created on the Thinglink web app: a suitable image was chosen, on which, in turn, each student was able to create a different tag. The computer connected to the interactive whiteboard allowed all the other students to follow the activity with great interest. The work was so successful that the pupils explicitly asked to carry out another activity using the same application. It was thus thought to "give voice" to the instruments of the symphonic orchestra by inserting an audio track for each family of instrument present in the orchestra. The class was divided into four new groups, each of which had the task of finding and downloading the .mp3 audio files of one of the four families of instruments, and saving them; with the help of the teacher we proceeded to load the audio tracks on Thinglink using the same image as the previous work. The expression of joy and pride that was read on the faces of children has greatly repaid the hard work! Everything was finally enhanced by the creation of a video using the Animoto web app, the drawings made by the students, and the photos taken during the various working phases. With a lot of collaboration and enthusiasm, the children created the storytelling of their activities by democratically choosing the best drawings, the most representative photos of the path, the phrases that accompany and tell each image, and the music that plays in the background. Thanks to this experience, the relationships between classmates were consolidated, above all, "new alliances" were born, where before there was a bit of indifference.

During the previous school year 2017-2018, I used the Kahoot and Socrative applications in two classes of ten-year students to verify in real time the knowledge acquired for a specific subject in mathematics and Italian language. The pupils welcomed them with great enthusiasm, especially Kahoot for its graphic layout and for the immediate reading of the ranking.

As a teacher I did not find the effectiveness of these applications for a really objective examination, due to some problems: a poor connection to the Internet

and the lack of a device for each student.
Instead I found it much more useful to resort to these two applications by having the same students write the questionnaire on a given topic, in groups or individually, and then submit it to their peers. In this way there is an effective effort in those who create the questionnaire to arrive at the fundamental notions of what they have learned and to rework them (S. Callai).

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The use of games to support the learning strategy is a consolidated practice in the teaching of many teachers, especially in lower grade schools. Technology support to effective teaching strategies can make students even more active and motivated in the learning process.
Last school year 2017-2018, I started using Kahoot, Socrative and Mentimeter. Basically I limited myself to the preparation and administration of multiple choice or true/false tests with the aim of consolidating and verifying the degree of learning achieved in the various subjects. The students immediately showed great interest and enthusiasm. The quiz maker Kahoot allows you to create engaging quizzes for individual and collective use, useful for the achievement of educational and/or learning objectives. Initially the quizzes involved the students only as players/users of the activities prepared by the teacher, but they soon proved to be also skilled creators of quizzes on history, geometry, arithmetic and other subjects. Work at school was done with mobile devices and an IWB. The question and the text of the answers appear only on the interactive board; the student sees symbols (geometric figures) and colors associated with the answers on the device. I realized that this setting forces the pupil to spend a certain period of time for the symbol / response association, in any case the Kahoot app stimulates students engaged in group activities and for quick answers.
The Socrative web app allows the student to proceed according to their own pace and in any case to successfully reach the proposed goal; the teacher can also analyze the results immediately. For these reasons it seems to me a suitable application to create checks.
The Mentimeter web app seemed useful to me especially for surveys, used in mathematics or geography and to express one's own judgment by voting in real time on the topics of interest covered.

In the current school year 2018-2019, the lessons have been articulated with a greater use of digital technology. I consider it useful to report here a significant experience of CLIL activity in gamification mode. On the occasion of the short-term mobility of groups of pupils in Italy, in October 2018, Polish and Portuguese pupils were hosted in my class IV (nine-year-old pupils). The geographical environment of the Regional Park of Molentargius-Saline (a wetland site of international value by the Ramsar Convention) was illustrated with images and texts downloaded from the web; its animals and its vegetation have been described, and the human activities developed over time. A simple and traditional "game of the goose" - adapted on the naturalistic topic chosen, designed and realized on cardboard by the same students in the previous days - gave the opportunity to children to socialize, to communicate in English, and to consolidate the knowledge . Finally the long awaited Kahoot quiz, also in English, the official language of the Erasmus + Project.

To involve pupils and entice them to a new topic, and above all to communicate more effectively, there are many web tools that allow you to make images interactive. I found Thinglink particularly usable; I used this mobile app mainly to discuss and present geography and science topics, also taking advantage of the flipped classroom methodology. The pupils made a video with the Animoto app to show the country they live in, using photos taken by themselves and composing captions with original texts.

In the initial phase of the project activities I had some doubts about the possibility of using new tools and apps in primary school: the training and experimentation I did showed not only that it is possible, but also that the motivation and active involvement of the students benefit (R. Concas).

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Smartphones, tablets and laptops are an integral part of the lives of young people and children; they use them daily for their interests, to develop their relationships and build new ones, to inform themselves, study, express their creativity. They are instruments with great potential that offer opportunities for growth, but which must be used responsibly. In the scholastic context they bring a great change because they integrate the resources of the teachers introducing them to the concepts of multimedia, interaction and sharing. They modify and integrate

teaching and learning environments, stimulate the attention and participation of students.

Designing good activities and developing them through the use of web-based platforms (such as Kahoot, Mentimeter, Socrative, Thinglink, Animoto) was initially a challenge for me. I immediately understood its potential but I had to try to use them repeatedly to fully understand how they works in order to incorporate them into everyday teaching. I started preparing verification quizzes using Kahoot and Socrative that allow you to see the results in real time; pupils have fun and the required competitiveness becomes a positive aspect and helps to increase motivation. I find it very useful to use Mentimeter in word cloud mode to create surveys that allow students in my class V (ten-year-old students) to express their opinion by voting on a topic of their interest. By using Thinglink and Animoto I can present the lesson making it more interesting. The active involvement of the students is manifested in the research of images and in the creation of captions; real opportunities for cooperatives and collaborative learning are generated.

In everyday teaching I also introduced various coding activities with the use of online resources or self-produced materials by the students themselves. Based on the experience gained over the past two years, I can say that my students have benefited from the introduction of innovative tools and strategies. The desire to work in small and large groups has increased in them, healthy competition has led them to become more aware of their skills and competences: pupils have taken on a more active role in the teaching-learning process (L. Fadda).

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I have been working in the school world for over twenty years and I have found that it is necessary to modulate and vary one's teaching constantly to motivate the students and implement an effective teaching-learning process. New technologies become valid allies in everyday teaching; gamification and game-based learning activities stimulate the creativity of pupils and teachers, can help solve problematic situations in a creative way, encourage them to give their best in a healthy competition. However, having digital tools in the classroom is not enough to implement a true didactic innovation: an adequate professional preparation of the teacher, curiosity and a constant updating on the news that offers technological progress

and the web is needed ... we need continuous training.
Participation in the Erasmus+ Project has contributed to reshaping my teaching practices and pushed me to use technologies more involvingly, to ensure that pupils are no longer spectators of what the teacher has prepared, but become themselves creators of learning products and can also learn through play.
In a first phase I used Kahoot and Socrative for the verification of English and mathematics in a class IV (pupils of nine years); in a second phase, the pupils, divided into small groups, have created their own checks to propose to classmates: cooperatives and collaborative learning, motivation, competition and prizes have become fundamental elements of my teaching. I also started using Thinglink because I think it can make visual learning easier and encourage children to do online research. The children also found the use of Padlet fun and engaging; a digital contribution was made where various activities carried out during the school year were documented, some of which were documented with Animoto.
It was very engaging to prepare the storytelling of an interdisciplinary lesson that starting from the English story "The very hungry caterpillar" involved the pupils of a class III (eight-year-old pupils) in an art workshop and play dough manipulation for build historical characters.
Based on the positive experience of these two years, I believe that gamification and team spirit, cooperatives and collaborative learning will have more and more space in my daily teaching (R. Manca).

REFERENCES

Bobbio, A. Bondioli, *Gioco e infanzia. Teorie e scenari educativi,* Carocci, 2019

L. S. Vygotskij, *Il ruolo del gioco nello sviluppo*, 1966

Bruner J. (1983). *Child's talk. Learning to use language*, Norton, New York (trad. it. *Il linguaggio del bambino*, 1987, Armando, Roma)

WEBSITE CITATIONS

https://www.statigeneralinnovazione.it/online/la-gamification-nelleducazione-questa-sconosciuta-moda-del-momento-nuova-frontiera-dellapprendimento/
https://www.uppa.it/educazione/scuola/importanza-del-gioco-nell-apprendimento/

Chapter 5

GAMIFICATION AT SCHOOL IN THE PERSPECTIVE OF AVAILABLE TOOLS, AGE OF STUDENTS AND EVERYDAY WORK

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Introduction

A few years ago this method of work was discussed during academic discussions or free exchange of opinions between interested people. At present, gamification is a standard method of work used not only in education, but also often in other industries that are unrelated to it such as marketing or human resources. In many companies or corporations it has become a way of managing the staff and motivating them for further actions. Gamification, due to its efficiency and excitement in the recipients while simultaneously eliminating the factor of monotony, has become a universal method.

In 2017 a group of teachers from Poland joined the project under the ERASMUS+ Games2Learn & Gamification2Engage program. For most of us it was a complete novelty. The term „gamification" itself was generally associated with the introduction of games to the educational process and was often confused with another concept of game based learning. During the training cycle in Poland and abroad these two concepts first of all disconnected and at the same time took on a completely different and full meaning. After two years of implementing the method into school practice, developing various scenarios of classes for different age groups and using appropriate tools, we have decided to share our thoughts and conclusions that may be useful for other teachers planning to implement gamification into their teaching process.

Reception

It is worth devoting a few sentences to how the method itself was perceived by the environment of other teachers, students and parents. Among the school staff, but also parents of students, there is a deep conviction about the dominance of modern technologies among representatives of the young generation. From interviews with parents and from conducted research surveys at the school in the 2017/2018 school year, it appears that the vast majority of students use modern technologies by using social networks and playing games. 90% of pupils admitted to using these forms of entertainment every day. It is clear from this that modern technologies have become an integral part of the functioning of young people, but also adults. The negative assessment of a large part of teachers and parents is associated with the unproductive use of these technologies, which are often used to kill time. The implementation of gamification among students initially met with a mixed assessment mainly due to the necessity of using, for example, a phone or tablet. Of course, it is not indispensible and the process of gamification can be successfully implemented without modern facilities, however, the number of available free tools on the Internet and the fact that each student has a phone or tablet diversifies this process and allows using modern technologies for other purposes than those that were most often indicated by students. We can also use them for more effective learning. After some time of implementing this new method of working, the parents' and the teachers' perception began to change significantly and eventually became an integral part of the work of many of them.

Some of us, for example during conducting school meetings, when the assumptions of the project and the implementation of the new method of work were described, met with the following opinion: „Gamification is a well-wrapped method of carrot and stick". Such an opinion represented by a small number of people probably involves the basic assumptions of gamification: introducing result charts, levels, competitions, points, etc. By some, this method was perceived as too hard. Of course, and this was verified, explaining that the goal and the course of, for example, a specific project or lesson is completely different.

Ultimately, gamification is very well rated among parents and teachers. From the very beginning, the students were open to changing the formula of the lesson. Their perception has not changed.

Flipped learning, gamification and projects

The use of flipped learning is great when introducing gamification. These two links do not have to be closely connected to each other, but as a pair they work, especially on the assumption that students work individually. However, if we interwoven in the project work, which often involves working in groups, the situation may become chaotic if we do not prepare it in advance. We feel that it is very important to properly plan everything. In order to avoid chaos during the cycle of such project activities, it is worth remembering that:

- the content is varied,

- at the same time it is not too difficult for any of the students,

- work in groups should be planned for an optimal amount of time, not too long,

- every student in the group must have a task (when working in groups not always everyone is involved).

Caring for the above-mentioned postulates allows to optimize the quality of work itself and significantly reduces the noise that often accompanies this type of activity using - assuming that students will work in groups. However, it should be noted here that it will be difficult to eliminate the noise completely. This is a minus often indicated by teachers, which you simply have to accept when deciding on forms of work that are often aroused by emotions.

An important and at the same time turning point in the implementation of projects by the method of gamification is their appropriate and thoughtful ending. It often happens that groups have performed their tasks perfectly, but when the work of each group comes together, a logistic problem arises. At this point, we have often supported ourselves with modern technologies. After the presentation of the work by all groups, as in any lesson, it cannot do without evaluation. One of the tasks

for each group may be, for example, to create an online quiz of content that they have prepared and which other groups have to solve. In order for knowledge not to become selective and to effectively complete the project at the same time, it is necessary to ensure proper form of training of all groups from the acquired knowledge concerning the whole subject. You can use applications, presentations or flipped learning to achieve this goal.

These types of teaching content are in our opinion very attractive to children and at the same time significantly improve the efficiency of work, but are not free of certain difficulties, especially for the teacher. In order to avoid disappointment or chaos at particular stages of implementation, it is worth planning the entire process minutely.

Apps

As indicated at the beginning of this article, modern technologies may become an interesting, though not an indispensable element of the implementation of gamification. There are a lot of interesting tools on the market that can be used in everyday work. In the Internet you can find a huge number of free applications being an attractive element in the process of gamification. We would like to take a closer look at the applications we learned during the training and not only, and describe their pros and cons, and confront them with the age of students.

One of the most popular applications in the world, thanks to which you can perform gamification in various ways in the classroom, is Kahoot! It contains such options as: quizzes, riddles, or group competition. A huge plus is the speed of action, graphic design and the ease of building, for example, quizzes by teachers and students. This tool is perfect as a summary of project work, when individual subgroups of students create quizzes for others or compete for points in a quiz created by the teacher. You can also use it as a proof-reading tool, for example after reading a book. This application is universal and works well with every age group, however, it should be remembered that in order to be able to create your own quizzes, an account setting is required, which may cause some problems for younger students. As a rule, in this case we asked their parents for help. The game

itself does not require the creation of an account, however, if one wants to create their own game an account needs to be created. A very big plus for teachers and students is the ability to download the entire scoreboard after each quiz or game. The alternative form of the same application is Quizizz, in no way lower than the Kahoot application!

Socrative is an equally powerful and still growing tool. Here the possibilities of competition and verification of knowledge seem endless, however, the edition is a bit more difficult than in the described Kahoot! The application is similar. Among students aged 6-10 the app sometimes caused problems due to its interface and availability only in English. In the case of older students we did not observe such difficulties.

The application and the site at the same time, which we often used while working with children, was Padlet which is a kind of board on which students can share sophisticated content or tasks. The application allows you to share content, photos and video image on a specific board, e.g. class or project one. Like all other applications, you must create an account. Our observations show that it works best with older children who possess advanced IT skills. Of course, everything is to be worked out, but if we care about the efficiency of work, older students will make better use of it.

An interesting, unusual and maybe not as universal tool is the Mentimeter application. It is not as graphically attractive as the others, but you can easily use it among all age groups. It worked best during project evaluation, free exchange of ideas between students on a specific topic and to create class graphics. We used it during the summary not only of projects, but also at the beginning of the year, when class elections were held or at the end of the school year to summarize the year and to know the expectations of children for the next one. Using this application does not require the creation of an account. However, it will be necessary in order to edit the content by children. The application is available in English.

Sometimes it happened that when we carried out the project using the rivalry method, together with the students we wanted a spectacular ending. We did not

necessarily mean a classic presentation of the content, but to create a virtual presentation or movie that combined the project content in a given subgroup. For the presentation to come out originally, we used the Animoto application. Thanks to it, students can create a slideshow or movie, which presents the content that the given subgroup has prepared. You can add music to movies and choose an interesting template. Most of the older students made classic presentations in the Power Point program. Animoto is simpler to use and nicer graphically. It is necessary to create an account in order to use it. In the case of younger students we asked for help from parents, but even the older children sometimes had a problem with the app. The best in using the application functions were children from the age of 10 and older. The application is available in English.

A very interesting tool for creating virtual tours and augmented reality is the ThingLink application. At this point we warn against full use of it among the youngest students. Due to the fact that it is available in English and enforces a large number of operations we used the application mainly with older students (+10). At the level of early school education, it caused many problems in handling. This tool is ideal for use during the project work. It stimulates students to search the web for relevant information and create „extended photos", which thanks to the pins pinned on them, we will learn a lot about, for example, the presented place in the world.

Some of us in our daily work also use the app Classdojo in which children collect points for specific tasks. It is an interesting tool for assessing behavior and for evaluating the implementation of assigned tasks. The form is very attractive for children, especially younger ones, who have their own avatars in it, which in turn can be edited later.

This is a short summary of the applications that we learnt about at the training, which we use during the gamification process. As additional, complementary tools, they make the course of classes or the implementation of projects more attractive. Of course, this always involves the necessity of having a tablet or phone, but as we have seen before, the vast majority of students already have them and organizing them for classes was never a problem. As a school, we do not have a

set of many mobile electronic devices, so in consultation with parents, children brought on the indicated classes their cellphones or tablets, so that we could use the above-mentioned tools, which we strongly recommend.

Gamification - organization of classes, room and content

In this part, we want to share our thoughts on the organization of work. After providing the students with basic information about changing the way of teaching and learning, it is worth to build with the children basic tools that will enable verification of progress and direct feedback for pupils. You can use the Class Dojo application for this, however, a big downside is the fact that such Internet information cannot be shown to children all the time, therefore a traditional paper seems to be better - creating a board on which the teacher will paste stickers informing at which stage of a project or a specific task we are and what we have yet to do. Creating boards is virtually free, there is an easy and continuous access to them, and creating them is an interesting, fun game. Before planning any project, it is absolutely necessary to ensure that every child has a measurable and relevant task. Sometimes the argument against introducing gamification is that it is harmful to some less talented children. In our opinion, such a statement is a distortion and results not from the very method, but from an organization that is not well thought out. Each content, regardless of the method of implementation, both when we talk about individual work, in small groups or expert groups, can be adapted to a specific child. If doubts arise in the first projects, the teacher can assign the tasks to specified individuals and groups. For subsequent projects, this task can be given to children themselves. Regardless of the formula chosen: design, workshops or other, it is worth remembering some very important indications. We have listed a few of them above in the project section, the others are classified below.

The effectiveness of gamification in the learning process is greatly influenced by:

- avoiding limiting yourself to one quick lesson based on gamification. Instead, invest in longer or shorter cycles that include an introductory and persisting process (many teachers treat gamification exactly the opposite)

- layout of work so that not only groups but also individual units are involved, taking into account the appropriate level of difficulty

- using various tools, not just applications

- avoiding not having an alternative solution in the case when content turns out to be incomprehensible at the expense of optimal simplification of whole classes (especially among younger children)

- ensuring the selection of content and tasks so that they give a sense of success to every student (this success should be visible first of all to peers, and in the second to the teacher himself)

- careful implementation of competition; unfortunately, it is difficult to get a positive competition in a group like the class, where there is a network of sympathy and antipathy

Each of us has made a large number of different scenarios for different age groups, including various content, since the start of the project. The postulates mentioned in the above two paragraphs are the result of our joint conversations and written thoughts, which should be taken into account in the process of building a cycle of activities by the method of gamification.

As has already been mentioned several times in this article, the mistake in our opinion is limiting ourselves only to applications, which in the end often cannot be used. This may be due to technical problems, the place where we want to do the classes and, ultimately, the very establishment of gamification, which treats applications as optional support. We encourage you to come up with other forms of work based on games. We used a few of them effectively during the classes and they enjoyed as much students' interest as well as teaching efficiency as ready-made, technological tools. Here are some ideas that we have developed:

- creating a simple game around the area based on collecting envelopes and obtaining information that leads us further

- using Lego blocks to create a mathematical game for younger students

- building a game based on the escape room for the older students (you can use

the classroom)

- using simple boards for coding in a mathematical project

- using ordinary cards at the stage of consolidation of mathematical knowledge with younger students

These are just a few of the hundreds of ideas through which we can implement gamification among students when we cannot or we find that we do not want to use the application.

Chapter 6

A SYSTEMATIC REVIEW ON GAMIFICATION AND GAME-BASED LEARNING IN ERIC DATABASE

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Introduction

Game-based learning and gamification, guided by a teacher, may be framed in teaching and learning strategies that will allow the student to acquire skills that are increasingly in line with what is advocated as fundamental for the 21st century as referred by Gee (2010): problem solving, peer interaction and collaboration, communication, digital literacy and critical thinking. Playing games makes it possible to combine powerful multimedia interaction resources with the ludic activities, with significant gains in skills acquisition (Gee and Morgridge, 2007).

Taking into account the rapid and constant technological evolution of the current times and the overwhelming amount of publications made available by numerous digital databases, it becomes a priority to follow strict procedures that allow selecting a set of bibliographic references.

According to Dickson, Cherry and Boland (2014) a systematic review is a literature review that is designed to locate, evaluate, and synthesize the best evidence available for a particular review question, consisting of 8 steps. For this review, we defined as a review question **"What are the conclusions and results of projects centered on Game-Based Learning and Gamification?"**

Methodology

We decided for this systematic review to follow the procedure designed by Dickson, Cherry and Boland (2014), in the sense to analyze, synthesize and present some data about the existing literature on international projects, the Erasmus+ type, related to game-based learning and Gamification. We pretended to assess what type of data and information, validated by peers, have already been studied and are available in a given database.

Performing scoping searches, identifying the review question and writing your protocol

In the first step, the development of the review question is a key element for a literature review and must be "clear, well defined, appropriate, manageable and relevant to the outcomes" (Dickson, Cherry and Boland, 2014). Thus, according to the authors, to draw the issue of review should follow a scheme based in 6 steps: (i) Identify an area of interest; (ii) carry out preliminary bibliographic research or early scooping; (iii) redefine or redesign the desired direction; (iv) terminate the review question and develop inclusion criteria; (v) consult peers or field experts; (vi) develop a protocol revision.

We then started the step of (i) Identifying an area of interest and in our research, we used the following keywords that we consider relevant: Erasmus +, Game-based Learning, Gamification; Pedagogical Innovation. Next, we decided to use the keywords in a combinatorial way in order to guarantee unique and relevant results for the search through the boolean operators "and" and "or", which implies that an article obtained in this research must include the two terms involved in the sequences:

With these keywords was built the preliminary sequence of systematic research.

i. Erasmus+ **AND** Game-based Learning

ii. Erasmus+ **AND** Gamification

iii. Erasmus+ **AND** Inovação Pedagógica

iv. Game-based Learning **AND** Gamification

v. Game-based Learning **AND** Inovação Pedagógica

vi. Gamification **AND** Inovação Pedagógica

According to the authors, we started then the step that requires (ii) carry out preliminary bibliographic research or early scooping. To start the initial research, we detected that it would be necessary to find lists of synonyms of the keywords defined for us in making our research the most comprehensive possible.

Finally, we define our keywords for search in databases:

(1) ("Game-based Learning" **OR** "Videogame-based learning" **OR** "GBL" **OR** "Games based learning" **OR** "Educational games" **OR** "Gameplay" **OR** "Interactive learning environments" **OR** "Games" **OR** "Academic games" **OR** "Serious games" **OR** "videogames" **OR** "video games" **OR** "Computer games")

(2) ("Gamification" **OR** "Gamificação" **OR** "Learning process" **OR** "game design thinking")

(3) ("Inovação Pedagógica" **OR** "Inovação pedagógica com tecnologia" **OR** "game design thinking" **OR** "Learning process" **OR** "Innovation" **OR** "educational Innovation" OR "Building Innovation" OR "Teaching Innovations")

(4) ("Erasmus +" **OR** "Erasmus+" **OR** "Erasmus plus" **OR** "Erasmus" **OR** "Comenius")

(5) 1 AND 2 AND 3

(6) 1 AND 2 AND 3 AND 4

Subsequently, we defined as a review question: "**What are the conclusions and results of Erasmus projects based on Learning based on Gamification and Gamification?".**

In our research, we will consider articles with quantitative approaches and qualitative approaches, because, according to McMillan and Schumacher (2001), educational research is a disciplined research, using both approaches.

Next, as databases for our research, we selected the Biblioteca do Conhecimento Online [Online Library of Knowledge] (b-on), as it allows access to scientific publications of research institutions and higher education, being a reference in the access to international scientific information. We have also opted for the Education Resources Information Center (ERIC) as a digital library, with a bibliographic and full text, comprehensive database of educational research and information.

We consulted ERIC and b-on, presenting the following results:

Table 1 – Preliminary search results

	1AND2	*1AND3*	*1AND4*	*2AND3*	*2AND4*	*3AND4*	*1AND2AND3*	*ALL*
ERIC	181	24 456	0	1695	0	0	16	0
b-on	1114	992	4	3042	0	0	45	0

We found in our research that the data obtained for the keyword "Erasmus +", and their synonyms, did not present a significant number of results. So, we decided to delete this keyword from searches.

As discussed by Cherry and Dickson (2014) in the third step, we refined our review question with this change in consideration: **What are the conclusions and results of projects centered on Game-Based Learning and Gamification?**

We started the next step and set the following inclusion and exclusion criteria:

Table 2 – Inclusion and exclusion criteria

Inclusion criteria	*Exclusion criteria*
Articles available in ERIC	
Peer review	Exclude repeated articles
Full text available	Exclude articles though out titles analyses
Since 2015	Exclude books, chapters, e-books and theses
Elementary Education	Exclude articles that don't display abstract and keywords
	Exclude articles by the analysis of the abstracts of the articles (excluding those that are not pertinent with the subject of the study)
	Exclude articles not related to elementary school

The definitive sequence of our systematic research was then constructed:

i. Game-based Learning **AND** Gamification

ii. Game-based Learning **AND** Inovação Pedagógica

iii. Gamification **AND** Inovação Pedagógica

The following is the final version of our keywords for searching the databases:

(1) ("Game-based Learning" **OR** "Videogame-based learning" **OR** "GBL" **OR** "Games based learning" **OR** "Educational games" **OR** "Gameplay" **OR** "Interactive learning environments" **OR** "Games" **OR** "Academic games" **OR** "Serious games" **OR** "videogames" **OR** "video games" **OR** "Computer games")

(2) ("Gamification" **OR** "Gamificação" **OR** "Learning process" **OR** "game design thinking")

(3) ("Inovação Pedagógica" **OR** "Inovação pedagógica com tecnologia" **OR** "game design thinking" **OR** "Learning process" **OR** "Innovation" **OR** "educational Innovation" OR "Building Innovation" OR "Teaching Innovations")

(4) 1 AND 2 AND 3

Then, according to the fifth step, we consulted a specialist in the field in order to validate the process we were following and get some advice and referral regarding the remaining phases.

Cherry and Dickson (2014) state that a quality research is guided by a research protocol and thus, as a sixth stage, we conceive ours that we will present with the results of our research.

Literature searching

In this step the articles are identified, using the selected bibliographic databases.

At this stage, we decided to only use the ERIC database, because the volume of data contributed to the research was impracticable. The following results were then presented:

Table 3 – Search results

	1AND2	*1AND3*	*2AND3*	*1AND2AND3*	*Total*
ERIC	185	24541	1700	16	26442

Screening titles and abstracts

In this step, the titles and abstracts of the studies selected in the surveys are read and those that are not relevant to the review question are excluded.

According to Dundar and Fleeman (2014) the next step is to apply the inclusion criteria. The results are shown in the table below.

Table 4 –Results of application of inclusion criteria

		1AND2	*1AND3*	*2AND3*	*1AND2AND3*	*Total*
Criteria	**Descriptive**	185	24541	1700	16	26442
1	Peer review	161	11811	888	12	12872
2	Full text available	60	1361	156	7	1584
3	Since 2015	58	693	81	6	838
4	Elementary Education	2	117	20	1	140

As referenced by the authors, all collected data were compiled into Excel tables, so that, using the tools the program has, it would allow to organize and catalogue the gathered information.

Obtaining papers

This phase involves obtaining the full texts of the selected studies.

Subsequently, we obtained the complete text of the articles selected in the previous phase, having resorted to a system for management of bibliographic references that allows to import the bibliographical references from databases and bibliographic catalogs.

Selecting full-text papers

At this stage the criteria are applied, excluding those articles that do not meet the defined criteria.

We started this phase with a hundred and forty texts, having applied, in stages, the exclusion criteria defined for our research.

Table 5 – Results of application of exclusion criteria

Criteria	**Descriptive**	**Total**
1	Exclude repeated articles	117
2	Exclude articles though out titles analyses	21
3	Exclude books, chapters, e-books and theses	20
4	Exclude articles that don't display abstract and keywords	19
5	Exclude articles by the analysis of the abstracts of the articles (excluding those that are not pertinent with the subject of the study)	13
6	Exclude articles not related to elementary school	7

We now present the flow diagram summarizing the review protocol and the compiled data.

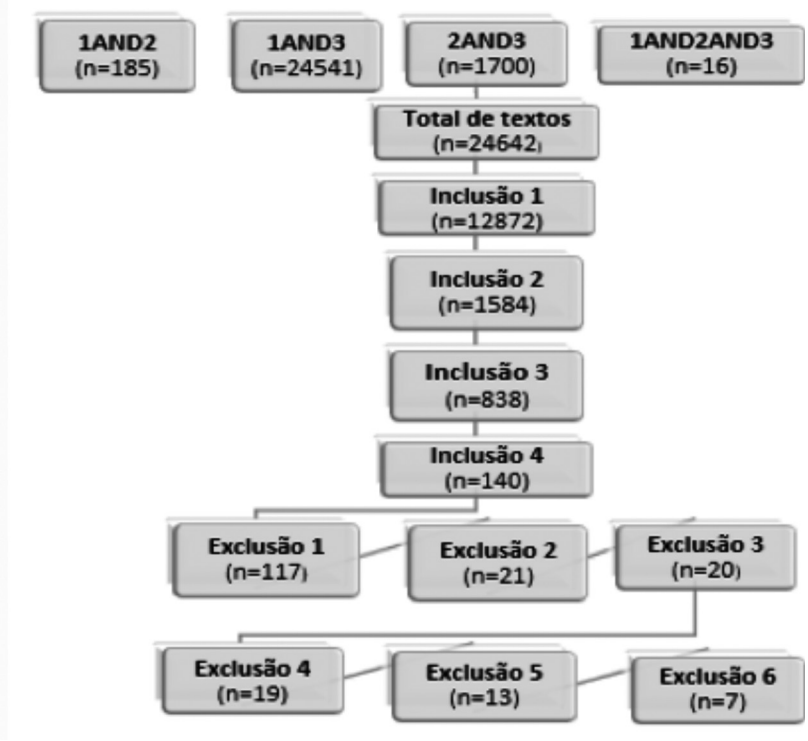

Diagram 1 – Review protocol with results

Adapted from Moher, Tetzlaff e Altman [The PRISMA Group] (2009)

Data extraction

All the collected data were organized and referenced through Excel grids, so that the data extraction was facilitated and its reading, and subsequent reference, was feasible, as mentioned by Fleeman and Dundar (2014).

Descriptive data

- Name
- Year
- Authors
- Objectives
- Type of publication
- Methodologies
- Participants

Analytic data

As discussed by Fleeman and Dundar (2014) at this stage, we revisit our review question in order to keep the focus of our study in mind. Thus, we summarized the data collected from the conclusions and results of the studies.

Table 6 – Categories and subcategories of analysis

6.2.1 Teachers	6.2.2 Students	6.2.3 Parents
• Teacher training	• Improvement in school performance	• Parental perceptions
• Teachers' perceptions	• Students' perceptions	• Remembrances
• Teachers' difficulties	• Students' preferences	
• Pedagogy	• Problematic students	
• Remembrances		

Analysis and synthesis

According to Cherry (2014), the purpose of this chapter is to provide a critical perspective of the data collected as a function of the established review question. Thus, the data collected in our systematic literature review were compiled into three categories: (a) Teachers, (b) Students, and (c) Parents.

Teachers

Within the category (a) Teachers, first subcategory refers to **Teacher training**. Both Karalar and Sidekli (2017) and Del Moral, Guzman and Fernández (2018) point out that it is necessary for teachers to be involved in the process of technological innovation in an educational context. For this to happen, it is necessary for teachers to be trained because only then will they be able to fully integrate these resources into their classes.

The second subcategory was defined by us as **Teachers' Perceptions**. According to Anđić, Kadić, Grujičić and Malidžan (2018), most teachers in the study consider that their schools are equipped with what is necessary for the use of educational games and 88.4% refer that they will implement the methodologies of learning through games in your classes. Marín-Díaz, Morales-Díaz and Reche-Urbano (2019) also point out that teachers consider that educational games help in the development of mental calculus and stimulate the development of non-violent behaviours.

The third subcategory addresses **Teachers' difficulties** in implementing game-based and / or gamification-based learning. Anđić et al. (2018) state that obstacles to the implementation of gaming-based learning are seen as a lack of equipment, time to prepare games and the digital illiteracy of teachers, even those who attend specialized training for this purpose.

In the subcategory **Pedagogy**, it is explained by Karalar and Sidekli (2017) that the students 'positive perceptions regarding the use of technology should be explored by the teachers, who can keep the students interested in the activities, transporting students' interest in the school contents. Del Moral, Guzmán and Fernández (2018) also reinforce this idea, pointing out that the interest shown by students in educational games is an argument for the methodology of game-based learning to be explored by educational institutions. Girmen and Kaya (2019) reinforce the idea of the benefits that learning through games bring to school results, noting that, in the student's perspective, the learning process undergoes only small changes and that the students' emotional connections

with the teacher and with school are strengthened, as classes become interesting and awaken curiosity. Also, Anđić et al. (2018) address the theme of student motivation as a positive impact factor in the educational process.

The last subcategory addresses the **Remembrances** for the implementation of gaming learning. Girmen and Kaya (2019) state that the whole process should be as detailed as possible, allowing the student to prepare for the activity, which should take place in an appropriate space. Anđić et al. (2018) clarify that teachers should tailor the games they intend to accomplish not only based on the content they intend to achieve but also on the target students.

Students

The first subcategory addresses **Improvements in school performance**. Girmen and Kaya (2019) conclude that students learn and enjoy themselves simultaneously, so the improvements in school performance demonstrated in their study are directly related to the Flipped Classroom Model (GPL) and Game-based learning.

Students' Perceptions are the second subcategory. Karalar & Sidekli (2017) discuss students' positive views of the use of technology. According to the authors, these positive perceptions should be used to integrate the use of the tablets in an educational context. Anđić et al. (2018) show that students show a strong interest in using games as a learning tool and would prefer to use them frequently. According to Dogan, Tingaz, Hazar and Zvonar (2018) students demonstrated that they prefer the digital game to more traditional games and that they perceive the educational game as entertainment and happiness.

The third subcategory refers us to the **Students' Preferences**. Karalar and Sidekli (2017) report that half of students prefer to read books on mobile devices while the other half prefers physical versions. However, most prefer outdoor play with colleagues than playing with mobile devices. According to Del Moral, Guzmán and Fernández (2018) students use mobile devices to search online, to see videos, to do homework, read books, listen to music and take pictures. They also point out that the use of attractive characters and stories promote extra motivation for

the use of mobile devices.

The fourth subcategory addresses **Problematic Students**. According to Girmen and Kaya (2019), the digital contents make students considered problematic to be interested and participate positively in the activities. The authors report that disruptive behaviors and inappropriate noises, which were customary in conventional classes, were gradually diminished in games-based learning activities.

Parents

The first subcategory refers to **Parental Perceptions**. According to Girmen and Kaya (2019), positive perceptions of parents may be related to the development that they have been sensing in their children, as they have seen their evolution and the growing dominance of technology.

The second subcategory addresses the **Remembrances.** Karalar and Sidekli (2017) argue that parents cannot oppose the current context of technology, so they should use it as an advantage, exemplifying appropriate behaviour and in an educational purpose. Girmen and Kaya (2019) state that the methodology of Game-Based Learning should be explained to parents so that they can understand the process and the role they have to play.

Conclusion

A systematic review uses a rigorous set of criteria by which it selects published and accessible studies. The present article briefly presented a systematic review of the literature on Game-Based Learning and Gamification carried out in the ERIC database.

Once we have defined our review question and the appropriate keywords for the study, we have defined the inclusion and exclusion criteria and constructed our review protocol.

Of the 26,442 articles found in the first research, 140 articles that met the inclusion

criteria were analyzed: peer review, full text available, published after 2015 and belonging to the field of study "education"

We then apply the exclusion criteria we defined for this review (exclude duplicate articles, exclude articles by reviewing titles, exclude books, book chapters, e-books and theses, exclude articles that do not have a summary and / articles excluded by the analysis of the abstracts of the articles and exclude articles not related to elementary education) having 7 articles fulfilled all the criteria and being on them that we focused our analysis.

Briefly, we can conclude that teacher training is a fundamental factor for the implementation of the methodologies Game-based learning and Gamification, both for equipping teachers with the necessary skills to master the techniques, as well as for allowing teachers to increase their digital skills. This digital illiteracy pointed out by some teachers, may explain the difficulties they experienced in the design and application of digital games and also some reluctance to use these tools and mobile devices in the classroom context. We conclude that most teachers have a positive perception of the methodologies Game-based learning and Gamification and that they recognize the value added to the teaching and learning processes, so that these should be widely disseminated and implemented by educational organizations.

Regarding students, the positive perception that children have of games and mobile devices must be equated. School and teachers should take into account students 'extra motivation, achieved through the use of mobile devices and the use of games, and the benefits to the learning process and improvement of school performance that the students' motivation, interest and commitment bring. Even at the level of students with behavioural problems, the use of these methodologies, techniques and educational tools may lead to improvements in both behaviour and school performance.

As for the parents, we conclude that they should be informed of the use by teachers of the methodologies of Game-based learning and Gamification, so that they can serve as facilitators of the process and not as opponents.

References

Anđić, B., Grujičić, R., Kadić, S. & Malidžan, D. (2018). A Comparative Analysis of the Attitudes of Primary School Students and Teachers Regarding the Use of Games in Teaching. IAFOR Journal of Education Volume 6 – Issue 1 – Spring 2018, 6(1), 25–41.

Boland, A., Cherry, G., & Dickson, R. (2014). Doing a Systematic Review: a student's guide. London: SAGE Publications LTD.

Cherry, G. (2014). Writing My Discussion and Conclusions in Boland, A., Cherry, G., & Dickson, R. (2014). Doing a Systematic Review: a student's guide. London: SAGE Publications LTD.

Cherry, G.; Dickson, R. (2014). Defining My Review Question and Identifying Inclusion Criteria in Boland, A., Cherry, G., & Dickson, R. (2014). Doing a Systematic Review: a student's guide. London: SAGE Publications LTD.

Del Moral Pérez, M. E., Guzmán Duque, A. P., & Fernández García, L. C. (2018). Game-Based Learning: Increasing the Logical-Mathematical, Naturalistic, and Linguistic Learning Levels of Primary School Students. Journal of New Approaches in Educational Research, 7(1), 31–39. https://doi.org/10.7821/naer.2018.1.248

Dickson, R., Cherry, G., & Boland, A. (2014). Carrying Out a Systematic Review as a Master's Thesis. in Boland, A., Cherry, G., & Dickson, R. (2014). Doing a Systematic Review: a student's guide. London: SAGE Publications LTD.

Dogan, P. K., Tingaz, E. O., Hazar, M., & Zvonar, M. (n.d.). How Do Elementary Students in Turkey and the Czech Republic Perceive the Game Concept? A Phenomenographic Study with Draw and Write Technique. Journal of Education and Training Studies.

Dundar, Y.; Fleeman, N. (2014). Developing My Search Strategy and Applying Inclusion Criteria Criteria in Boland, A., Cherry, G., & Dickson, R. (2014). Doing a Systematic Review: a student's guide. London: SAGE Publications LTD.

Fleeman, N.; Dundar, Y.(2014). Data Extraction: Where Do I Begin? in Boland, A., Cherry, G., & Dickson, R. (2014). Doing a Systematic Review: a student's guide. London: SAGE Publications LTD.

Gee, J. P. (2010). Good video games and good learning. Phi Kappa Phi Forum, v. 85, n. 2, p. 34-37.

Gee, J. P.; Morgridge, T. (2007) Being a lion and being a soldier learning and games. In: COIRO, J. et al. (Ed.). Handbook of research on new literacies. New York: Routledge.

Girman, P., Kaya, M. F. (2019). Skills and Enriching Activities: Digital Stories and Games 1, 12(1), 555–572.

Karalar, H., & Sidekli, S. (2017). How Do Second Grade Students in Primary Schools Use and Perceive Tablets? Universal Journal of Educational Research.

Marín-Díaz, V., Morales-Díaz, M., & Reche-Urbano, E. (n.d.). Educational Possibilities

of Video Games in the Primary Education Stage According to Teachers in Training. A Case Study. Journal of New Approaches in Educational Research.

Marchetti, E., & Valente, A. (2015). Learning via Game Design: From Digital to Card Games and Back Again. Electronic Journal of E-Learning.

McMillan, J. H., & Schumacher, S. (2001). Research in education: A conceptual framework (5th ed.). New York: Addison Wesley Longman.

Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009) Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. https://doi.org/10.1371/journal.pmed.1000097

Prensky, M. (2013).Digital game-based learning. New York. Paragon.

Chapter 7

GAMES AND GAMIFICATION IN EDUCATION: WHAT DOES PORTUGUESE RESEARCH TELL US FROM THE PERSPECTIVE OF THE PUPILS?

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Introduction and brief theoretical contextualization

The research on topics such as games or gamification is very wide, and even when considered together it remains a great challenge to move forward with a state of the art or a systematic review of literature. Thus, a search on games and gamification, in online repositories or digital databases, can result in numbers that quickly reach the hundreds of thousands. And even when criteria (of both inclusion and exclusion) are applied, among others, of a linguistic nature (for example, documents in Portuguese) or chronological (defining a period of time, such as for instance a decade or five years), the numbers may remain big, if not huge.

Therefore, and because the syntheses of literature have been gained increasing importance as primary research activities (cf. e.g. Cardoso, Alarcão & Celorico, 2010; Weed, 2005), it is considered relevant to outline a first portrait of the research held on the theme of games and gamification, from the pupils' viewpoint. Hence, and in order to make such an exploratory study possible, the mapping of knowledge is restricted to the research published in Portuguese, available in open access and indexed on the RCAAP (Scientific Repository of Open Access of Portugal), on those two topics and within that perspective. In this context the following question emerges as the research problem: how has knowledge about this theme evolved in the Portuguese scenario? It is then aimed at presenting what the Portuguese research tells us about games and gamification from the perspective of the pupils.

In contemporary society, increasingly plural and globalized, the challenges facing the human being are manifold - it is undeniable. And so, new forms of teaching

and learning are also emerging (Cardoso, 2018). In these contexts, *mutatis mutandis*, games have come to know a prominent place and role, not always socially recognized, namely if they are to be used in formal learning settings. But, its popularity or preference, in contrast to that of other resources or tools, can be attributed to their main characteristics, which are decisive for those who play them throughout life: cognitive stimulation, critical and creative thinking, developing competences, entertainment, experiencing emotions, learning, problem solving, simulation of real situations, socialization, team/individual work, testing hypothesis (cf. Johnson et al, 2013; Vygotsky, 2007; Kishimoto, 2002; Piaget, 1990; Chapman, 1988; Bruner, 1966). In fact, a game is more than a physiological phenomenon or a psychological reflex, it goes beyond the limits of purely physical or biological activities (Huizinga, 1993). Or yet in other words,

> The application of gamification and game-based learning in education, and its relationship with motivation and positive competitiveness, have been increasingly being focused on account of their potential of inducing behaviors and enhancing a deeper understanding of concepts, as well as their personal and individual appropriation and complexity. Good games create good learning by using problem-solving scenarios that produce deep involvement and satisfaction, and at the same time teach you to work for goals, to make choices, and to go over the consequences. (cf. Barradas & Lencastre, 2017)

Another feature that makes games so appealing is the fact that they have been evolving with a strong link to technology. They have thus become available online and on digital scenarios, making it extremely easy to access to, not only on personal computers but also on smartphones and tablets too. This is also a consequence of the new social paradigm in which we live in, where information circulates intensely through networks mediated by technology (Cardoso, Pestana, & Brás, 2018). Our participation in these networks determines our access to knowledge and the reconfiguration of relational processes, which, in turn, entail great challenges and simultaneously opportunities to learn and evolve, to better respond to our personal or professional needs (Pinto & Cardoso, 2017).

Other references and principles could be called to theoretically frame the contextualization of this study, however the knowledge mapped within it will certainly point out towards those main directions. Therefore, a brief description of the methodological options of the study and the procedures followed in the definition of the corpus of analysis are presented in the next section of this text.

Methodological design and presentation of the corpus of analysis

The methodology of this exploratory, descriptive and interpretive study assumed a mixed nature, combining quantitative and qualitative approaches, guided by a multimodal meta-analytical strategy, inspired by the MAECC®, that is, the meta-model of analysis and exploration of scientific knowledge® (Cardoso, 2007). Therefore, the methodological design included the data collection, organization, and analysis.

The data collection followed a rigorous and iterative process, as the number of documents that are to be found in an advanced search on a given repository can't be previously anticipated. It had been established that the RCAAP (Scientific Repository of Open Access of Portugal) was the source in which to collect the documents for the definition of the corpus. The geographical scope of the search was limited to the Portuguese resources aggregated in the RCAAP, because, as mentioned, the research problem was focused on the Portuguese scenario. The descriptors used were "games", "gamification" and "pupils", firstly tested in Portuguese and then in English, using preferably the Boolean operator "and". There was no chronological nor linguistic boundary defined for the search, which proved to be unnecessary, as will be further perceived.

As we have been witnessing, defining a corpus based on the documents of the RCAAP can be quite a challenging task (cf. e.g. Cardoso, 2012 and 2018; Pinto, Cardoso & Pestana, 2019; Pinto, Pestana & Cardoso 2018), namely because we can end up with too many or, on the contrary, with very few documents to put forward a meta-analytical study or a literature review and knowledge systematization. In this case it was not different, so we had to balance and decide between "No documents match your query" and "26461 documents found" out of "576454 Documents [possible] indexed from 226 Resources". After nine

attempts, revisited and updated on 3rd June 2019, and bearing in mind the constraints faced, those successive searches led us to consider a corpus of 9 documents, sorted by "Relevance" by the RCAAP, in a descendent order, as described in table 1.

1.	**Análise de Gamificação no Simulador de Operações Cibernéticas (SIMOC)** Brustolin,Fernando José; Brandão,José Eduardo Malta de Sá Este estudo qualitativo apresenta o caso do Simulador de Operações Cibernéticas (SIMOC) adotado pelo Exército Brasileiro no treinamento de pessoal em defesa cibernética, sob a perspectiva da gamificação. Investigou-se a ocorrência de onze elementos de jogos e de outras práticas associadas à gamificação do ensino e da instrução a fim de determinar se o caso SIMOC é um exemplo de gamificação. Foram coletadas evid... **Date:** 2017 | **Origin:** SCIELO Portugal **More info.**
2.	**O impacto da animação e da avaliação automática na motivação para o ensino da p...** Tavares, Paula Correia A aprendizagem da programação é uma tarefa complexa que coloca desafios importantes. Nesta dissertação, propõem-se duas abordagens ao processo de ensino nas disciplinas de Programação que visam aumentar a motivação dos alunos e a sua auto-estima. As propostas apresentadas resultam de um estudo cuidado das dificuldades que os alunos sentem ao contactar com a programação de computadores, quer a nível do raciocíni... **Date:** 2018 | **Origin:** RepositóriUM - Universidade do Minho **More info.**
3.	**A gamificação aplicada no processo de ensino-aprendizagem da disciplina de econ...** Assunção, António Pedro Em contexto educativo há uma necessidade constante de adaptar as práticas pedagógicas de modo a adequar os processos de ensino-aprendizagem às características dos alunos e promover o sucesso da aprendizagem. Este trabalho tem a finalidade de refletir sobre novas estratégias pedagógicas que permitam contribuir para a aprendizagem dos alunos. Mais concretamente, pretende-se analisar a influência da gamificação no... **Date:** 2018 | **Origin:** Repositório da Universidade de Lisboa **More info.**
4.	**Gamificação no Ensino da Gestão** Silva, Rui Jorge Rodrigues da O conceito de Gamificação geralmente mais encontrado e aceite na literatura apresenta-se como o uso de elementos de design de jogo em contextos não jogo, direcionados a um público alvo cuja utilização tem como objetivo a aprendizagem de uma determinada temática de conhecimento (Deterding, Dixon, Khaled, & Nacke, 2011). Nesse sentido, a Gamificação é um fenómeno composto por diversas aplicações em diferentes áre... **Date:** 2019 | **Origin:** uBibliorum **More info.**
5.	**Recursos digitais para diagnóstico e avaliação do tema Circunferência no 3º cic...** Rocha, Marta Isabel Cunha da O Ensino tem vindo a sofrer muitas alterações ao longo dos últimos anos. Desde os programas das disciplinas às práticas letivas, muitas têm sido as modificações que a Escola tem suportado. Uma das principais razões para estas mudanças está relacionada com o crescente insucesso dos alunos. A falta de motivação e de interesse dos discentes pela aprendizagem tem condicionado muito a obtenção de sucesso às diversas... **Date:** 2017 | **Origin:** RIA - Repositório Institucional da Universidade de Aveiro **More info.**

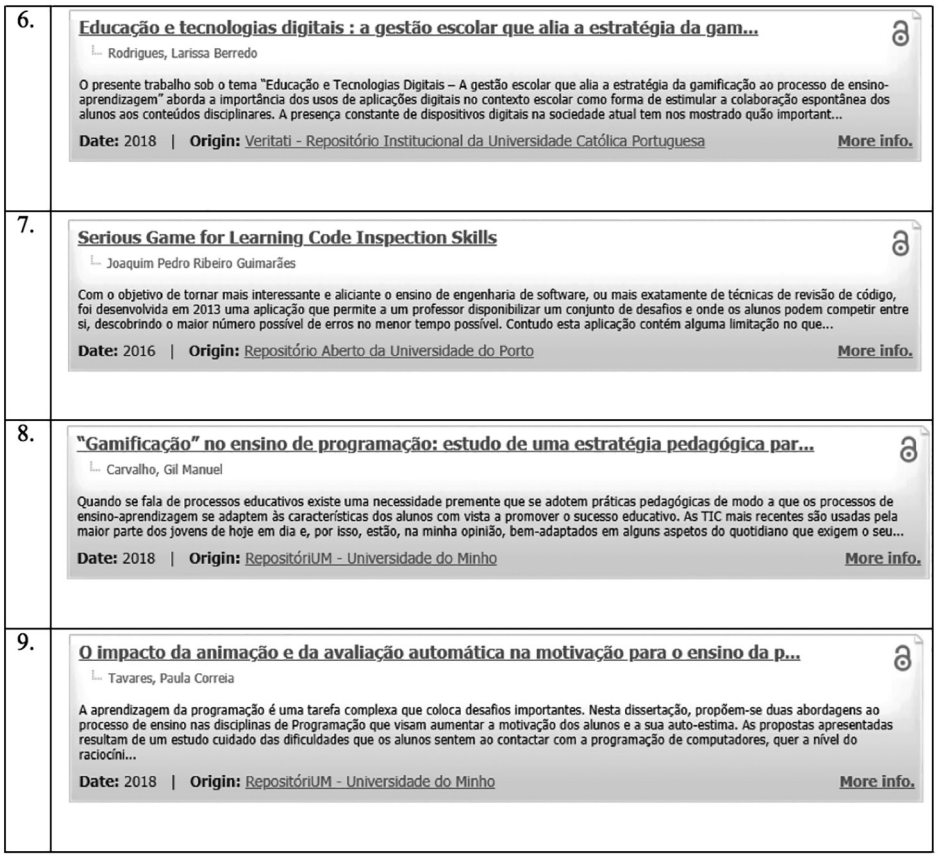


Table 1. Corpus of analysis
Source: data collected for this study.

These documents resulted from the advanced search represented on Figure 1, that is, from the Boolean search in which the descriptors "jogos" (games), "gamificação" (gamification) and "alunos" (pupils/students) were combined by the operator "and" within the selected RCAAP Type "Abstract". They are all available on open access, as we later confirmed.

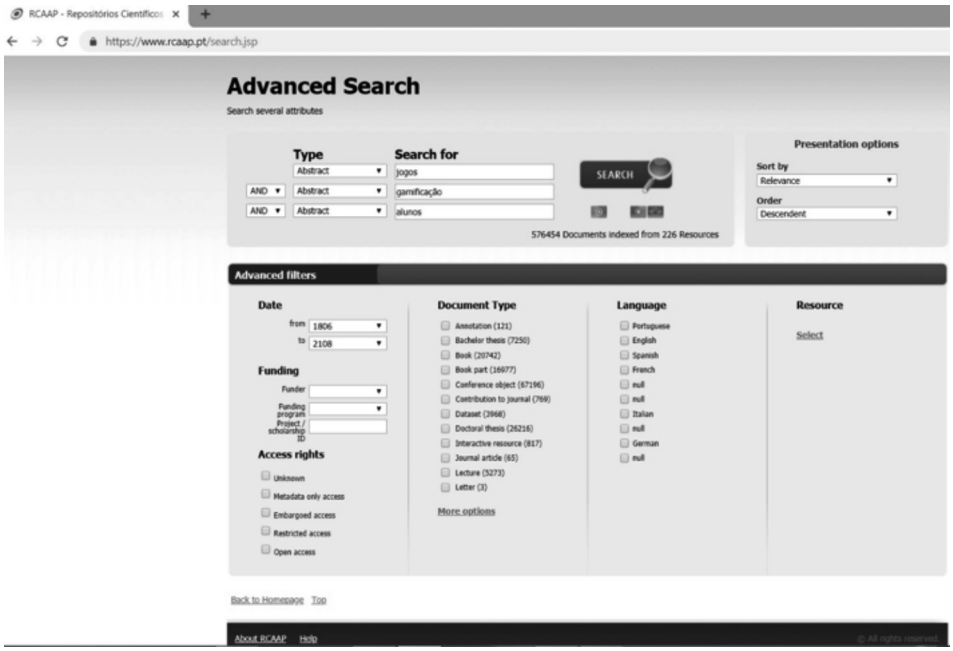


Figure 1. Boolean search on RCAAP

Source: data collected for this study.

A deeper look at other of the RCAAP's metadata, which is recovered from the blue columns that appear on the right side of the RCAAP's website (Figure 2), adding to most of the "document[s] details" (available by clicking on the "More info." button), enables to organize the documents differently, for instance as presented in table 2. It also makes it possible to proceed to the analysis of the corpus that is synthetized on the following section. It is worth mentioning again that with regard to the "Access rights" all of the 9 documents are "Open access", that is why this metadata is not included on table 2. The "description" is not included in table 2 as well, but its information was considered in the analysis of each document (as will be referred to afterwards). Moreover, the related document(s) suggested in each document details were not considered for analysis as they did not fit the purpose of this study.

Figure 2. Some of the Results of the search on RCAAP leading to definition of the corpus

Source: data collected for this study.

The analysis of the table 2 enables us to point out already to the following conclusions:

- the documents of the corpus of analysis Date mostly from the year 2018 (4 out of 9 documents); there are also documents from 2017 and 2016 (respectively 2 documents in each year), and also 1 document from 2019 – it should be noted that there will certainly be others indexed throughout the 2019 year;
- each document has only one Author, and there is no author with more than one document;
- the most prevailing Document type is the "Master thesis" (4 out of 9), followed by the "Research article" and the "Doctoral thesis" (respectively 2 documents each), and 1 "Conference object";
- the most represented Resource is the "RepositóriUM - Universidade do Minho" (with 2 documents, namely one "Master thesis" and one "Doctoral thesis"); in the other resources there is only one document for each, and

all except one are originally indexed in institutional repositories (the exception being the SCIELO Portugal, i.e. the Brustolin & Brandão's 2017 "Research article");

- all documents are written in the Portuguese Language, except one (Guimarães' 2016 "Master thesis", which is written in English);
- among the top 8 words presented in the RCAAP's Subject item/(meta) category all are in Portuguese; "gamification" is included in 7 of the 9 documents, whereas "sciences" appear in 5, "learning", "social" and "teaching" each in 4 documents, and finally "area", "scientific" and "domain" each in 3 documents.

TITLE					
Author(s)	Date	Document Type	Language	Origin or Resource	Subject(s)
ANÁLISE DE GAMIFICAÇÃO NO SIMULADOR DE OPERAÇÕES CIBERNÉTICAS (SIMOC)					
Brustolin,Fernando José ; Brandão,José Eduardo Malta de Sá	2017	Research article	Portuguese	SCIELO Portugal	gamificação; segurança cibernética; jogos; espaço cibernético de treinamento; estudo de caso
DESENVOLVIMENTO DE COMPETÊNCIAS TRANSVERSAIS NO ENSINO SUPERIOR					
Lopes, Rui Pedro ; Mesquita, Cristina ; Figueroa, Evaristo Galeana ; Rama, María de la Cruz del Río	2016	Conference object	Portuguese	Biblioteca Digital do IPB	Inquiry based learning; Ensino superior; Estratégias de ensino-aprendizagem; Pensamento crítico; Gamificação
A GAMIFICAÇÃO APLICADA NO PROCESSO DE ENSINO-APRENDIZAGEM DA DISCIPLINA DE ECONOMIA NO ENSINO PROFISSIONAL					
Assunção, António Pedro	2018	Master thesis Advisor(s) Cabrito, Belmiro Gil	Portuguese	Repositório da Universidade de Lisboa	Jogos; Gamificação; Educação; Aprendizagem; Motivação; Relatórios da prática de ensino supervisionada - 2018; Domínio/Área Científica::Ciências Sociais::Ciências da Educação; Domínio/Área Científica::Ciências Sociais::Ciências da Educação; Domínio/Área Científica::Ciências Sociais::Ciências da Educação

GAMIFICAÇÃO NO ENSINO DA GESTÃO					
Silva, Rui Jorge Rodrigues da	2019	Doctoral thesis Advisor(s) Rodrigues, Ricardo José de Ascensão Gouveia; Leal, Carmem Teresa Pereira	Portuguese	uBibliorum	Ensino da Gestão - Ensino Superior - Gamificação -; Gamificação - Processo Ensino--Aprendizagem; Gamificação - Ensino da Gestão - Portugal; Gamificação - Motivação - Alunos do Ensino Superior - Portugal; Domínio/Área Científica::Ciências Sociais::Gestão; Domínio/Área Científica::Ciências Sociais::Gestão; Domínio/Área Científica::-Ciências Sociais::Gestão
RECURSOS DIGITAIS PARA DIAGNÓSTICO E AVALIAÇÃO DO TEMA CIRCUNFERÊNCIA NO 3º CICLO DO ENSINO BÁSICO					
Rocha, Marta Isabel Cunha da	2017	Research article Advisor(s) Descalço, Luís; Oliveira, Paula	Portuguese	RIA - Repositório Institucional da Universidade de Aveiro	Gamificação; Recursos digitais; Ensino; Matemática; Circunferência; Ângulos; Arcos; Questões de escolha múltipla; Exercícios parametrizados
EDUCAÇÃO E TECNOLOGIAS DIGITAIS: A GESTÃO ESCOLAR QUE ALIA A ESTRATÉGIA DA GAMIFICAÇÃO AO PROCESSO DE ENSINO-APRENDIZAGEM					
Rodrigues, Larissa Berredo	2018	Master thesis Advisor(s) Estevão, Carlos Alberto Vilar	Portuguese	Veritati - Repositório Institucional da Universidade Católica Portuguesa	Educação; Gestão escolar; Tecnologias digitais; Gamificação; Education; School management; Digital technologies; Gamification; Domínio/Área Científica::Ciências Sociais::Ciências da Educação; Domínio/Área Científica::Ciências Sociais::Ciências da Educação; Domínio/Área Científica::Ciências Sociais::Ciências da Educação

SERIOUS GAME FOR LEARNING CODE INSPECTION SKILLS					
Joaquim Pedro Ribeiro Guimarães	2016	Master thesis [Supervisor: João Carlos Pascoal Faria]	English	Repositório Aberto da Universidade do Porto	Engenharia electrotécnica, electrónica e informática; Electrical engineering, Electronic engineering, Information engineering; Ciências da engenharia e tecnologias::Engenharia electrotécnica, electrónica e informática; Engineering and technology::Electrical engineering, Electronic engineering, Information engineering; Ciências da engenharia e tecnologias::Engenharia electrotécnica, electrónica e informática; Ciências da engenharia e tecnologias::Engenharia electrotécnica, electrónica e informática; Engineering and technology::Electrical engineering, Electronic engineering, Information engineering; Engineering and technology::Electrical engineering, Electronic engineering, Information engineering
"GAMIFICAÇÃO" NO ENSINO DE PROGRAMAÇÃO: ESTUDO DE UMA ESTRATÉGIA PEDAGÓGICA PARA SUCESSO NA APRENDIZAGEM					
Carvalho, Gil Manuel	2018	Master thesis Advisor(s) Osório, António José	Portuguese	RepositóriUM - Universidade do Minho	Ciências Sociais::Ciências da Educação; Ciências Sociais::Ciências da Educação; Ciências Sociais::Ciências da Educação

O IMPACTO DA ANIMAÇÃO E DA AVALIAÇÃO AUTOMÁTICA NA MOTIVAÇÃO PARA O ENSINO DA PROGRAMAÇÃO					
Tavares, Paula Correia	2018	Doctoral thesis Advisor(s) Henriques, Pedro Rangel; Gomes, Elsa Maria Ferreira	Portuguese	RepositóriUM - Universidade do Minho	Programação; Aprendizagem; Motivação e Auto-confiança dos alunos; Animação de Programas; Avaliação Automática de Programas; Feedback imediato; Gamificação; Programming; Learning; Students' motivation and Self-confidence; Program Animation; Automatic Program Evaluation; Immediate Feedback; Gamification

Table 2. Corpus of analysis organized according to the RCAAP's metadata and documents' details
Source: data collected for this study.

The mere exercise of recovering and analyzing the RCAAP's metadata and documents' details points out to the following further conclusions:

1. The information available in the RCAAP's document details is not the same for each document, that is, the (meta)categories may vary from document to document – e.g. in Guimarães (2016) the advisor is not presented (whereas in the other three master theses catalogued as such this information is mentioned);
2. The information available through the RCAAP does not always matches the information available in the document origin/resource – e.g. Rocha (2017) is catalogued in the RCAAP website as a "Research article", whereas in the RIA repository (the institutional repository of the University of Aveiro) it is catalogued as a master thesis (this could in fact be anticipated or assumed, since in the RCAAP's document details the advisors are indicated).

More conclusions can be withdrawn from an in-deeper analysis of the corpus, according to the MAECC's categories, as will be presented in the next section.

Meta-interpretation, discussion of the data and knowledge mapping

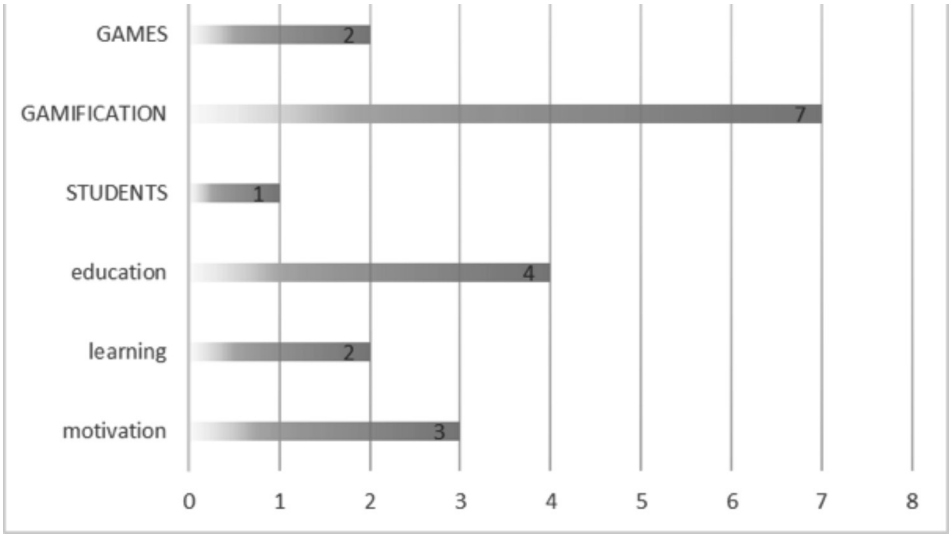
Besides the three concepts that were considered as descriptors during the Boolean search – namely, and as already mentioned, "jogos" (games), "gamificação" (gamification) and "alunos" (pupils/students) –, the analysis of the keywords listed in each document of the corpus evidences the terms presented in table 3. It is worth mentioning that the keywords are quoted like shown in each of the original document of the corpus; and that there are two documents with no keyword indicated, which is why there are not included in table 3 below (namely Guimarães, 2016; Carvalho, 2018). This fact points out again to the diversity of the meta-data included in each of the repositories aggregated in the RCAAP and, on the other hand, to the diversity of the norms of presenting institutional/scientific works.

Document's reference	Document's keywords
Brustolin & Brandão (2017)	gamification; cybersecurity; games; cyber range; case study
Lopes et al (2016)	inquiry-based learning; higher education; teaching-learning strategies; critical thinking; gamification
Assunção (2018)	games, gamification, education, learning, motivation
Silva (2019)	Gamification; Serious Games; Motivation; Flow; Attitude; Perceived Learning; Education; Management; Accounting; Marketing
Rocha (2017)	Gamification, digital resources, education, mathematics, circle, angle, arch, multiple choice questions, parameterized exercises
Rodrigues (2018)	"Education"; "School Management"; "Digital Technologies"; "Gamification"
Tavares (2017)	Programming; Learning; Students' motivation and Self-confidence; Program Animation; Automatic Program Evaluation; Immediate Feedback; Gamification

Table 3. Keywords of the documents analyzed according to the MAECC® matrix
Source: data collected for this study.

The analysis of the data presented in the above table 3 results for instance in the graph 1, with regard to the grouping of the descriptors defined for our study (games, gamification, pupils/students), highlighted in capital letters, and the top 5 keywords listed in each of the 7 documents in which they are indicated (games, gamification, education, learning, motivation).

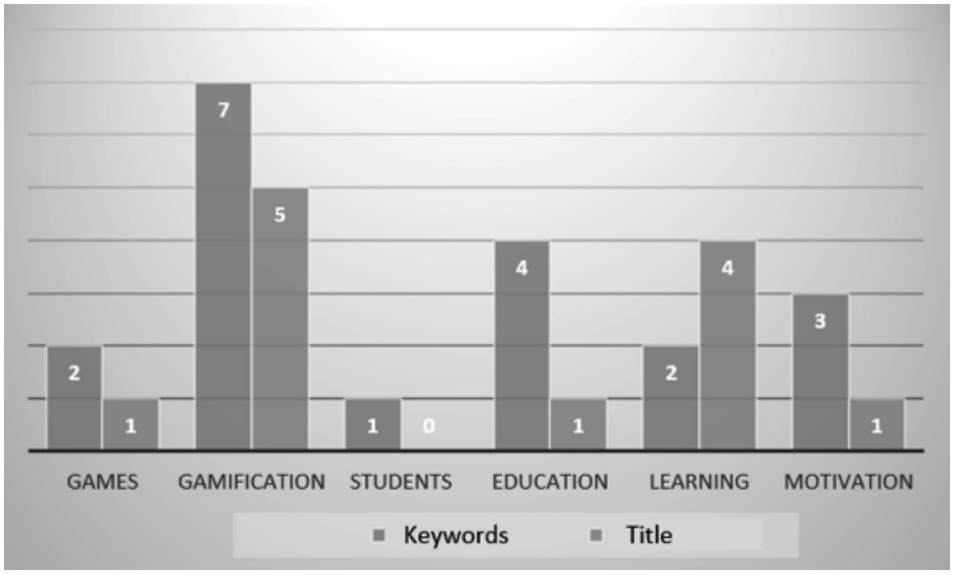
Graph 1. Total number of prevailing terms/concepts in the analyzed documents



Source: data collected for this study.

Regarding those 6 concepts (games, gamification, students, education, learning, motivation), it was further analyzed whether or not they are included in the title of the documents of the corpus. This comparison resulted in the graph 2, and it also evidenced that in two documents they are not mentioned in the title (Lopes et al, 2016; Rocha, 2017).

Graph 2. Comparison of the prevailing terms/concepts in the documents' keywords and titles



Source: data collected for this study.

However, gamification is still the predominant concept. But, is it characterized in the abstract of the documents? That is not the case in Rocha (2017), who again does not refer to gamification. On the contrary, Brustolin & Brandão (2017) state that "[t]he occurrence of eleven elements of games and of other practices associated with the gamification of learning and instruction were investigated to determine whether the SIMOC case is an example of gamification." Lopes et al (2016) consider gamification as a pedagogical approach, "applied as an integrated teaching-learning strategy. This includes the definition of formative evaluation, classification of students and learning experiences, that reconciles practical work with educational games". Moreover, Assunção (2018) includes gamification in "a set of new teaching strategies that promote student learning". He also recognizes the following:

> gamification has been presented as a powerful tool that can be used in several contexts, namely in Education. Gamification means the use of

> game elements in non-game contexts. It's a concept that reflects motivation, engagement, gameplay, reward systems and collaborative teaching. It makes the classroom more innovative and interactive where students become active agents of the teaching-learning process.

Silva (2019) shares a similar understanding, since he refers that:

> The gamification concept more often found in the literature and more widely accepted refers to the use of game design elements in non-game contexts, targeting an audience that uses them to acquire certain knowledge (Deterding, Dixon, Khaled, & Nacke, 2011). In that sense, gamification is applied in different areas, including education, and may be used as tool to enhance students' Motivation (MOT), Flow (FLO), Attitude (ATT) and Perceived Learning (PLE), allowing for significant improvement of the teaching/learning process. It has been used in different fields of knowledge, such as marketing, medicine, sports, engineering, mathematics, computing, history, languages, physics, chemistry, biology, among others.

Whereas for Rodrigues (2018), she only refers to gamification as a strategy too but without necessarily clarifying its conceptual meaning(s) or theoretical roots. However, she identifies how it can be implemented, for example by using "gameplay mechanics as punctuation, complying with rules, challenges, range of levels, receiving badges as the performance and awards, all planned strategically and monitored by the faculty member responsible for discipline." Guimarães (2016) does not clarify either (some of) the conceptual meaning(s) or theoretical roots of gamification. Instead, he refers to "an application that includes serious games concepts" and also to "add gamification concepts to it." For that purpose, he assumes that "it was necessary to research gamification elements that favor the continuous use of the application and promote competitiveness."

Tavares (2017) also only states that "[t]he importance of including, in the educational support systems, elements traditionally used in the context of games to stimulate the motivation was studied and an enrichment of PEP tool through the inclusion of techniques of gamification was still proposed." Finally, Carvalho

(2018) perceives gamification as a "process […], which is a strategy of interaction between students and teachers based on the offer of incentives that stimulate the commitment in a playful way."

Analyzing again the prevailing terms/concepts in the documents' keywords and titles (Graphs 1 and 2), and adding the subject areas in which games and gamification was applied a visual systematization can be provided as represented in figure 3.

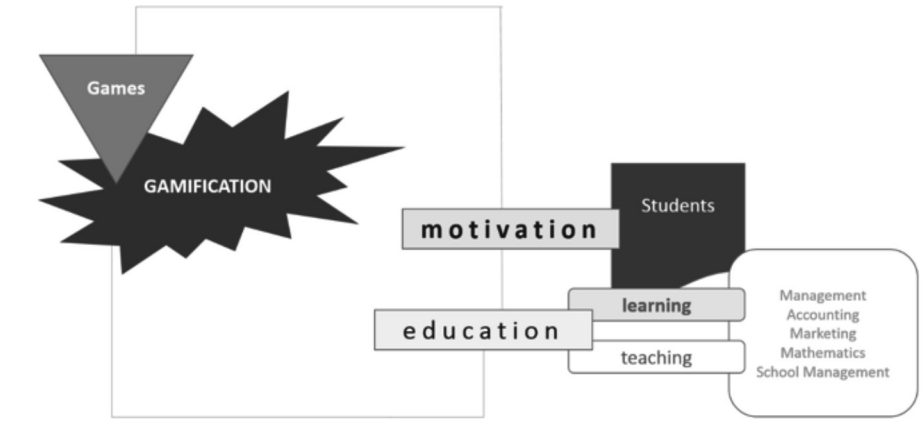


Figure 3. Conceptual map drawn upon the prevailing and other terms of the analyzed documents' keywords and titles

Source: data collected for this study

It is worth noting that in Figure 3 it was meant to weave a hierarchical network of possible relations between the meta-analyzed concepts; although its representation may seem elementary, the content, because it is complex, admits other interpretations, which can be intertwined in a later study, in a new (re)design of the conceptual map on games and gamification from the pupils/students' perspective, including by resorting to different tools (for example by using CmapTools, Mindomo, or similar resources).

Although not all of the MAECC's categories were fulfilled in this exploratory study, unlike what had initially been foreseen, it is clear that the analysis of the

conceptual contributions of the documents of the corpus alone can still be further explored. On the one hand, this fact can be explained by the richness of such literature reviews and knowledge systematization, and, on the other hand, by the demanding efforts they entail. In any case, the stimuli they provide for future research seems endless; some of these possible future directions will be pointed out together with the remarks provided in the final section of the text.

Final remarks and further research

As recognized in the previous paragraph, the research question defined for this study – Games and gamification in education: what does Portuguese research tell us from the perspective of the pupils? – discloses several other discoveries which were not yet unveiled in this text. Nevertheless, some of the answers that may shed some light on such a challenging and still emerging topic were revealed; it was decided to highlight two of them, as follows, since they are perceived to be the most significant ones.

From the analysis and mapping of the concept of gamification, as presented in the abstracts of the documents of our corpus, it can be highlighted that it emerges mainly as a consequence of a need to improve and update learning but above all teaching processes (namely and specifically focused on assessment strategies, including, for instance, automatic program evaluation, immediate feedback, multiple choice questions, and parameterized exercises). This focus on assessment may be explained by the current technological nature of games, as new alternative and digital forms of assessment are also being explored (cf. e.g. Cardoso, Pereira & Nunes, 2015).

So, the perspective of the pupil/student is not explicitly evidenced, as it was initially anticipated and expected. But again this could be predicted already from the moment that it was realized that the word "students" is mentioned just once, if we only bear in mind the documents' title and keywords (cf. Tavares, 2017). This conclusion must be further informed and complemented in a follow-up of our preliminary and exploratory research.

A follow-up research will ultimately also make it possible to identify good

practices and map recommendations, useful for the different educational actors, who are using or willing to use games and gamification. It is also expected that the results of further research will allow us to perceive the networks that are woven in Portugal on pedagogical practices using games and gamification in education, approaching its contributions to educational theory and practice from the perspective of the pupils. In short, it is hoped to further contribute to the knowledge on this subject that, due to its many potentialities, is important to continue to deepen. Because, as Pinto & Cardoso (2019) conclude, "the gamification of learning is a trend, as an inevitable and irreversible path, specially if we consider the potential of the application of artificial intelligence to digital games."

REFERENCES

Barradas, R.; Lencastre, J.A. (2017). Gamification e game-based learning: Estratégias eficazes para promover a competitividade positiva nos processos de ensino e de aprendizagem. Investigar em Educação, Edição Especial "Mundo digital e educação", vol. 6 (2), pp.11-37. Revista da SPCE, Sociedade Portuguesa de Ciências de Educação.

Bruner, J. (1966). Toward a theory of instruction. Cambridge: Harvard University Press.

Cardoso, T. (2007). Interacção verbal em aula de línguas: meta-análise da investigação portuguesa entre 1982-2002. Aveiro: Universidade de Aveiro. Tese de doutoramento. http://hdl.handle.net/10773/1465

Cardoso, T. (2012). Jogos e Mobile Learning em Portugal: em que nível estamos? Em A. A. A. Carvalho, T. Pessoa, S. Cruz, A. Moura & C. G. Marques (Org.). Atas do Encontro sobre Jogos e Mobile Learning, pp.61-76. Braga: CIEd. ISBN 978-989-8525-15-4.

Cardoso, T. (2018). Educação a Distância e Inclusão Digital: mapeamento de pesquisa em acesso aberto. In Mª J. Cavalcante et al. (Ed.). Tecnologias da Educação: passado, presente e futuro, pp.281-298. Fortaleza, Brasil: Edições UFC (Universidade Federal do Ceará). ISBN 978-85-7282-753-9.

Cardoso, T., Pestana, F. e Brás, S. (2018). A rede como interface educativa: uma reflexão em torno de conceitos fundamentais. Interfaces Científicas, v. 6, n. 3, pp.41- 52 http://dx.doi.org/10.17564/2316-3828.2018v6n3p41-52

Cardoso, T.; Alarcão, I.; Antunes Celorico, J. (2010). Revisão da Literatura e Sistematização do Conhecimento. Porto: Porto Editora. ISBN 978-972-0-34573-8.

Cardoso, T.; Pereira, A.; Nunes, L. (2015). Avaliação e tecnologias no ensino superior. Lisboa: LE@D, Laboratório de Educação a Distância e Elearning. ISBN 978-972-674-762-8 http://hdl.handle.net/10400.2/5775

Chapman, M. (1988). Constructive evolution: origins and development of Piaget´s thought. Cambridge: Cambridge University Press.

Huizinga, J. (1993). Homo ludens: o jogo como elemento da cultura. São Paulo: Perspectiva.

Johnson, L., Adams Becker, S., Cummins, M., Estrada, V., Freeman, A., & Ludgate, H. (2013). NMC Horizon Report: Edição Ensino Superior 2013. Tradução para o português por Ez2translate. Austin, Texas: O New Media Consortium.

Kishimoto, T. M. (2002). O Brincar e Suas Teorias. São Paulo: Pioneira Thomson Learning.

Piaget, J. (1990). Seis Estudos de Psicologia. Lisboa: Publicações D. Quixote.

Pinto, J., & Cardoso, T. (2017). Redes Sociais e Educação Aberta: Que relação? Em P. Torres (Org.). Redes e Mídias Sociais (2ª edição, pp. 75-92). Curitiba, Brasil: Appris Editora.

Pinto, J.; Cardoso, T. (2019). Aprendizagem baseada em jogos, um caminho de gamificação na era da inteligência artificial? Em Em Mª J. Gomes, A. Osório & A. L. Valente (Org.). Atas da XI Conferência Internacional de TIC na Educação «Challenges 2019: Desafios da Inteligência Artificial, Articial Intelligence Challenges». Braga: Universidade do Minho, Centro de Competência TIC do Instituto de Educação.

Pinto, J.; Cardoso, T.; Pestana, F. (2019). Competências Digitais, Qualificação e Empregabilidade. Um mapeamento dos documentos indexados no RCAAP em recursos portugueses, com acesso aberto e em Português. Em A. D. Figueiredo (Ed.), Número temático "Competências Digitais", RE@D - Revista de Educação a Distância e Elearning, (2)1, pp.26-45. Lisboa: LE@D, Laboratório de Educação a Distância e Elearning. http://hdl.handle.net/10400.2/8106

Pinto, J.; Pestana, F.; Cardoso, T. (2018). Competências Digitais, Qualificação e Empregabilidade: Constituição de um Corpus de Análise a partir do InCoDe.2030. Em P. Holanda et al (Eds.). Atas da XVII CHEC - Conferência de História Comparada do Ceará «CHEC 2018: Tecnologias do passado, presente e do futuro». Fortaleza, Brasil: Editora UFC (Universidade Federal do Ceará), pp.804-814. ISSN 2237-2229.

Vygotsky, L. S. (2007). A Formação Social da Mente (7.ª ed.). São Paulo: Martins Fontes.

Weed, M. (2005). "Meta Interpretation": A Method for the Interpretive Synthesis of Qualitative Research. Forum Qualitative Sozialforschung / Forum: Qualitative Social Research, 6(1). http://dx.doi.org/10.17169/fqs-6.1.508

CORPUS OF ANALYSIS

Assunção, A. P. (2018). A gamificação aplicada no processo de ensino-aprendizagem da disciplina de economia no ensino profissional. Relatório da Prática de Ensino Supervisionada, Mestrado em Ensino de Economia e de Contabilidade. Lisboa: Universidade de Lisboa, Instituto de Educação. http://hdl.handle.net/10451/34851

Brustolin, F. J.; Brandão, J. (2017). Análise de Gamificação no Simulador de Operações

Cibernéticas (SIMOC). RISTI - Revista Ibérica de Sistemas e Tecnologias de Informação, (23), pp.103-118. https://dx.doi.org/10.17013/risti.23.103-118

Carvalho, G. (2018). "Gamificação" no ensino de programação: estudo de uma estratégia pedagógica para sucesso na aprendizagem. Braga: Universidade do Minho. Dissertação de mestrado. http://hdl.handle.net/1822/58254

Guimarães, J. (2016). Serious Game for Learning Code Inspection Skills. Porto: Universidade do Porto. Dissertação de mestrado. https://repositorio-aberto.up.pt/handle/10216/104327

Lopes, R. P.; Mesquita, C.; Figueroa, E. G.; Rama, Mª (2016). Desenvolvimento de competências transversais no Ensino Superior. Em People, Source of Innovation and Value Creation in the Organization. Riga, Latvia. http://hdl.handle.net/10198/13693

Rocha, M. (2017). Recursos digitais para diagnóstico e avaliação do tema Circunferência no 3º ciclo do ensino básico. Aveiro: Universidade de Aveiro. Dissertação de mestrado. http://hdl.handle.net/10773/25087

Rodrigues, L. (2018). Educação e tecnologias digitais: a gestão escolar que alia a estratégia da gamificação ao processo de ensino-aprendizagem. Lisboa: Universidade Católica Portuguesa. Dissertação de mestrado. http://hdl.handle.net/10400.14/27337

Silva, R. (2019). Gamificação no Ensino da Gestão. O caso das Unidades Curriculares de Contabilidade e do Marketing. Covilhã: Universidade da Beira Interior. Tese de doutoramento. http://hdl.handle.net/10400.6/6977

Tavares, P. (2018). O impacto da animação e da avaliação automática na motivação para o ensino da programação. Braga: Universidade do Minho. Tese de doutoramento. http://hdl.handle.net/1822/55902

Chapter 8

THE FORMATIVE SCENARIO OF VIDEOGAMES AND GAMIFICATION: CONTRIBUTIONS FROM PUBLICATIONS IN SPANISH SCIENTIFIC JOURNALS OF EDUCATION AND SOCIAL SCIENCES

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Clarifying concepts: video games, gamification and serious video games

Among one of technologies that have recently been considered as positive in its incorporation into teaching, and in a variety of educational levels, is the triad formed by videogames, serious videogames and gamification, although they imply different conceptions as it shall be discussed, they allow teachers to attract their students to educational content they wish to develop and have students learn by engaging in entertaining activities; thus in different reports Horizon (Johnson et al., 2012, 2013 and 2014) point to them as technologies that will have a strong penetration across different educational levels.

As López (2016, 2) points out: "The possibilities of incorporating videogames as a pedagogical tool have been discussed since their emergence in cultural life in the mid-eighties." It was understood in the educational world that video games would bring about a link amongst new generations, born in the digital era, with classic pedagogical programs. "In any case, as the author cited above also signals in their incorporation into the educational system, more lights appear than shadows, and a number of these aspects shall be discussed in our work.

We must therefore start by presenting the analysis that has made of them, we will proceed to clarify what is to be understood by them, because all three involve

different aspects, even if they are related. We can state from the beginning that a videogame is an element that presents a series of distinctive characteristics: it is electronic, it is interactive, it is based on a set of rules and established restrictions, it is oriented to a clear objective that is often considered a challenge, and offers feedback on a continuous basis to facilitate the user to control their progress to achieve the objective or challenge (González-Calero and Arnau, 2018).

The fundamental difference between "video games" and the so-called "serious video games" lies within the fact that the former are designed from a commercial stance and the latter are designed to fulfill an educational function: training certain skills or understanding complex processes (social, political, economic, psychological or religious). On the other hand López (2016) points out that "serious video games" are related, from their simulation, to some aspect of reality, which generates an identification between the player and the part of reality represented in the virtual simulation. It is possible to speak of an immersion in the problem that you want to present from your virtual simulation; and at the same time, its educational nature comes because the recreation of a virtual simulation allows the player an experimentation without risks.

Hence, it can be stated that "serious games" are games designed with a formative purpose rather than for entertainment purposes. The expression "serious" refers to those games that are used in the educational and scientific sector, their main use being in the field of medical care, urban planning, engineering and politics. In the field of education they are quite effective for learning specific skills in the field of languages, mathematics, or communication skills. With them, the resolution of real problems in a simulated reality environments is pursued, which renders their use difficult for purposes different than those for which they were created, being quite effective because of the possibilities they present: showing examples that are difficult to teach in real life, provide joy and pleasure, motivate students, encourage cooperation with others, sharpen creativity, reward achievements in an immersive manner, their ability to simulate reality, key tool to promote learning and transfer knowledge, promote ability to work as a team, encourage experimentation or learning by doing, interactivity and immediate feedback, error is naturalized, the concepts of negotiation, delegation and trust are strengthened and other opinions

are valued, tolerated and accepted (Gallego et al., 2014 ; Poy-Castro et al., 2015; Wartenweiler, 2018).

Its design, which implies the putting into action of specific narrative structures (Morales, 2015), brings an inherent difficulty in knowing how to define the primary and secondary objective that we can pursue with it, and as Gonzalez and Quero (2016) specify, if we place the educational as the main objective and leisure as a secondary one, the motivation of the student-player to advance in the game is jeopardized, because he perceives that it is a game to learn and no longer interested. On the contrary, if we prioritize the continuity of the player, a greater time of exposure of the student-player to the contents is achieved, and in this way they are more effective for learning.

On the other hand, gamification implies "using mechanics, aesthetics and thinking based on games to involve people, motivate action, promote learning and solve problems" (Kapp, 2012, 10), for Capell and others (2017 , 135) the gamification consists of "the use of strategies, dynamics and elements of the game in contexts and environments not proper to it, with the aim of transmitting something through involvement and motivation, within the recreational framework of fun..

On the other hand, for Tecnológico de Monterrey (2016, 4) gamification "is the application of principles and elements of the game in a learning environment with the purpose of influencing behavior, increasing motivation and encouraging student participation. ", All with the purpose of solving a problem, and as a teaching strategy used in teaching is used to" provoke specific behaviors in the student within an environment that is attractive to the student, that generates a commitment to the activity being engaged in and which supports the achievement of positive experiences to achieve meaningful learning. " (Tecnológico de Monterrey, 2016, 8). To summarize, it is used with the intention of increasing the participation and motivation of students (Castañeda et al., 2015), and as Sanchez and others (2017) have suggested, at no time should it be understood as a simple addition of points or badges in training contexts.

To conclude this presentation of definitions, and in order to synthesize, we will cite the considerations made by the Tecnológico de Monterrey (2016, 9) for the

three terms we have cited: gamification, serious games and game-based learning:

- Gamification: "It entails the use of principles and elements of games to motivate learning, not properly the use of games in themselves."
- Serious games: "These can be defined as immersive computer-based games for educational and informational purposes."
- Games-based learning: "The use of games or video games as a medium for learning"

Its possible success in teaching is justified by various happenings, one of which can be taken from the work by Gonzalez and Quero (2016, 370) commenting the following about the possibilities offered by video games for education: "It is an invitation to broaden our learning zone and explore the panic zone or non-experience zone through the game and the invitation to participate and to transgress in a friendly, pleasant and free learning space for experimentation ". And another, of the research that has been done regarding the perceptions that teachers and future teachers have of the usefulness of these technologies for learning that is truly significant (Aznar-Díaz and others, 2017, Correa and others, 2017, Lorca and others, 2017). Hence, it can be clearly said that the learning aspect based on digital games is gaining strength and is attracting attention for its application in educational environments (Herrero et al., 2017).

What do video games, gamification and serious games add to the educational context?

We must start by acknowledging that from its origin the contributions that have been granted to videogames, to serious videogames and to gamification, come many times more from pseudo pedagogical speculations and educational myths than from distinctions made through educational research. The latter is precisely one of the problems they present for their incorporation into teaching and one of the needs claimed by different people related to the field of educational technology (Marín, 2012). While we must also recognize that some of the meta-analyzes carried out on research and publications have indicated their positive effects

(Commolly et al., 2012; Sampedro, 2012).

Where it seems that there is some agreement in different research is that its use improves student motivation, their level of satisfaction with the development of the subject and attention span (Commolly and others, 2012, Sampedro, 2012, Almonte and Bravo, 2016).

There is also certain concurrence that their incorporation into teaching improves perception skills and spatial recognition, acuity and visual attention, special representation, oculo-manual coordination, the speed of reaction to multiple stimuli (Sampedro, 2012; López, 2016, González and Quiros, 2016, Barr, 2017). In summary, it improves different psychomotor skills.

From a neuroscientific stance, the theory of multiple intelligences and learning approaches has been questioned (Mora, 2018), a group of authors indicate that the elements we are analyzing have high potential to favor different types of intelligences. and students who have an active learning style (Sampedro, 2012, González and Queró, 2016). What is certain is that different types of strategies used with videogames and gamification favor the development of collaborative learning and social skills among students to reach the solution and overcome the challenges of the game (Martín, 2017; García and others, 2019).

We seem to find some consensus in different researches carried out, in that their use improves logical reasoning, facilitates mathematical learning, and different aspects of cognitive development related to the scientific-technical field (González and Quiros, 2016; Capell and others, 2017, González-Calero and Arnau, 2018, Hartanto and others, 2018, Lorca and others, 2019).

Another area of teaching in which its effectiveness is shown is the acquisition of reading and writing skills (Aguilar and Adell, 2018, Jiménez and Diez-Martínez, 2018, Del Moral and others, 2018, Hartanto and others, 2018).

Finally, it should be noted that in the case of gamification, in addition to some of the aspects mentioned above, specific potential for the evaluation and assessment of students is recognized (Castañeda and others, 2015, Del Moral, Guzmán and Fernández, 2017), as well as its incorporation into e-learning, b-learning

and MOOC actions (Mattar and Nesteriuk, 2016, García-Sastre and others, 2018, Torres-Toukoumidis and others, 2018).

Contributions from the review of the research published in Spanish scientific journals.

Having made these comments, we shall proceed to present the research we have carried out. Indicating that in the first place the objective was to perform a meta-analysis of the articles published in Spanish scientific journals on the educational field and the social sciences on the topics of video games, educational use of video games, serious games and gamification. For the selection of the articles a criterion was adopted that the journals were indexed in 2018 in the "Emerging Sources Citation Index", to which some journals of the JCR database were incorporated.

The period of analysis was between the years 2009 and 2019, articles from 39 journals were reviewed, using the key words: "videogames", "serious videogames" and "gamification." Identifying 153 articles. The journals with the most articles published in the aforementioned period were: "RED" (15) (https://www.um.es/ead/red/red.html), "Digital Education Review" (12), "PixelBit. Revista de Medios y Educación" (12) "https://recyt.fecyt.es/index.php/pixel), "Relatec" (11), "Educar" (9), "RIED" (9) (http://revistas.uned.es/index.php/ried), "Edmetic" (8) (http://www.uco.es/ucopress/ojs/index.php/edmetic/index), y "Journal of New Approaches" (8) (https://naerjournal.ua.es/).

To achieve our goal, the following phases were followed: a) Identification of the journals; b) Selection of articles; c) Analysis tab creation; d) Coding of the articles; and e) Obtaining conclusions.

The analysis sheet includes the following elements: a) Author / s, b) Magazine, c) Number, d) Year, e) Name of the article, f) Theoretical or Research article, g) Educational level of development of the experience, h) Variables analyzed, i) Type of instruments used for the collection of information, and j) Results obtained.

It should be noted that 65 articles were theoretical, 77 investigations and 11 that

could be classified as documentary research focused on different problems related to the resources we analyze, such as: gamification and e-learning (Torres-TouKoumidis et al., 2018), gamification and intellectual disability (Del Moral and Villalustre, 2018; Vidal and others, 2018), video games and collaborative learning in primary education (Martín, 2015), or the creation of videogames by teachers) (Dorado and Gewec, 2017).

In terms of years the publications of articles were distributed in the following way: 2009 (3), 2010 (7), 2011 (7), 2012 (4), 2012 (4), 2013 (9), 2014 (17), 2015 (18), 2016 (27), 2017 (27), 2018 (31) y 2019 (3). We must also note that the vast majority of articles (111) focused on video games, followed by gamification (28) and 12 that referred to the theme of "serious video games".

Regarding the educational level in which they were focused, and in this case only taking into account the articles that were research, the highest percentage is found in secondary / high school (23), followed by infant / primary (19), University (16), and social guarantee programs (1). Nine of the articles had been made with a population that could comprise different educational levels and another nine were related to the teaching staff.

The interest of the subject we have analyzed has awakened as we can see in the appearance of different monographs in specific journals: NAER (2014 - "Videogames: oppor tunities for learning"), Educate (2017 - "Learning through the gamification"), and Edmetic (2018 - "Neuro-educational and socio-emotional bases for working with videogames in educational contexts."

It should also be stated from the beginning that there is a strong trend among students, in using video games for merely recreational purposes while wasting the educational possibilities they offer (Ricoy and Ameneiros, 2016), of which we will see below are positive.

The analysis of the articles allows us to reach a series of conclusions, and the first of them, and where there is a real agreement is that the use of these instruments arouses real motivation, acceptance and positive attitudes on the part of students (Marcano, 2014, Chacón and others, 2016, De Castro, 2015, Evaristo-Chyong,

2016, Legerén and Doval, 2016, Munday 2016, Rico y Agudo, 2016, Vergara and Mezquita, 2016, Alonso, 2018, Cornellá Estebanell, 2018, Chiazzese and others, 2018, Moreno and Suvires, 2018, Fernández-Rubio and Fernández-Oliveras, 2018).

Another aspect that we could highlight is that its use has been proven effective for students to acquire the skills provided in the subject and improve their academic performance and this has happened with different disciplines, such as: history (Evaristo-Chyong, 2016 ; Moreno and Suvires, 2018), graphic design (Labrador and Villegas, 2016), business economics (Vergara and Mezquita, 2016), mathematics, mental calculation and solving mathematical problems (Nieto et al., 2014; Gutiérrez-Soto, 2015, Ramos y Botella, 2016, Capell, others, 2017, biology (Herrero and others, 2014), history (Rodríguez and Gutiérrez, 2016, García-Gómez and others, 2017), or environment science (Sampedro and others, 2017).

Specifically, different studies have shown the relevance of this type of mediafor language learning, the acquisition of reading fluency, reading comprehension, the acquisition of new vocabulary, and the acquisition of linguistic and reading skills thanks to its effectiveness in revising vocabulary. and grammar through specialized repetitions (De Castro, 2015, Munday, 2016, Rico and Agudo, 2016, Brazo et al, 2018). As well as its proficiency in the treatment of dyslexia (Jiménez-Porta and Dice-Martinee, 2018).

We must specify that a series of investigations have shown that its use has been proven to be effective for a range of aspects: acquisition of team work skills and collaborative work (Del-Moral and Guzmán-Duque, 2014; Quesada and Tejedor, 2016); improve ICT skills and digital competence (Quintanal, 2014), development of personal, social and intellectual skills (Quintanal, 2016), acquisition of norms of conduct (Del Castillo and others, 2012), or the development of computational thinking (Chiazzese and others, 2018). At the same time different works have pointed out how their use can be used for the empowerment of the different multiple intelligences (Garmen et al., 2019; Del Moral et al., 2016).

Research papers have also been published that show negative aspects in their interaction, such as, for example, that their use produces cognitive disorders in

students (Carmona et al., 2011), or that a high frequency of use has an impact on the decrease of grades and academic performance (Chacón and others, 2017) and in the increase of the obesity of the gamers (González and others, 2017). We should all recognize that, in the Spanish context, there is not a great abuse of commercial videogames consumption by high school and university students (Castro et al., 2015), furthermore students perceive that their use does not isolate them, but on the contrary they function as socializing instruments (Sánchez et al., 2010) enabling them to be in contact with other people.

In any case, we must be aware that the mediating role played by the family is decisive regarding the time that teenagers spend on the screen and in the type of content consumed in video games, and in the distribution of study-videogame time (Bringué and others ----; Lloret and others, 2013)

A volume of research has developed in what we might consider its use from a gender perspective; and here the results draw attention to the fact that women show greater responsibility both in the activity they do with video games, where they prefer strategy video games, and in the time invested, on the contrary, the boys spend more time and prefer violent games (Espejo et al, 2015; Ricoy and Ameneiros, 2016; Sierra and Fernández, 2017). Elseways, different works highlight that men consume videogame at a higher rate than women (Espejo et al., 2018, Marín, and others, 2019).

Its use has been shown as positive in the development of social skills and communication in people with Downe syndrome; likewise, the teachers who have implemented them appreciate improvements with respect to work in the classroom with students with special educational needs in aspects such as the use of time, motivation, performance or the extension of the educational process outside the classroom (Sánchez-Rivas and others 2017; Aguilar and Adell, 2018). Also, Cortes and others (2012) conclude that their use helps these people build their social identity.

Another line of work has focused on the perceptions that teachers have of these educational resources. We should state that their incorporation to into teaching and as instruments of educational innovation are well perceived by teachers, both

in gamification (García, 2014, Marín and others, 2015, Aznar-Díaz and others 2017), as well as videogames (Del Moral and Fernández, 2015; Conde and Rodríguez, 2018). The professors also perceived by researchers as key informants, both for their evaluation and co-production (Eguía-Gómez and others, 2015, Contreras-Espinosa and others, 2016). Being useful elements for the empowerment of the development of emotional skills in teachers (Guerra et al., 2018).

Finally, we should remark that when research has been carried out with professional players of commercial videogames, it has been found that they obtain higher scores in attention, flexibility and cognitive interference than peers of their same age who are not players (Perea and De la Peña, 2018).

As far as the type of research is concerned, the vast majority could be classified within the quantitative paradigm; The following instruments are generally used: Likert questionnaire (Evaristo-Chyong, 2016; Rico and Agudo, 2016; Rodríguez and Gutiérrez, 2016; Vergara and Mezquita, 2016; Chacón and others, 2017; Sánchez-Rivas and others, 2017; Sierra and Fernández, 2017, Alonso, 2018, Moreno and Suvires, 2018); Performance test (Gutiérrez-Soto, 2015; Moreno and Suvires, 2018); reading comprehension test (De Castro, 2015); standardized tests (psychological, physiological, skills, competences, logical-mathematical, naturalistic and linguistic intelligences of each student, ... (González et al., 2017 ;, Aguilar and Adell, 2018; Del Moral and others, 2018; Perea and De La Peña, 2018), interviews (Eguía-Gómez and others, 2015, Cortés and others, 2012), and observation (Quesada and Tejedor, 2016; Capell et al., 2017).

In conclusion

The documentary review study carried out allows us to identify a series of ideas, which we summarize in the following statements: 1) The studies have focused mainly on the educational possibilities of video games and not so much in the analysis of "serious games" and in gamification; 2) There is a progressive trend towards your research; the vast majority of localized jobs have occurred in recent years; 3) Its application has focused on a diversity of knowledge areas and at different educational levels, recognizing their validity in the educational

application; 4) We have not found research that tends to point out that its incorporation into teaching has negative consequences; 5) Both teachers and students show support for their educational incorporation; and 6) Its incorporation into the educational practice has a positive impact, both in the motivation for learning and in the improvement of academic performance and in the acquisition and improvement of different skills and abilities..

Finally, note, that on one side, that it is necessary to carry out investigations that are not specific actions but more developed longitudinally in time, and where at the same time different types of variables that could interfere in the results found are controlled, and on the other side, research in the search for research strategies.

References

Aguilar, L. y Adell, J. (2018). Instrumento de evaluación de un videojuego educativo facilitador del aprendizaje de habilidades prosódicas y comunicativas. RED. Revista de Educación a Distancia, 58, Artíc. 6, 31-10-2018.

Alonso, A. (2018). Evaluación de un videojuego educativo de contenido histórico. La opinión de los estudiantes. Relatec, 17(1), 61-75.

Aznar-Díaz, I. y otros (2017). Percepciones de los futuros docentes respecto al potencial de la ludificación y la inclusión de los videojuegos en los procesos de enseñanza-aprendizaje. Educar, 53(1), 11-28.

Barr, M. (2017). Video games can develop graduate skills in higher education students: A randomised trial. Computes & Education, 80, 86-97.

Brazo, A. I. y otros (2018). Aprendiendo léxico y ortografía francesa en la universidad mediante el videojuego SRIBBLENAUTS. EDMETIC, Revista de Educación Mediática y TIC, 7(2), 18-36.

Bringué, X. y otros (2013). Menores y ocio digital en el siglo XXI. Análisis exploratorio de perfiles de usuarios de videojuegos en España. Bordón, 65(1), 147-164.

Capell, N., Tejada, J. & Bosco, A. (2017). Los videojuegos como medio de aprendizaje: un estudio de caso en matemáticas en educación primaria. Píxel-Bit. Revista de Medios y Educación, 51, 133-150.

Carmona, J. y otros (2011). MII-School: A 3d videogame for the early detection of abuse of substances, bullying, and mental disorders in adolescents. European Journal of Education and Psychology, 4(1), 75-85.

Castañeda, L. y otros (2015). Pedagogías emergentes: tecnologías para la educación flexible, En Cabero, J. y Barroso, J. (coords.). Nuevos retos en tecnología educativa, Madrid: Síntesis, 195-214.

Castro, M. y otros (2015). Uso de videojuegos y su relación con las conductas sedentarias en una población escolar y universitaria. Journal for Educators, Teachers and Trainers, 6(1), 56– 66.

Chacón, R. y otros (2016). Videojuegos Activos como recurso TIC en el Aula de Educación Física: estudio a partir de parámetros de Ocio Digital. Digital Education Review, 29, 112-123.

Chiazzese, G. y otros (2018). Engaging Primary School Children in Computational Thinking: Designing and Developing Videogames. EKS, 19(2), 63-81.

Conde, I. y otros (2018). Indagando en las experiencias del profesorado para incorporar los exergames en las aulas de Educación Física. Edmetic7(2), 1-17.

Correa, R. y otros, (2017). Horizontes educativos de los videojuegos. Propuestas y reflexiones de futuros maestros y educadores sociales. Educar, 53(1), 67-88.

De Castro, J. (2015). Maximum consequentia: un videojuego educativo para Ejercitar la comprensión lectora. Innovación Educativa, 25, 191-206.

Del Moral, E. Villalustre, L. (2018). Análisis de serious games anti-bullying: recursos lúdicos para promover habilidades prosociales en escolares. Revista Complutense de Educación, 29(4), 1345-1364.

Del Moral, E. y Fernández, C. (2015). Videojuegos en las aulas: implicaciones de una innovación disruptiva para desarrollar las Inteligencias Múltiples. Revista Complutense de Educación, 26(Núm. Especial), 97-118.

Del Moral, E. y otros (2016). Proyecto Game to Learn: aprendizaje basado en Juegos para potenciar las inteligencias lógico- matemática, naturalista y lingüística en educación primaria. Pixel-Bit. Revista de Medios y Educación, 49, 177-193.

Del Moral, E. y otros (2018a). Game-Based Learning: Increasing the Logical-Mathematical, Naturalistic, and Linguistic Learning Levels of Primary School Students. Journal of New Approaches in Educational Research, 7(1), 31-39.

Del Moral, E. y otros (2018b). Aprendizaje basado en juegos: activando las inteligencias lógico-matemática, naturalista y lingüística en el alumnado de Primaria. NAER.

Del-Moral, E. y Guzmán-Duque, A. (2014). CityVille: juego colaborativo, comunicación y desarrollo de habilidades en redes sociales. NAER, 3.

Dorado, S. y Gewec, A. (2017). El profesorado español en la creación de materiales didácticos: los videojuegos educativos. Dgital Education Review, 31, 176-195.

Eguia-Gómez, J.L. y otros (2015). Juegos digitales desde el punto de vista de los profesores. Una experiencia didáctica en aulas primaria catalanas. EKS, 16(2), 31-48.

Espejo, T. y otros (2015). Análisis descriptivo del uso problemático y hábitos de consumo de los videojuegos con relación al género en estudiantes universitarios. Relatec, 14(3), 85-93.

Evaristo-Chiyong, I. y otros (2016). Uso de un videojuego educativo como herramienta para aprender historia del Perú. RIED. 19(2), 35-52.

Garcia, F., Valls, C., & Gisbert, M. (2019). Diseño e implementación de un cambio

metodológico en el ámbito científico mediante la gamificación y el modelo de las 5E. Edutec. Revista Electrónica De Tecnología Educativa, (66). https://doi.org/10.21556/edutec.2018.66.1187

García-Gómez, S. y otros (2017). ¿Los alumnos quieren aprender con videojuegos? Lo que opinan sus usuarios del potencial educativo de este medio. Educar, 53.

García-Sastre, S. y otros (2018). Uso de la colaboración y la gamificación en MOOC: un análisis exploratorio. RIED. Revista Iberoamericana de Educación a Distancia (2018), 21(2), 263-283.

Garmen, P. y otros (2019). Inteligencias múltiples y videojuegos: Evaluación e intervención con software TOI. Comunicar, 58, 95-104.

González, J.M. y Quero, M. (2016). Los videojuegos como recursos educativos., en Cacheiro, M.L., Sánchez, C. y González, J.M. (coords.). Recursos tecnológicos en contextos educativos. Madrid: UNED, 348-389.

González-Calero, J. y Arnau, D. (2018). Game over or continue? Los videojuegos en la enseñanza de las matemáticas. En Cózar, R. y De Moya, M. (coords.). Entornos humanos digitalizados: experiencias TIC en escenarios educativos. Madrid: Síntesis, 17-33.

Guerra, J. y otros (2018). Percepción de habilidades docentes a través de las emociones mediante el uso de videojuegos de temática social. Edmetic. 7(2), 57-77.

Hartanto, A., Toh, W. X., & Yang, H. (2018). Context counts: The different implications of weekday and weekend video gaming for academic performance in mathematics, reading, and science. Computes & Education, 120, 51-63.

Herrero, D. y otros (2014). La Teoría de la Evolución y la selección natural: aprender a través del juego y la reflexión. NAER, 3.

Herrero, M. y otros (2017). Aprendizajes científicos y educación ambiental en entornos lúdicos: potencialidad de un videojuego en línea sobre desastres naturales para la educación formal de maestros. In Actas del V Congreso Internacional de Videojuegos y Educación (CIVE'17). https://riull.ull.es/xmlui/bitstream/handle/915/6680/CIVE17_paper_16.pdf?sequence=1&isAllowed=y.

Jiménez, A. y Diez-Martínez, E. (2018). Análisis del contenido de apps y videojuegos: implicaciones en procesos cognitivos en la lectura inicial. Apertura, 10(1), 71-87.

Johnson, L. y otros (2012). The NMC Horizon Report: 2012 Higher Education Edition. Austin, Texas: The New Media Consortium.

Johnson, L. y otros (2013). Technology Outlook for Australian Tertiary Education 2013-2018: An NMC Horizon Project Regional Analysis. Austin, Texas: The New Media Consortium.

Johnson, L. y otros (2014). NMC Horizon Report: 2014 Higher Education Edition.

Austin, Texas, Estados Unidos: The New Media Consortium.

Kapp, K. (2012). The Gamification of Learning and Instruction. Game-based methods and Strategies for Training and Education. San Francisco: Pfeiffer.

Labrador, E., y Villegas, E. (2016). Unir Gamificación y Experiencia de Usuario para

mejorar la experiencia docente. RIED, 19(2), 125-142.
Legerén, B. y Doval, M. (2016). We are European Citizens. Playing to learn to be European. EKS, 16(2), 49-68.

Lloret, D. y otros (2013). Relaciones entre hábitos de uso de videojuegos, control parental y rendimiento escolar. European Journal of Investigation in Health, Psychology and Education, 3(3), 237-248.

López, C. (2016). El videojuego como herramienta educativa. Posibilidades y problemáticas acerca de los serious games. Apertura, Revista de Innovación Educativa, 8(1), 1-15.
Lorca, A. y otros (2017). Actitudes de los docentes en formación inicial sobre videojuegos. Digital Education Review, 31, 39-60.

Lorca, A. y otros (2019). Cuestionario sobre actitudes y concepciones en los videojuegos y su implicación didáctica en el aula de Ciencias (CVJ/AC): características psicométricas. International Journal of Educational Research and Innovation, 11, 101-120.
Marcano, B. (2014). Gráficos, jugabilidad e interacción social, las mayores motivaciones para jugar Call of duty. Reflexiones educativas. NAER, 3, -------

Marín, V. y otros (2015). ¿Puede entrar la Gamificación en las aulas de primaria? Digital Education Review, 27, 55-68.

Marín, V. y otros (2019). Posibilidades educativas de los videojuegos en la etapa de Primaria según los maestros en formación. Estudio de caso. NAER, 8, -----

Martín, M. (2015). Potencia el aprendizaje colaborativo (Martín, M. (2015). Videojuegos y aprendizaje colaborativo. Experiencias en torno a la etapa de Educación Primaria. Enseñanza & Teaching, 16(2), 69-89.

Mattar, J. y Nesteriuk, S. (2016). Estratégias do Design de Games que podem ser incorporadas à Educação a Distância. RIED. Revista Iberoamericana de Educación a Distancia, 19(2), 91-106.

Morales, J. (2015). Serious Games. Diseño de videojuegos con una agenda educativa y social. Barcelona: UOC.

Moreno, V. y Suvires, M.A. (2018). Gamificación en la docencia de lingüística clínica: un Cluedo para los trastornos del lenguaje. @tic, 21, 49-56.

Munday, P. (2016). The case for using DUOLINGO as part of the language classroom experience. RIED, 19(1), 83-101.

Nieto, S. y otros (2014). Xbox360Kinect: herramienta tecnológica aplicada para el desarrollo de habilidades matemáticas básicas, en alumnos de segundo grado de Educación Básica en México. Relatec, 13(2), 103-117.

Perea, M. y De la Peña, C. (2018). Influencia de los videojuegos comerciales en procesos neuropsicológicos en estudiantes universitarios. REIDOCREA, 7, artículo 5, 55-62.

Quesada, A. y Tejedor, S. (2016). Aplicaciones educativas de los videojuegos: el caso de World of Warcraft. Piexel-Bit. Revista de Medios y Educación, 48, 187-196.

Quintanal, F. (2016). Gamificación y la Física–Química de Secundaria. EKS, 17(3), 13-28.

Ramos, S. y Botella, A.M. (2016). La integración del videojuego educativo con el folklore. Una propuesta de aplicación en Educación Primaria. Revista Electrónica Interuniversitaria De Formación del Profesorado, 19(3), 115-‑121.

Rico, M. y Agudo, J. (2016). Aprendizaje móvil de inglés mediante juegos de espías en Educación Secundaria. RIED, 19(1), 121-139.

Ricoy, C. y Ameneiros, A. (2016). Preferencias, dedicación y problemáticas generadas por los videojuegos: Una perspectiva de género. Revista Complutense de Educación, 27(3), 1291-1308.

Sampedro, B. y otros (2017). El videojuego digital como mediador del aprendizaje en la etapa de Educación Infantil. Educar, 53, 187-196.

Sánchez, P.A. y otros (201). Aspectos sociales de los videojuegos. Relatec, 9(1), 43-52.

Sánchez-Rivas, E y otros (2017a). Videojuegos frente a fichas impresas en la intervención didáctica con alumnado con necesidades educativas especiales. Educar, 53.

Sánchez-Rivas, E., y otros (2017b). Classcraft: From gamification to ludicization of classroom management.Education and Information Technologies,22(2), 497-513.

Sierra, M. y Fernández, M. (2017). Percepción de los videojuegos en educación social: una visión de género. International Journal of Educational Research and Innovation (IJERI), 7, 135-148.

Tecnológico de Monterrey (2016). EduTrends. Gamificación. Monterrey: Instituto Tecnológico de Monterrey.

Torres-Toukoumidis, A. y otros (2018). Revista Complutense de Educación, 29(1), 129-145

Vergara, D. y Mezquita, J.M. (2016). Diseño de juegos serios para Reforzar conocimientos: una Experiencia educativa en Secundaria. Profesorado, 20(2), 238-254.

Vidal, M.I y otros (2018). Revisión y análisis de investigación Publicada sobre intervención gamificada en Discapacidad intelectual. 18(2), 274-297.

Wartenweiler, T. (2018). Serious play in education for social justice - An exploratory study. Journal of New Approaches in Educational Research, 7(1), 61-69.

Chapter 9

PERCEPTION OF BRAZILIAN PRE-SERVICE TEACHERS ON PEDAGOGICAL PRACTICES BASED ON GAMIFICATION

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Introduction

This paper is part of an investigation carried out during the Masters in Education, held at the Federal University of Santa Catarina (UFSC), in a gamification experience with pre-service teachers. The research goal was to develop its media competence to educate *to*, *about*, *with* and *through* media, from a critical, instrumental and expressive-productive approaches. Gamification in this context was used at the same time as methodology, theory and pedagogical practice. In this chapter, the emphasis was placed on students' perceptions of game elements, and how these elements influenced their learning and engagement in the course.

As it is a research designed between games and education, we must first highlight the profound spatio-temporal changes that digital technologies have brought into their framework. This current sociocultural reality imposes a new educational problem on teacher training: to develop critical, technical, productive and creative skills for the use of technologies and to do so while maintaining engagement and motivation within dynamic and meaningful learning. In this context, the media-education (ME) emerges as a theoretical-methodological field that seeks to establish pedagogical mediations in the educational context between media and culture. ME consists of a set of actions and reflections aimed at contributing to the training of all citizens, especially young people, to develop the necessary skills for the search, selection and understanding of information and critical analysis, the use and production of messages and content "(Cruz, 2018, p.193). According to Bianchi (2014), one of the main challenges imposed to pre-service teachers'

education in Brazilian universities is to establish strategies for the insertion and critical and productive appropriation of information and communication technologies (ICT) in the context of media education, in curricula. According to the author, pre-service teacher courses, because they train people who will work in elementary education, need to prioritize "thinking and acting critically in the digital culture and ICT, with digital literacy being one of the competencies deriving from the media-education" (Bianchi, 2014, p.33). Consequently, "knowing how to use these technologies properly for educational purposes is a new requirement of today's society regarding the performance of educators" (Kenski, 2003, p.5). However, this use cannot occur in a simply technical way, but with awareness, critical reflection and knowledge of its possibilities of use (Kenski, 2003).

In this scenario, digital games are objects of multiple faces that connect aesthetic, historical, theoretical and technical knowledge. Santaella (2013) presents the games as a "hybrid, poly and metamorphic" field:

> The growing importance that "gamer culture" has played in society, with an undeniable impact on the concept of entertainment, education and training, is only ignored by few, and the game as a cultural product is seen, from various perspectives, as a medium, a manifestation of art, new way of learning and even as the latest icon of pop culture, which only comes to prove the remarkable influence and cultural relevance of games in the contemporary world. Few still have doubts that this is an expressive and complex cultural phenomenon, aesthetic and language that was able to develop, in its short period of existence, whole rhetoric of its own that cannot be neglected. The latest facet concerning games lies in the phenomenon of gamification (Santaella, 2013, pp. 3258-3263).

Gamification is part of a movement that emerged from the growing interest in games as learning resources, called Game-Based Learning (GBL), which

is dedicated to the integration of games into the learning process, usually to teach a skill or to attain a specific objective (Van Eck, 2015). According to the author, digital games have been able to promote general educational skills, such as spelling and reading, and an extensive range of cognitive abilities, including spatial visualization, divided attention, and knowledge mapping. Within GBL, there are four approaches to integrating games into the learning process: 1) students create games from scratch; 2) Educational games are developed from scratch to teach students; 3) commercial games are integrated into the classroom; 4) games are used as a basis for teaching in the so-called gamification, e.g. the elements of game design (mechanics, challenges, rewards, strategies, narrative) are used outside the context of games, with the aim of motivating individuals to action, help solving problems and promote learning (Kapp, 2012). In education, gamification is based on systems of rules, experiences, narratives and cultural roles to build an environment similar to the universe of games and conducive to the development of certain skills. Therefore, it can be understood as a tool with potential for motivation and student engagement, as well as active learning. However, gamification cannot be limited to the elements of games (mechanics, dynamics, components). It must be a broad process which also concerns the construction of the repertoire of new multimodal and multicultural languages, the exploitation of new pedagogical tools and practices and the development of new methodologies. It is no use to apply gamification in vertical and hierarchised processes or purely content approaches. It will only make sense if it turns learning into challenges - a hard, meaningful and epic work (McGonigal, 2012), with well-defined goals and objectives, which seeks to increase apprentices' experiences through language and game metaphors, from its elements.

However, using games as a pedagogical resource (educational or commercial), or gamified, it is still necessary to go a long way to understand *when*, *where* and *how* to use them. In the context of digital culture and media-education, this research sought to investigate how pre-service teachers would experience pedagogical practices based on this unprecedented approach in initial teacher training courses. The main question that we tried to answer was: How to apply gamification to train pre-service teachers with media competence to educate *to*/*for*, *with* and *through* media, from a critical, instrumental and expressive-productive

approach? To try to answer this question, the didactic proposal was carried out in a pre-service teacher course in Pedagogy of the UFSC, Florianópolis, Brazil (Santos, 2018). The purpose of this chapter is to narrate this experience through the students' perception of game elements design and how they understood its influence on learning, involvement and motivation throughout the course. Before narrating the gaming, activities used and the students' narratives about gamification, it is necessary to explain which game elements gave the basis for the proposal.

The elements of games and game design as the basis of gamification

The game elements, according to Schell, are "the core of what the game really is. They are the interactions and relationships that remain when all aesthetics, technology and history are withdrawn "(2011, p.130). Challenges, missions, rewards and feedbacks: it is through them that experiences are built that can motivate, entertain and engage players.

Challenges and missions are the elements that provide players the path of what to do in the world of gamified experience. According to game designer Jane McGonigal (2012, p.62), what makes us face challenges is the desire for blissful productivity, which is the "feeling of being immersed in work that produces obvious and immediate results". Ramos and Cruz (2018) argue that games involve the players guided by challenges that contribute to motivation and engagement. Overcoming challenges leads the player to learn, and through this interaction exercises skills and improves their performance. Therefore, "the game offers a field of experimentation through exploration, action and reflection, often in such an engaging way that it makes learning more fun and attractive" (Ramos, Cruz, 2018, p.41).

Rewards respond to a desire to collect the human being (Zichermann & Cunningham, 2011). The authors emphasize that, despite being a strong trend, few studies have been carried out to identify the motivations behind this desire to collect. James Halpern's taxonomy identifies ten main reasons why people collect: knowledge and learning; relaxation and stress reduction; personal pleasure

(including appreciation of beauty and pride of ownership); social interaction with fellow collectors and others; competitive challenge; recognition; altruism; desire to control, possess and bring order to a small part of the world; nostalgia and/or a connection with history; accumulation and diversification of wealth. Feedback within the universe of games is one of its most essential elements and is therefore widely used in the gamification movement. It returns information to players about their position regarding the game, correctness, mistakes, achievements and failures.

Feedback is one of the most important game mechanics, intrinsically linked to scores and progress (Zichermann and Cunningham, 2011). From these three main elements, to create the experience of gamification was necessary to investigate how the game design process would be in an educational situation. The research of Dicheva et al. (2015) who studied the game design elements of 34 case studies, showed that there is no commonly accepted classification by all authors. However, when analysing these studies, the authors outlined several principles common to game educational design. In Table 1, in the item Analysis of the results, we will describe how these principles were applied in the specific practice of the gamified subject.

Methodology

The empirical research was carried out at the UFSC from August 1 to December 5, 2017 (within NADE - Deepening and Diversification Studies Centre), in the course of "Production of audiovisual language, digital and hypermedia in education". The research has an applied qualitative approach, descriptive and exploratory. The methodological approach was Design-Based Research (DBR), which gathers research and development of pedagogical interventions in real learning settings. Wang and Hannafin (2004) describe DBR as a methodology to improve educational practices through systematic, flexible, and interactive review, analysis, design, development, and implementation based on collaboration between researchers and other professionals involved in a project in real contexts, always seeking to project principles or theories. The participants of the research were 16 pre-service teachers from UFSC (15 women and 1 man).

The course was hybrid because we had 10 face-to-face classes and 10 online activities mediated by technologies, primarily through a group created in WhatsApp and Moodle. Classes were divided into pedagogical workshops, seeking to adapt to the three media-education perspectives: instrumental, critical and expressive-productive, so that what we proposed in the content was applied in practice. Based on the gamification theories (Kapp, 2012; Werbach & Hunter, 2012; Zichermann & Cunningham, 2011) we chose three main game elements to be applied in gamification: the online challenge (tasks performed online), rewards (represented by the gamification table with a set of badges) and feedback system (score and immediate comments to each task carried out; evaluation forms about each class later filled in online by students; return of the researchers on the types and tasks to the beginning of each lesson and assistance through WhatsApp).

The challenge offered rewarding work (McGonigal, 2012) involving the three dimensions of media-education (Fantin, 2011): a) Educate with the media (instrumental perspective), encouraging the exploration of several different software in the activities; b) Educate about the media (critical angle), proposing activities that allow reflection; c) Educate through the media (expressive-productive perspective), prioritizing the practical result of the challenge always through a production using the media languages.
The weekly course occurred on Tuesdays. Every Thursday the online challenge was released together with tasks to accomplish it, as well as the delivery date. As in a game, with each new challenge, the activities became more complex and required more dedication of the students, following the suggestion of levels or the proper ordering of the problems, proposed by Gee (2009).
Gamification leaderboards had the following categories:

- **Learning path:** the "game map", graphically signalling where the students were and what they had to go through to finish the course;
- **Feedback:** At the end of each class, an online form was released to gather students' opinions about the lesson, content and methodology used.

- **Forums, chats, etc.:** forum badges were created to stimulate collective intelligence, interaction, participation among students in the Moodle learning platform;
- **Online Challenge:** badges delivered whenever students perform weekly expressive-productive activities within established criteria;
- **Extras:** bonuses (badges in the form of coins) delivered to students in games or ludic activities performed during classes;
- **Types of players:** Based on the research by Nicole Lazzaro (2004) and his theory "4 Keys 2 Fun" we developed the four profiles of players for the course: Obstinate, Curious, Attentive, Funny.
- **Attributes:** Researchers created attributes with inspiration in role-playing games (RPGs). The higher the score on these items, the more significant the advantages during class for students to use related skills. We offer the following skills: commitment, media, creativity, production, distance learning.

Four types of tables were developed, each with a player profile. Printed on Matte Paper Couché with a 250g weight of A4 size, they had coloured stickers printed to paste on the tables and filled them after each class as the students won the rewards.

The feedback system was developed with a dual purpose: 1) to receive responses from the students to the theoretical and methodological procedures adopted, so that we could improve the practice and adapt the proposal to the target audience, helping them in their difficulties, frustrations and doubts; 2) respond and demonstrate our perception of the works, projects and challenges presented. We also wanted to be available through the WhatsApp, in a group created primarily to assist in the online activities, whenever the students felt the need. This constant and immediate feedback for Gee (2009) is one of the great qualities of digital games that, according to the author, should be copied by the school. Games give verbal information 'at the right time' (when players need it) or 'on-demand',

'when the player feels the need for it, is ready for it and can make good use of it' (Gee, 2009, pp.5-6).

Analysis: students' perception about gamification

From what we described, gamification in a course had a triple role: 1) methodology for developing activities and strategies; 2) theory that supports both research and program content studied, and 3) practice being applied in class and replicated by students in their activities.

Gamification, as a methodology developed so that each activity in the classroom, Distance Learning, presence, Feedback, play activities, among others, resulted in score and rewards. Thinking this process requires a series of strategies to choose the adequate game elements, appropriate for each situation, the learning objectives and the level of each student, as well as the time available to perform each task. The main reason for using gamification was its potential for engagement and motivation, necessary for the development of meaningful learning. Next, we will highlight the students' perception regarding the elements of game design used in the course. The basic elements were: challenges, rewards and feedbacks. For each of these elements will be brought definitions from studied bibliography to dialogue with the comments of students, in literal excerpts taken from the online forms. Students' speeches are in italics and identified by the initials of their names in upper case letters, in parentheses, or by the abbreviation AN (and the response order number) for anonymous forms.

Fullerton (2008) clarifies that the challenge is not only a difficult task to accomplish; it is also dynamic. In this perspective, the psychologist Csikszentmihalyi (1990) identified the elements of pleasure that lead to the state of Flow. When the challenge is neither too difficult to complete, nor straightforward to cause boredom: *"I think it is good to work from home related to the previous class. It's adding up a lot. I believe that the form requested is in a way neither too much nor too little. So, I can carry out the activities even though I have other faculty and life demands"* (RB). The proposed progression of difficulty allows the state of flow to be maintained, as soon as the student learns to use the media, activities

become more challenging: *"I can follow up and deliver them on time. I believe that because they call themselves "challenges" they tend to become more difficult over time, and that is the goal, they are perfectly fulfilling their role"*(JR). Zichermann and Cunningham (2011, p.65) suggest that the ideal is to ensure that there is always a challenge for the players. They should be able to get into the experience and always have something interesting and substantial to accomplish, and that is what we intend for their overall experience: *"I'm enjoying it, it's a way to make us study at home too."* (GN).

The **rewards** attributed through the leaderboards were selected within the game design elements by meeting the human desire to collect, one of the most powerful instincts, according to Zichermann and Cunningham (2011, p.65). Its use was evaluated positively by the vast majority of the research participants: *"W-O-N-D-E-R-F-U-L :)* (JS)"; *"I am loving, because it is good stimulator of commitment to the subject"* (CV); *"I find a fascinating methodology that has been able to draw students' attention" (CL). "I love it, and it makes me motivated"* (ML). In the speech, we perceive a significant factor of extrinsic motivation, when its cause is external to the person or the task, related to rewards.

Feedback was an essential game design element for gamification. Through it we were able to receive crucial information to evaluate the progress of the course, the development of the iterative cycles and the students' learning. *"It is interesting not only for the teacher who receives the feedback, but mainly for us to learn/ remember the content said in the classroom or read"* (AN2). However, it is essential to emphasize that using this strategy requires time and dedication from the professionals involved, to be accessible through various channels (WhatsApp, Moodle, e-mail) as long as possible: *"Yes, a lot. The Whatsapp group was always very active, and this is crucial. The real-time response, when needed, always. It is unfair to demand and expect this from teachers, but it was great to have happened"*(AN4). Regarding the availability and listening to the students' demands, their lines show success: *"Yes, we always reviewed the online challenge, shared the experiences and took away the doubts "* (AN1); *"Yes. It was enlightening when the teachers brought the main points that we had doubts. And usually there were some that we had in common or that only one colleague had thought of, but*

we discovered that they belonged to everyone "(AN8).

The design principles emphasised by Dicheva et al. (2015) were the foundation of our proposal. Each principle corresponds to a description that was followed in our research as a checklist for the educational activities. Table 1 presents in the 1st column the principles of gamified educational design suggested by Dicheva et al. (2015). In the 2nd column the game mechanics used in the subject and, in the last column the feedback from the students that we identify or associate with the application of each of these strategies in practice.

Table 1 – The principles of applied gamified design and student's feedback

Design Principles (Dicheva et al., 2015)	Game Mechanics (Santos, 2018)	Student's Feedback (Santos, 2018)
Specific, clear, immediate, moderately difficult objectives.	Detailed description of the lessons in Moodle. Extra material for deepening.	"Practically all courses use Moodle, but since a lot of NADE was online we used a lot more, it was very well organized and easy to interpret, it was the first time I used the forum too!" (AN1)
Clear, concrete challenges and missions, useful learning tasks with increasing complexity.	Weekly online challenges that increased the level of difficulty each week.	"I liked having the resumption of content with a game at the end and the challenges of MOODLE. It made me learn the content and expand my knowledge on technological tools, making me think about how to use them in my classes."(AN7)
Customization with personalized experiences, difficulty levels adapted and gradually increasing.	Four player profiles with attributes related to their skills	"I found it interesting because, in this way, the evaluation process benefits everyone. Some people have more difficulty working from a distance. Others in group work. In the way the evaluation was put, everyone had a chance to show what they had the best and to challenge themselves too."(AN5)

Progress indicator visible.	Leaderboard	"I liked to have used the (what is the name?... the sheet that we were filling with the stickers? I will call it the game sheet [laugh]) game sheet and relate the awards with the activities proposed in Moodle. It instigated us to bring good results, aiming at the fast completion of the sheet and the future awards. "(AN2)
Immediate feedback, or in short cycles, immediate rewards, rather than vague long-term benefits.	Written feedback after each class. Real-time feedback from WhatsApp	"I thought it was sensational! The teacher also listens, students show that there is a concern in changing something that has been misunderstood. Also, feedbacks show failures and success in certain classroom attitudes and activities, and this strengthens the planning of the next semesters. "(AN5)
Competition and cooperation / loops of social engagement.	Team activities, according to the players profile.	"Yes, competitiveness has always stimulated me and was no different from the subject. Although it was dense, it did not tire me."(AN7)
Rating / increase of levels.	Badges received at each activity performed	"The coolest thing for me was that the subject on gamification was all gamified, with challenges, points, bonuses, among others." (AN1)
Visible status of reputation, recognition, social credibility.	Table tracking.	"The impression left by this methodology is that it can benefit the learning process. I can still put as an example, the excitement and excitement of the majority of the students when the table of accompaniment and awards from the day before was available, I found the idea incredible and encouraging. Congratulations ". (JS)
Access or unlock content.	The challenges were released every week.	"I had already used [MOODLE], but with this course it was very different, since they used it in many more ways than my other teachers and a more reliable method, releasing activities and classes as they occurred or when it was necessary. "(AN7)

Freedom of choice: several paths to achieve the goals.	Flexibility, according to the students' needs.	"I would suggest that according to some activities and their difficulties, the deadline was enlarged. Thank you for understanding me. My depression was strong this semester, and it was complicated for me to be in my best."(AN8)
Freedom to fail: low risk activities, with the possibility of several attempts.	Dispersed evaluation in many activities, none of them having considerable weight.	"I thought it was excellent. I hate static evaluation. I prefer formats like that of the course, malleable, along the semester "(AN4). "I liked it because it takes the evaluation of discipline from the tests and activities and makes the student stop focusing only on it and see the importance of the presence as well." (AN7)
Storytelling.	Digital storytelling through audiovisual production workshops.	"What I liked best was to know a little about storytelling and its creation, I would like everything that was predicted to show, but by unforeseen events, it did not occur." (AN1)
New identities or roles.	Player Profiles: Activities for each player profile.	"A little of everything, the activity which the H group danced was a lot of fun" (AN6)
Boarding facilitated	Videos, dynamics and ludic activities performed in all classes, always bringing the dynamics of games.	"The classes were always very dynamic, and I felt comfortable to participate. The methods used by the teachers were great and inspiring."(AN8)
Time restriction	Time scheduled for Online Challenges	"There could be more openness and flexibility for some task deadlines". (AN6) "It was great. I think the time to do the tasks wasn't enough."(AN8)

The game elements were perceived as a language that can be used along the way to help in learning: "*I understood that there are many ways of learning. And that we can explore and use them so that students can have meaningful and enjoyable*

learning "(AN8). Besides: "I learned that the game could be included in several situations, and when *it is used in class can help a lot in the child's learning. Besides the gamification part, the technological experiences we had were significant for our classroom activity, and we need to know a little about the universe of children, which today is very mediatic*"(AN1).

Conclusion

It is possible to state that the subject offered experience of digital culture throughout the course, both in theory and practice, in critical and expressive-productive activities, so that each student was able to advance in the semiotic domains of technology, in the personal and in the professional scope, allowing for reflecting on their future pedagogical practice. It was visible in the speeches collected at different moments, the strengthening of digital culture, as well as the construction of new senses concerning technologies. They were able to experience the construction of knowledge *with* media, *over*/*for* media and *through* media in dialogical and cooperative movements, thus breaking with a merely instrumental and content dimension.

We apprehended in this formative context that promoted actions were seen by students as crucial in the construction of their knowledge so that most of them accepted the challenges and took on the task of exploring the technologies and learning. Finally, the research results, through student's feedback, demonstrate that gamification facilitated learning, content fixation and resumption, the interaction between students and teamwork, and motivation and engagement to carry out activities and class participation. Thus, gamification is an efficient and effective methodology, especially when combined with other active methods. In general terms, it is worth highlighting that we have made the experience more motivating and fun, and extremely relevant to the context of digital culture.

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References

BIANCHI, Paula. Formação de professores e cultura digital: Observando caminhos curriculares através da Mídia-educação. Tese (doutorado) – Universidade Federal De Santa Catarina, Programa de pós-graduação em educação física. Florianópolis, 2014.

CRUZ, Dulce Márcia. Construção de narrativas e a criação de jogos digitais: uma proposta de novos letramentos em espaço escolar. In: RAMOS, D. K. (Org.); CRUZ, D. M. (Org.). Jogos digitais em contextos educacionais. 1. ed. Curitiba: CRV, 2018. v. 1. 210p.

CSIKSZENTMIHALYI, Mihaly. (1990). Flow: The Psychology of Optimal Experience." Journal of Leisure Research, 24(1), pp. 93–94. Disponível em: https://bit.ly/2HLxnnj Acesso em: 04 abr. 2019.

DICHEVA, D.; DICHEV, C.; AGRE, G.; ANGELOVA, G. Gamification in Education: A Systematic Mapping Study. Educational Technology & Society. v. 18, n. 3, p.1–14, 2015. Disponível em: https://eric.ed.gov/?id=EJ1070047 Acesso em: 04 abr. 2019.

FANTIN, Mônica. Mídia-educacão: aspectos históricos e teórico-metodológicos. Olhar de Professor, v. 14, n. 1, 2011. Disponível em: https://goo.gl/7PHcca Acesso em: 04 abr. 2019.

FULLERTON, Tracy. Game design workshop: a playcentric approach to creating innovative games / Tracy Fullerton, with Christopher Swain, and Steven S. Hoffman. —2nd ed. 2008.

GEE, James Paul. Bons video games e boa aprendizagem. Perspectiva, v. 27, n. 1, p. 167-178, 2009. Disponível em: https://periodicos.ufsc.br/index.php/perspectiva/article/view/15838. Acesso em: 3 abr. 2019.

KAPP, K. The gamification of learning and instruction: game-based methods and strategies for training and education. San Francisco: Pfeiffer, 2012.

KENSKI, Vani Moreira. Tecnologias e ensino presencial e a distância. Campinas, SP: Papirus, 2003.

LAZZARO, Nicole. Por que jogamos jogos: quatro teclas para mais emoção sem história. 2004. Disponível em: < http://xeodesign.com/xeodesign_whyweplaygames.pdf> Acesso em: 22 abr. 2019.

MCGONIGAL, Jane. A realidade em jogo: por que os games nos tornam melhores e como eles podem mudar o mundo. Rio de Janeiro: Best Seller, 2012.

RAMOS, D. K.; CRUZ, D. M. A tipologia de conteúdos de aprendizagem nos jogos digitais: o que podemos aprender? In: RAMOS, D. K. (Org.); CRUZ, D. M. (Org.). Jogos digitais em contextos educacionais. 1. ed. Curitiba: CRV, 2018. v. 1. 210p.

SANTAELLA, Lucia. Comunicação ubíqua: repercussões na cultura e na educação. São Paulo: Paulus, 2013.

SANTOS, Juline M. F. P. dos. Produção de disciplina gamificada: uma proposta de letramento midiático com aproximações entre mídia-educação e aprendizagem baseada em jogos. Dissertação (Mestrado) - Universidade Federal de Santa Catarina, Centro de Ciências da Educação, Programa de Pós-Graduação em Educação, Florianópolis, 2018.

SCHELL, Jesse. A arte de game design: o livro original. Rio de Janeiro: Elsevier, 2011.

VAN ECK, Richard N. Digital game-based learning: still restless after all these years. Educause Review, v. 50, n. 6, p. 13-28, 2015. Disponível em: https://goo.gl/TnvqNK Acesso em: 07 mai. 2019.

WANG, Feng; HANNAFIN, Michael. Design-based research and technology-enhanced learning environments. In: Educational Technology Research and Development, v. 53, n.4, p 5-23, 2005. Disponível em: https://bit.ly/2HNfdBE Acesso em: 10 mai 2019.

WERBACH, K.; HUNTER, D. For the win: how game thinking can revolutionize your business. Philadelphia: Wharton Digital Press, 2012.

ZICHERMANN, G.; CUNNINGHAM, C. Gamification by design: implementing game mechanics in web and mobile apps. Sebastopol: O'Reilly Media, 2011.

Chapter 10

DIGITAL GAMES AND EXECUTIVE FUNCTIONS - A CASE STUDY WITH THE MEDIATION OF GAMEBOOK GUARDIANS OF THE FOREST

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Introduction

Schooling process, especially in Brazil, presents grim indicators in relation to children and teenagers learning. Data originated from Prova Brasil, Exame Nacional do Ensino Médio – ENEM, at Pisa – Programme for International Student Assessment - Programa para Avaliação Internacional de Estudantes, among other official evaluation mechanisms show grim results which place Brazil in very low positions, indicating students deficiencies towards languages which comprise writing, reading and math, fundamental to developing other skills and, consequently, becoming citizens capable of asserting themselves, being critical and transforming Brazil into a better country.

In that context, the development of programs and projects aiming at stimulating students' Executive Functions (EF) is constituted by actions that might contribute to a more promissing scene. Authors such as Seabra, Reppold, Dias & Pedron (2014), Capovilla and Dias (2008), Dias and Seabra (2013) present and discuss some research performed during the period from 2008 to 2014 which investigated, both directly and indirectly, the EF deficits and their impact on school performances of the subjects.

The present chapter lies within that context and aims at socializing the results of the investigation performed from 2016 to 2018, with a group of children aging

from 8 to 12 at Escola Municipal Roberto Santos, in Salvador - Bahia. The aim of the research was to analyze the contributions of the gamebook Guardians of the Forest for stimulation of EF and their impacts on those students' learning.
In so doing, we divided the chapter into three sections. On the first section, we briefly present the concept of EF and its relation with school environment. On the second one, we discuss the methodological procedures applied to the investigation, outlining the subjects and the devices used. The presentation and the analysis of the results constitute the third section. After that, we present the conclusions.

Executive Functions: from clinic spaces to school environments

EF are a set of mental processes of a superior order which control and give support to other processes related to an adaptable behavior (Granpeesheh, Tarbox, Najdowski, & Kornack, 2014; Hughes & Ensor, 2005), thus becoming responsible for thoughts, behavior and emotions regulation (Munakata, Michaelson, Barker & Chevalier, 2013) and within school context, become important for children learning. There are several studies associating school performance to those abilities (Carvalho, 2015; Cragg & Gilmore, 2014; Goldin *et al*., 2013; León, Rodrigues, Seabra & Dias, 2013).
Such functions are also considered as an *umbrella term* (Hughes & Ensor, 2005) because they encompass different abilities, such as Inhibitory Control, Attention, Problem Solving, Planning, although there is no consensus on which ones of these, once EF definition is excessively ample (Granpeesheh *et al*., 2014). This conceptual polysemy contributed for distinct models. However, Diamond's (2013) has been the most prominent model of investigation in this particular field. That model emphasizes the Working Memory (WM), the Inhibitory Control (IC) and the Cognitive Flexibility (CF) as base functions.
WM is the ability of storing information and being able to retrieving them when necessary. According to Comitê Científico do Núcleo Ciência Pela Infância – NCPI - (2016), a child uses that function to perform activities which involve a number of steps without the need for hints; remembering strategies and rules in different games; linking ideas between oral and written languages; making associations between narrated facts from a story without the need for images. While

performing math calculations, for instance, students must keep provisory answers in WM (Cragg & Gilmore, 2014).

IC involves the ability of controlling one's own behavior, thinking, emotions and attention in accordance with the environment which surrounds them (Diamond, 2013). Children use that EF at school when they need to wait for their turn to talk; to focus on proposed activities; to inhibit inadequate behavior; when playing "Freeze tag"; to remain attentive while reading a tale (NCPI, 2016) or even, while studying math calculations, by inhibiting ineffective strategies in favor of others, more sophisticated ones (Cragg & Gilmore, 2014).

On its turn, CF is related to perspective or rule changes, and also to creative thinking ("think outside the box") (Diamond, 2013). That EF is fundamental to the understanding of different forms of interacting with a game, for instance, trying different strategies for a satisfactory result in a scientific experiment or in a complex math problem (Cragg & Gilmore, 2014; NCPI, 2016).

The descriptions and examples indicated above point out the relevance of the consolidation of such functions in distinct scenarios, especially at school, once they are essential for learning. For Diamond (2013), the functions cited above subsidize the construction of other ones with higher levels of complexity such as reasoning, problem solving and planning, as well as other essential abilities for autonomy, such as creativity, perseverance, cooperation, mutual respect and discipline (NCPI, 2016). Such abilities have been considered as relevant for learning in the 21st century.

The development process of these functions starts during infancy, once it is a sensitive period due to high cerebral plasticity, that is, there is a greater capacity of transformation of children's brain due to stimuli and undertaken experiences (NCPI, 2016), being consolidated during adulthood and declining proportionally to aging, also contributing to diseases such as Alzheimer.

EF can be stimulated in a variety of forms, including with games mediation, physical activities, yoga, martial arts, mindfulness and school curriculum (Diamond & Lee, 2011).

Games, whether analogical or digital ones, create situations, by means of their mechanics, which challenge the player to solve them, stimulating the functions indicated above. However, interactive environments have been recently created

specifically for that purpose. These games have been denominated *brain games, brain digital games* or even *cognitive games*. For Ramos, these cognitive games comprise "a set of various games which deal with cognitive aspects, proposing the intersection between games concepts, amusement and cognition" (Ramos, 2013, p. 20). Among national and international researches which exemplify these strategies, Ramos (2013) with *Escola do Cérebro*; Gray, Robertson & Rajendran (2015) with *Brain Quest*, or even Klein, Hassan, Wilson, Ishigami & Mulle (2017) with *AttentionTrip* stand out.

Thus, considering the relevance of strategies creation for EF improvement during infancy, added to the fact that the game, while a ludic activity, is a remarkable experience in children's lives, the Centro de Pesquisa Comunidades Virtuais da Universidade do Estado da Bahia developed the Gamebook Guardians of the Forest (GB). So, the environment intends to stimulate EF in a ludic manner, as well as the distinctive literacy levels.

Literacy is hereby understood beyond reading and writing, being the ability of knowing how to consume a media, being capable of critically understand and interpret their messages transmitted through distinct languages, remixing it, adopting a role of co-producer of the content (Jenkins, 2008). So, the reader-player transits between the role of consumer and prosumer

Methodological Strategies: Gamebook under the spotlight

Game Based Learning practice can be understood from three perspectives. The first with the mediation of games produced as a means of entertainment, like Civilization; or even with the development of games by students and teachers and, finally, a third approach which proposes actions in interface with games produced for educational ends (Klopfer, Osterweil & Salen, 2006). It is under that perspective that the project was developed at Escola Municipal Roberto Santos, with GB mediation in order to stimulate EF.

The research had the initial participation of 11 children, state school students with average age of 9, mostly boys (72,7%). 27,3% of them were girls. Both underwent neuropsychological evaluation, which consisted of evaluating the neuropsychological development of the participants, especially regarding to

EF, by means of psychological tests and tasks. After this first phase, interactions with the Gamebook, involving 10 children, were performed. Lastly, at the final phase, a reassessment with 7 children was performed, during which the procedures undertaken at the first phase were repeated, aiming at verifying whether there had been any alteration in the cognitive performance demonstrated by means of neuropsychological instruments. The evasion of children during the investigative process was due to the following motives: absence from school activities (two of them) and transference to another school (two of them).

It is important to point out that the small number of children in the investigation is due to the following reasons: a) parents authorization for their children to take part in the research; b) the neuropsychological tests performed which demanded the participation of experienced psychologists performing the tests; c) the cost of the tests. Those were the reasons why the research was developed with small number groups. Also, a similar investigation was held in the same school with different groups with mediation of the open world of *Minecraft.*

The methodological approach used was characterized as of quasi-experimental base (CAMPBELL, 1979), with the neuropsychological tests: Five Digits Test - FDT (Sedó, Paula & Malloy-Diniz, 2015) and the Brief Neuropsychological Assessment Instrument for Children (Neupsilin-Inf) (SALLES *et al*., 2016). FDT's aim is to measure the velocity of cognitive processing, focus and attention reorientation capacity, also the capacity of dealing with interferences, IC and CF subcomponents.

Neupsilin-Inf was utilized in order to identify the functioning profiles of the neuropsychological processes on these children (SALES *et al*., 2016). The battery was performed in its entirety. However, in this chapter, only the tasks digits repetition (span) backwards, Corsi block-tapping test and GO / NO-GO testing, for IC and WM, will be analyzed.

After that first phase, children interacted with the Gamebook through individual tablets during November and December, 2017, completing 8 sessions of 30 minutes each.

GB is an appbook which links the idea of interactive digital book to games mechanics with challenges, missions, sets of rules, rewards and feedback, which may be applied to distinct contexts of learning, including the clinical one. GB has

a gameplay structured in 8 minigames (MG) with 10 levels each, within a narrative which unfolds in the Amazon Forest and whose aim is to stimulate EF. The narrative challenges the player, impersonated by Lyu, a 8 year-old girl, to protect the Amazon Forest from deforestation with the help from characters pertaining to Brazilian folklore, such as the Werewolf, Iara, Curupira, Saci-pererê. In order to do so, the player will have to solve objectives in short, medium and long terms which demand the action of the EF discussed above.

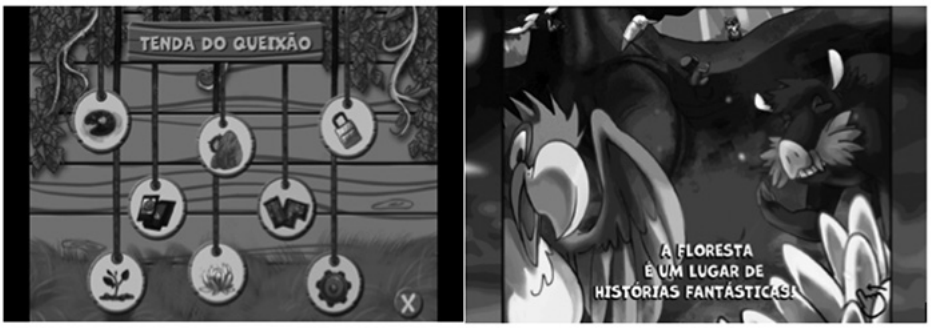

Figure 1 – Screenshots taken by the authors of the images of the story and also of GB's MG.

Neupslin-Inf and FDT application and correction protocol were used for data analysis. In the first case, the gross score of the sub-tasks analyzed, as well as the Z-score, calculated from test norms. It is important to clarify that Z-score can be defined by how much a measure moves away from the average, in terms of Standard Deviations. So, when that score is positive, it indicates that the measure is above average, and when the score is negative, it means that the measure is below average (Vilela, 201-?).

In relation to FDT, the number of errors and gross time (s) were considered. From that on, the averages of these variables were calculated, considering the score of all participants of the group. Afterwards, the gross scores were rated according to the FDT reference percentages from "far superior" to "extremely low".

Finally, the percentage variation calculation, between the first and second assessments, was based on the concept of percentage variation which demonstrates the difference between the two measures, by means of the following formula

V= (Pa-Pr)/Pax100, being V=variation, Pa=score in the Assessment, Pr=score in the Reassessment.

GB contributions for executive functions stimulation

The great question we face in the field of research and teaching involving the mediation of digital games is related to the absence of consistent evidence which may justify and strengthen intervention practices within distinct contexts, including the ones pertaining to school. In 2017, the researchers Alves and Coutinho organized the book Digital games and Learning – foundations for a practice based on evidence, with results from research performed by Brazilian, Portuguese and Spanish investigators who presented, debated and socialized the results of their investigation.

In the aforesaid book, it was possible to point out the necessity of researching with more experimental or quasi-experimental focus, so that they could point the evidence from distinct methodological approaches. Thus, aligned with that demand, we performed the research here presented in the hybridization of qualitative and quantitative contributions. However, performing investigations of a more experimental base demands a greater number of subjects and, consequently, a structure which entails higher financial, personnel and technical resources capable of controlling all external variables.

Thus, we performed a pilot study considering such factors with a small group of children, as stated before. We will show the results and a discussion about the neuropsychological assessment performed with the subjects both at the level of assessment and the reassessment after the interaction with the Gamebook. The results evidence the possible contributions of that media for stimulating EF: IC, CF and WM, which will be separately presented and analyzed.

Inhibitory Control

Chart 1 shows that, in relation to FDT, children took longer performing the activity. It outlines that the variables correspond to performance timing. Thus, high scores indicate that it has taken time for the child to complete the tasks, what may mean difficulties, such as to inhibit inadequate behavior. Conversely, one can perceive that the same individuals made less mistakes when performing

reading and choice tasks, measures related to this EF. So, one can suppose that the children increased their level of attention during the activity, after the interaction with the GB.

Chart 1

Percentage variation between IC assessment and reassessment

Inhibitory control	
Test	**Percentage Variation (%)**
FDT (time)	↑14.1
FDT Reading (errors)	↓100
FDT Choice (errors)	↓63.1
Neupsilin-Inf (gross score)	↑8.3
Neupsilin-Inf (Z-score)	↑81.9

Taking into consideration the variable time and the measure of percentage, at the assessment phase, the range indicated that children were between 50% and 25% (medium and low medium) and at the reassessment it decreased to the range of 25% to 5%. (inferior medium and boundary zone). While observing IC through the lenses of Neupsilin-inf subtest, the change between the two phases was subtle. Although Z-score has increased, it remained negative, what indicates the rate below average. Yet, one can observe that, in the assessment, the participants left the boundary zone rate and moved to the inferior medium zone, characterizing a possible enhancement in that function.

The results presented here already indicate that the mediation of interactive environments, such as those pertaining to games, may embody spaces for EF stimulation in a ludic and joyful manner.

Working Memory

WM was, among the EFs, the one which presented the best results, once it has demonstrated an augmentation of the score in all activities, which in turn may demonstrate an increase towards children performance. As observed at chart 2, the prominence of the visuospatial WM, which has presented considerable

increase in the gross score. Furthermore, Z-score left its position slightly under the boundary zone reaching the medium range. As for digital repetition activity, one can perceive also an increase in relation to gross score. Z-score, in turn, is no longer negative, remaining in the very same initial range, that is, it was positioned at medium range and remained there.

Chart 2

Percentage variation between WM assessment and reassessment

Working Memory	
Test	**Percentage Variation (%)**
Neupsilin-Inf Visuospatial Working Memory (gross score)	↑103.3
Neupsilin-Inf Visuospatial Working Memory (Z- score)	↑121.4
Neupsilin-Inf Backwards Digits (gross score)	↑22.6
Neupsilin-Inf Visuospatial Working Memory (Z-score)	↑103.1

Cognitive Flexibility

CF, in its turn, has demonstrated a decrease in its execution time in relation to FDT activities, what can be regarded as a positive outcome. The alternation and reading are the main activities related to that EF, and one can perceive that they presented a decrease in the number of errors, what can be an indication of development of this very function. Yet, data evidenced that children left the range between 50% and 25% (medium and low medium), moving to the range of 25% and 5% (inferior medium and boundary zone), according to chart 3.

Chart 3

Percentage Variation between CF assessment and reassessment

Cognitive Flexibility	
Test	**Percentage Variation(%)**
FDT (time)	↓5.6
FDT Reading (errors)	↓100
FDT Alternation (errors)	↓66.6

The presented results are characterized by a quantitative approach and are mere indicators of cognitive changes. We point out that the instruments choice was

made based on its reliability and on the rigorous validation methods through which they are scrutinized before they are made available. However, it is worth outlining that the isolated data cannot be predictive of the children individual development, once it has been performed a specific timeframe cut-off. Rating its participants is not the goal intended here, but solely to produce indicators of which functions can be invested in order to achieve the best performance.

Said that, we verified that GB and other environments, produced in order to stimulate EF, may contribute for their improvement. We point out that the data above evidenced that GB generated improvement on EF that can be verified by means of neuropsychological instruments indicated in this chapter, allowing us to affirm that digital games may bring contribution for the development, constituting themselves as an alternative for the process of teaching and learning.

The function that presented the best indicators was WM, that not only indicated gaining on gross score and Z-score, produced an augmentation of the standardization range of the children. That evidence was similar to the results found in Thorell, Lindqvist, Bergman, Bohlin & Klingberg research (2009), in which WM presented the best results through mediation with the Cogmed system, a software of cognitive training. CF also showed a decrease in both the activity time and number of erros, thus indicating improvement. Inhibition, in its turn, presented less perceptive changes related to FDT, although it has presented an increase in relation to Neupsilin-Inf, as showed in Chart 1.

The smallest changes in CF and IC functions, in relation to WM results, may be associated to GB, once each EF presents a difference at the difficulty level with which they can be improved by training, taking into consideration the underlying psychological and neural processes.

Thus, GM strategies aimed at WM may have been more efficient than those of GM, IC and CF. Yet, it is possible that the improvement rate differences at the stimulation levels may be related to children distinct background and development levels, demanding differentiated levels of stimulation, thus favoring more effective contributions towards cognitive gain. Such data may contribute for subsidizing, on the part of the teachers, more differentiated pedagogical practices, considering the cognitive profile of each child, enabling function improvement.

Interaction with GB also evidenced a good performance in regard to WM

activities, possibly contributing for the fact that this very EF has been the most stimulated one, as evidenced during reassessment. The Blue child (age 8), for instance, easily performed Replantio MG, what may indicate an optimal performance, once the aforesaid MG features mechanisms which stimulate WM predominantly, that is, in order to solve the challenge, the players need to evoke the right sequences of the buds, which present different colors.

Children EF performance, both in the tests and while playing the game, may be indicators of how they behave in daily situations and in school routine. Rosa's case (age 9), for example, revealed difficulty in interrupting inadequate behavior both in some moments of the game and test scores. The teacher points out that this child is unable to respect silence moments, shows difficulty in accepting and understanding adults' requests, also showing aggressiveness and using physical means in order to obtain what she needs. Such facts may be related to difficulties in social conviviality, which are also influenced by EF (Diamond, 2013).

Still, in both aforementioned cases, one can perceive a performance increase in the individual tests in relation to IC. In face of that, there is a necessity of an increased commitment to improve the performance which stimulates EF, once studies on cerebral development demonstrate that early infancy experiences are crucial for the construction of solid bases of adaptative and positive behavior. It is believed that these actions may cooperate with better academic performances at long term, reducing social inequalities and diminishing learning difficulties (Carvalho, 2017; Harvard, 2011; León *et al*., 2013).

It is also important to mention that, by proposing intervention activities, it is necessary to take into consideration the specific characteristics of the concerned group. In that specific case, the participants come from state school and, in their majority, they are part of a vulnerable social environment, characterized by families and communities of low socioeconomical level, lacking or barely having access to educational, social, cultural and health resources, factors which can be considered as ones of risk for the optimal performance of EF.

We believe that the results presented above contribute to reinforcing the need of public universities to remain aware of the situation, creating development spaces with interactive environments which, through a ludic and joyful approach, may constitute themselves as learning spaces which stimulate EF for state school students.

Thus, the access to new forms of learning are made possible, ones aligned with the demands of the 21st century generation, which is contextualized with contemporary society. This way, GB achieves its goal, once it is made available free of charge in apps stores of mobile devices and can be easily and interestingly used at school.

Verde (age 9) stated: "All that I wanted was attending this class!" "I love that game!" That confirms what Prins, Dovis, Ponsioen, Brink and Oord (2011) affirm about this kind of stimulation, which can be motivating and joyful. It is important to emphasize that, although we have explained to them what the project was about, for them, the meetings were always "a class with a tablet", reinforcing that everything that happens within the school environment is a class, in spite of the objective.

Every study has its limitations and in the case of the study presented here, we mention the following ones: a) absence of control group, differently from the majority of the studies reported. That fact may result in the difficulty of controlling the other variables which may have interfered in the participants performance, such as their own natural development, background, among others (Campbell, 1979); b) possible external influences, once the assessment was carried out at school. In Brazil, state schools have a frequent occurrence of strikes, interruptions that interfere with school dynamics and mainly investigative ones; c) time made available for the interaction with the game may not have been enough to achieve neuroplasticity – the capacity that our Central Nervous System (CNS) presents which modifies morphological and functional properties in response to alterations generated by the environment. With more interaction time, CNS could be developed from intensive, highly repetitive and focused sensory–motor stimulation (Costa *et al.*, 2000; Oliveira, Salina & Annunciato, 2001).

Finally, we affirm that measuring EF is a great and difficult undertaking, once various factors such as biological maturation and the school experiences which influence them (Ramos & Segundo, 2018), in accordance with Rivero, Querino and Alves (2012), who add that EF development is a complex research field, making it difficult to measure which functions have really been trained by videogames.

We suggest that further research take into consideration such factors, increasing the number of interactions and adding a control group. Besides, a long-term

assessment is recommended, because some studies, such as the one done by Diamond and Lee (2011), suggest that the benefits may not be immediately evident, but only some months later.

Conclusions

Learning based on digital games may constitute themselves an interesting strategy in order to stimulate children and teenagers EF, as it recovers in a ludic way, the joy of learning, placing the student as a protagonist of the learning process.

The use of neuropsychological tests was important for evaluating children's advances, especially after interacting with GB, pointing out the improvement of working memory.

Within that context, we reaffirm the necessity of investment in intervention methods for such abilities, considering the reality of Brazilian children, including those ones engulfed in contexts of social vulnerability. The associations made among EF, school performance and social abilities justify the integration of these activities into school curricula since the initial grades.

The results of the research with the mediation of GB were socialized with the teachers of the school involved in the study, in order to allow subsidizing the design of pedagogical practices which stimulate EF with or without interaction with this interactive environment. Besides, data related to the subjects' interactions with the game enabled identifying aspects which may be improved not only in GB, but in propositions of games development for scenarios of school learning.

Finally, the present study confirmed the necessity of performing longitudinal studies, especially in state schools which demand a greater attention not only from public agencies, but also from the universities which must be aware of their surroundings, contributing in a more effective way to the improvement of Brazil's educational system, but especially in order to promote an adjustment of the school environment to meet the demands of contemporary society and the needs of their students and teachers.

REFERENCES

Alves, L. & Coutinho, I. (2016). Jogos digitais e aprendizagem: Fundamentos para uma prática baseada em evidências. Campinas: Papirus.

Campbell, D.T., & Stanley, J.C. (1979) *Delineamentos experimentais e quase experimentais de pesquisa*. Editora da Universidade de São Paulo, SP.

Capovilla, A. G. S., & Dias, N. M. (2008). Habilidades de linguagem oral e sua contribuição para a posterior aquisição de leitura. PSIC, 9(2), 135-144.

Carvalho, C. F. (2017). *Programa de estimulação das funções executivas: contribuições para desenvolvimento cognitivo de crianças em situação de vulnerabilidade e expostas ao manganês.* Tese de Doutorado, Programa de Pós-graduação em Psicologia, Universidade Federal da Bahia, Salvador, Bahia, Brasil.

Cerqueira, L. de C., Dórea, M. de F., Vieira, J., Jesus, M. G. de, & Alves, L. (2017, Jun). Letramento e Games: Práticas Motivacionais e Autônomas. *Anais do Congresso Internacional de Ambientes Hipermídias para Aprendizagem.* Florianópolis, SC, Brasil. In: São Paulo: Blucher, 3(11), p.51-60.

Comitê Científico Do Núcleo Ciência Pela Infância. Estudo Nº III: *Funções Executivas e Desenvolvimento na primeira infância: Habilidades Necessárias para a Autonomia.* São Paulo, 2016. Recuperado de: <http://tinyurl.com/yyqj4vzu>.

Carvalho, C. A. S. M. (2015). *Funções executivas e desempenho acadêmico em alunos do 3º ano do ensino fundamental.* Dissertação de Mestrado, Mestrado em Educação, Universidade do Vale do Sapucaí, Pouso Alegre, MG, Brasil.

Costa, R. M. E. M., Piovesana, A. N., Oliveira, D. A. de, Braz, P. F. A. , Cheniaux, E., Mauro, M F., & Werneck, V. M. B. (2000). Estimulação cognitiva através de ambientes virtuais inteligentes. *Gold Book: Inovação Tecnológica em Educação e Saúde*, Rio de Janeiro, *1*, p.405-420.

Cragg, L., & Gilmore, C. (2014). Skills underlying mathematics: The role of executive function in the development of mathematics proficiency. *Trends in Neuroscience and Education, 3*(2), pp. 63-68. Recuperado em: https://www.sciencedirect.com/science/article/pii/S2211949313000422

Diamond, A. (2013). Executive Functions. *Annual Review of Psychology, 64*, pp. 135-168. Recuperado de: http://dx.doi.org/10.1146/annurev-psych-113011-143750

Diamond, A., & Lee, K. (2011). Interventions shown to Aid Executive Function Development in Children 4–12 Years Old. *Science (New York, N.Y.), 333(6045)*, pp.959–964.

Dias N. M. & Seabra A.G. (2013). Funções executivas: desenvolvimento e intervenção. Temas sobre Desenvolvimento; 19(107): pp. 206-12.

Dórea, M. F.; Cerqueira, L. C.; Vieira, J., & Alves, L. (2017, Mai). Estratégias motivacionais: diálogo entre a Teoria do Flow e o GB. *Anais do XII Seminário de Jogos Eletrônicos, Educação e Comunicação*, Salvador, BA, Brasil. 13(1), pp. 96-105.
Granpeesheh, D., Tarbox, J., Najdowski, A., & Kornack, J. (2014). *Evidence-based treatment for children with autism: The card model* (1a ed.). Amsterdam: Elsevier.

Goldin, A. P., Hermida, M. J., Shalom, D. E., & Costa, M. E.; Lopez-rosenfeld, M.; Segretin M. S., et al. (2014). Far transfer to language and math of a short software-based gaming intervention. Proc. Natl. *Acad. Sci.U.S.A. 111*, 6443–6448. Recuperado de: https://www.pnas.org/content/111/17/6443.

Gray, S., Robertson, J., & Rajendran, G. (2015, Jun). BrainQuest: an active smart phone game to enhance executive function. *Anais do Interaction Design and Children Conference*, Boston, Mass, USA, pp. 59-68

Guimarães, P., Tourinho, A., Vieira, J., & Alves, L. (2016, Jun). Uma Análise das possíveis contribuições do Gamebook Guardiões da Floresta para estimulação das funções executivas. *Anais eletrônicos do XV Simpósio Brasileiro de Games*, São Paulo: USP, SP, Brasil, pp.1165- 1168.

Hughes, C., & Ensor, R. (2005). Theory of mind and executive function in two-year-olds: A family affair? *Developmental Neuropsychology, 28(*2), pp. 645–668. Recuperado de: https://www.ncbi.nlm.nih.gov/pubmed/16144431 .

Klein R.M., Hassan T., Wilson G., Ishigami Y., & Mulle J. (2017). The AttentionTrip: A game-like tool for measuring the networks of attention. *The Journal of Neuroscience Methods, 289*(2017), pp. 99–109. Recuperado de: https://www.ncbi.nlm.nih.gov/pubmed/28711379.

Klopfer, E., Osterweil, S., & Salen, K. (2009). Moving learning games forward. *The MIT Education.* Recuperado em 20 de fev. 2019 de: http://education.mit.edu/papers/MovingLearningGamesForward_EdArcade.pdf.

León, C. B. R., Rodrigues, C. C., Seabra, A. G., & Dias, N. M. (2013). Funções executivas e desempenho escolar em crianças de 6 a 9 anos de idade. *Revista Psicopedagogia, 30*(92), pp. 113-120. Recuperado em 13 de fevereiro de 2019, de: http://pepsic.bvsalud.org/pdf/psicoped/v30n92/05.pdf.

Munakata Y., Michaelson L., Barker J., & Chevalier N. (2013). As Funções Executivas na Infância. In: *Enciclopédia sobre o Desenvolvimento na Primeira Infância*. Quebec, Canadá: J. Bruce Morton, pp.13-18.

Oliveira, C. E. N., Salina, M. E., & Annunciato, N. F. (2001). Fatores ambientais que influenciam a plasticidade do SNC. *Acta Fisiátrica, 8*(1), pp. 6-13. Recuperado de http://www.revistas.usp.br/actafisiatrica/article/view/102269

Prins P.J.M., Dovis S., Ponsioen A., ten Brink E., & Van der Oord S. (2011). Does computerized working memory training with game elements enhance motivation and training efficacy in children with ADHD? *Cyberpsychology, Behavior and Social Networking., 14*(3): pp. 115–122. Recuperado em 25 de fevereiro de: https://www.ncbi.nlm.nih.gov/pubmed/20649448

Ramos, D. K., & Segundo, F. R. (2018). Jogos Digitais na Escola: aprimorando a atenção e a flexibilidade cognitiva. *Educ. Real.,* Porto Alegre, 43(2), p. 531-550. Recuperado em 12 de fevereiro de 2019, de: http://www.scielo.br/pdf/edreal/v43n2/2175-6236-edreal-43-02-531.pdf.

Rivero, T. S., Querino, E. H. G., & Starling-Alves, I. (2012). Videogame: seu impacto na atenção, percepção e funções executivas. *Neuropsicologia Latinoamericana, 4*(3), pp. 38-52. Recuperado em 10 de fevereiro de 2019, de: http://pepsic.bvsalud.org/pdf/

rnl/v4n3/v4n3a04.pdf.

Salles, J. F., Fonseca, R. P., Miranda, M. C. Berlin, C., Rodrigues, C. C., & Barbosa, T. (no prelo). (2016). *Instrumento de Avaliação Neuropsicolinguística Breve Infantil NEUPSILIN-Inf* . São Paulo: Vetor.

Seabra, A.G.;Reppold, C.T. ; Dias, N. M. & Pedron, A.C (2014). Modelos de funções executivas. In: _____(Org.) Inteligência e funções executivas. Ed. Memnon. São Paulo, pp.39-50.

Sedó, M. P., J.J., & Malloy-Diniz L.F. (2015). O teste dos cinco dígitos / Manuel Sedó; versão brasileira Jonas Jardim de Paula, Leandro Fernandes Malloy-Diniz; [tradução Otto Mendonça][Manual].São Paulo: Hogrefe CETEPP.

Thorell, L.B., Lindqvist S., Bergman, N., Bohlin, G., & Klingberg, T. (2009). Training and transfer effects of executive functions in preschool children. *Dev. Sci., 12*(1), pp. 106–13. Recuperado de: <https://onlinelibrary.wiley.com/doi/epdf/10.1111/j.1467-7687.2008.00745.x>.

Vilela, G. B. J. (201-?). ESTATÍSTICA: Teste Z (ou Escore Padronizado) [Apostila do Centro de Pesquisas Avançadas em Qualidade de Vida], Campinas: Cpaqv.

Chapter 11

TEACHER TRAINING THROUGH GAMING IN CYBERCULTURE: REFLECTIONS ON ONLINE EDUCATION WITH THE COMENIUS GAME

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Introduction

Educational relations take on a new meaning within Cyberculture, a contemporary culture that affects the ways of existence in the world through the use and connected digital technologies. Cyberculture opened new possibilities, such as the access to information and technological advances that changed the way we communicate, work, relate with others, among other everyday actions. These technological advances provide a never before seen freedom, as one no longer need to be in a particular place at a specific time to do our job or some of our daily activities. Artificial intelligence changed our relationship with objects, games. Augmented reality and virtual reality take us to fictitious, real or mixed spaces and mobile devices allow us the mobility never before experienced.

The way we live today has affected school life. How we think, connect with others has changed. Children from all ages bring to school all sort of technological devices (tablets, computers, mobile phones, connected interface toys) and settle new ways to become engaged in the classroom and link knowledge.

School as a place for socialisation is permanently challenged to assist the digital transformations. Teachers must follow those changes, not only by including technology in their classes but also by rethinking their pedagogical strategies. The use of technology *per se* will have an end if it is not with a regular, critical, reflexive and structuring process. The teachers' role is vital, by using social and technical devices, such as games, providing changes in curricula and trusting is the possibility of more meaningful and ludic learning.

This article will approach the use of games in teacher training, especially the Comenius Game. Comenius is an educational game that contributes to media literacy in education and it was developed by researchers in EDUMÍDIA: Educação, Comunicação e Mídias[1]. The research field took place during a Teacher Training Course to Online Education at the Federal Institute of Rio de Janeiro, as a way to mobilise knowledge to gamification in online education using games.

As methodology we used action research in Cyberculture (Santos, 2014), to produce knowledge in contemporanean culture using digital (Santos, 2014). In action research teaching and research walk side-by-side. The researcher develops a training environment in order to understand a phenomenon that is disquieting him.

Cyber Culturists are interacting horizontally with the teacher-researcher (Stenhouse, 1991), as in an online education context all the involved are looked at as trainers and researchers, sharing significant experiences. As researchers we learn with trainees with all the subjectivity that occurs in the training process.

Our goal is to understand how gaming can contribute to online education through their reflections in the training processes. The research is developed over the proposal where students play the Comenius Game in two versions: online and face-to-face in order to reflect how we could include games and gamified experiences in the classroom.

Offering that environment, we have the exchange of knowledge on how to use games and gamification in online education. This contributes to understanding this phenomenon and provides the teacher opportunities for discussion with students.

The theoretical framework is supported by the studies of (i) Santos (2014) to online education and to action research in Cyberculture; (ii) Macedo (2014) to the understanding about experiential teacher, (iii) Alves (2015,2016) in order to support our understanding about games and gamification in education; and (iv) Cruz (2016,2018) specifically about Comenius Game, a game that has contributed to the empirical component of the training course.

The article develops in specific topics: introduction, where we present the research context, the goal and the methodology. In section 2, we reflect on the game in education within Cyberculture. In section 3 we present how the training research

1 Research group led by Professor Dulce Márcia Cruz from the Federal University of Santa Catarina, Brazil.

methodology will engage the research fields. In section 4 we will present the wider notion "Experiential training to game in online education". Finally, we will conclude synthesising the contents approached.

Games in education within Cyberculture

> Games are one of the most important expressions of culture. For J. Huizinga (1980) it is in and through play that cultures are born and develop. Before Huizinga, Shiller was the first researcher to write about games, showing, in the Aesthetic Education of Man, how this practice relates physical and moral action in which its rules "balance human action" (Sennett, 2009, p. 301). But it will be Huizinga who will offer the most complete treatise on games, stating that it is an essential dimension of the human, being found in all times and civilizations. Game is a cross-cultural phenomenon, existing even in societies that do not have a specific word to express it. (Lemos, 2010, p.60)

Game has a fundamental role in societies, thinking culture in a specific way. Through games, along History, the interactions between individuals were made to teach and learn, to live together with proper rules and with it came pleasure and fun. According to Lemos (2010, p.60), the game creates social, space and time relations.

Game's potential invites us to reflect on its use in education, especially to stimulate a meaningful learning, from dialogic processes that are not tedious to the student, who live in Cyberculture. "School seems to face an important challenge before a student who requires playful learning spaces, where there can be engagement, immersion and pleasure in learning" (Coutinho, Rodrigues, & Alves, 2015, p. 45). The features highlighted by the authors (engagement, immersion and pleasure) are important factors to provide meaningful moments to our students.

Game enhances an opportunity to change the pedagogical conceptions, as it considers engagement, collaborative actions and satisfaction, that are the basic premises of games and also learning. Pedagogical practices using games may be included without any major curricular ruptures and maintaining the teacher's

autonomy/protagonism (Minho & Alves, 2016, p.1). For that matter, online education presents a possibility that attends the expectations to include game as a pedagogical procedure.

In Cyberculture, the game gathered multiple functionalities. Digital games can be immersive, mobile, locative games, use virtual reality, augmented reality, among others. Immersive games transport the player to a different reality. Mobile games are portable and use 3G technology, Wi-fi, Bluetooth, GPS and RFID, available in smartphones and tablets. Locative games are based in location, locative media are a way to affect the development of games sensitive to context (Mont'alverne,2012, p. 10). Locative media use the "physical dimension of space in direct interaction with the electronic space through sensors, wireless networks and mobile devices for information and communication" (Lemos, 2010, p.61).

The alternative reality games "use the city of ubiquitous computing as support, expanding our notion of digital media and configuring a modality of practice in transmedia that has its emphasis on the potential presented by the place for mediation" (Andrade, 2015, non-paged). Virtual reality games use graphical elements from other reality, in a hypothetical environment. Augmented reality brings layers or filters to a real image, such as in "Pokemon Go".

Besides using games, there is the possibility to gamify educational procedures. "Gamification is a methodology that adds elements of fun to a game in real-world situations." (Coutinho, Rodrigues, & Alves, 2015, p. 46). Meaning that to use the logic of game in diverse contexts, such as using the question/answer about a certain content, a project developed in groups, challenges for the class to achieve and offering rewards to accomplishments.

> Carolei and Tori [3] enlarge Murray's logic, highlighting that a truly gamified process is based upon three elements that blend and complete: acting, immersion and fun. Acting is the way a player behaves and his different levels of prominence. Immersion is the way he enters and keeps himself within the game's magical circle. Fun is what carries him to other worlds and possibilities and how the player transforms and is transformed by what is different from him (Carolei, Munhoz, & Gavassa, 2016, p. 1253).

The authors mention the word "transformed". It is our believe that experience promotes the "transformation". It is important to highlight that the production of knowledge that we idealise predicts research with the experience and the dialogue between practice/theory/practice, research begins with a practice (field), then a theoretical substantiation that contributes to our reflection upon the events that happened in the field and moving to the comprehension of that practice with consolidated thoughts enabled by the study.

When experiencing the practice with the research field, we idealised a research device[2] that anticipated the experience of the game; after all, nothing better than to act to understand the logic, the rules and how it affects the teachers in training. Later on, following the theoretical analysis on the subject, it was possible to understand that we developed a research tool to learn about the game and learn about the use of media in education (the theme of the Comenius Game) with the same basic logic of the game. So, in this way, we observed that the training occurred for the game, so that the teachers understood the potentialities of the game, and through the game, using the Comenius Game. We believe it is important to situate the reader on the research procedures for an understanding of the reasons for each theoretical-methodological option and also to exemplify gamification with the research case itself.

> This conception of the training experience was fundamental to think about the teachers training, although it is an already widespread practice, the use of the logic of games in the education still faces resistance of the majority. Also, gamification is aligned with the concept of formative experience, since it potentiates rich learning experiences as highlighted by the author. This is because gamification strategies are designed to involve people emotionally, mobilizing a sense of autonomy, engaging them in a purpose. (Minho & Alves, 2016, p. 1).

Minho and Alves (2016) state that gamified training experiences are "experiences that allow the immersion of the individuals in authenticated situations of learning

2 We assume the concept of a device from Ardoino (2003), for whom the devices are ways and means used by individuals to express notions necessary to the researcher to understand the research phenomena.

that privilege the use of game elements and allow reflections of self-knowledge, re-signification of practices and creation of strategies" (p. 1). The intention was that when experiencing themselves as students, with the proposal of learning through the game and seeing the formative possibilities of this pedagogical procedure, there were transformations in ways to plan the classes and reflect on their didactics. Comenius Game was selected for this purpose as its approach uses technology in teaching.

Comenius is both digital and board educational game that tackles the use of media by teachers. We use the game as a tactic for the mobilization of knowledge related to the use of technologies, such as media and games, in education. Mainly to spark reflections for gamification in online education with practical experiences, as student-players, to learn about the game, through the game.

The narrative of the Comenius Game begins in 1964 and involves a teacher named Lurdinha. The teacher is visited by Comenius, who travels through time and discovers that the teachers of the future continue to teach traditional classes without using the technologies. Lurdinha receives the mission to travel to the future in which the use of the media is starting in the schools and to help teachers in its use. Between challenges and quizzes, Lurdinha goes through the evolution of media: the printing media, mass media, web media reaching virtual media, as explained below:

> Thus, to become the hero of the story and save the future, Lurdinha will have to go through a series of challenges and the evolution of the media, organized in bimesters; being the first two months with printed media (newspaper, HQ, book, etc.), the second with the mass media (radio, TV, computer, etc.), the third with the web media (social networks, games and blogs) and the fourth with virtual media (software, games, augmented reality, etc.). It is up to the player to learn and master each media in his given period and, along with Lurdinha, progresses in every mission accomplished (Cruz, 2016, p. 1521).

Figure 1 – Online version of the Comenius Game

Source: http://www.gamecomenius.com/modulo1/

The images were taken from module 1 of the online version of Comenius Game and from them you can identify the interaction of the game with the player. In her first mission Lurdinha has to choose the space of the class, the grouping of the class, the didactic procedure and the media used, in that first moment the printed media. The third image is the vision of the city, where the character can walk to increase her cultural skills, going to the cinema, the museum or the library. By clicking on these spaces' questions, related to the places, are made available. With each correct answer, the score is increased. The game contributes to the teacher's media literacy, from the choice of use to the answers of the quiz, where in each response, a new media that was hidden, is made available. According to a problem situation, Lurdinha chooses which media is the most appropriate to provide learning. The game shows in a playful way how to combat traditional lessons and use the communication interfaces to provide classes that promote engagement and fun.

Further reflection is needed, including on the training of educators facing a challenging reality. We believe that the best way to learn to play and work with games is by playing, and in doing so, we develop our research and training device. When using the game with the practitioners we realized that many experiences have transversals this process, which will be detailed along the next topic, where we will approach research methodology.

The methodology used in Research-Training in Cyberculture

The choice of the research method is personal and implicational, affecting the researcher in its relationship with the research object, with its theoretical and epistemological options.

> Neither disinterested research, nor authoritarian change, is the pattern conquered in this methodological edification that points to the co-participation and co-construction of knowledge implied and engaged in the eminently political act of educating. For this reason, method seems here to be the chosen path, reflected action and training (Macedo, 2010, p.14).

The method that considers contemporary and cybercultural issues need to be open to innovation, to unpredictability, to the event (Macedo, 2016), to error and specific options of scientificity.

Morin (2005) highlights the need for the observer to include himself in the research, with the investigation of his own practice, in a self-critical way: "thus, we see that the very progress of scientific knowledge demands ... that the subject reintroduces itself self-critical and self-reflective in its knowledge of objects "(Morin, 2005, p.29). Facing such important foundations to make / think the research, there was the choice of action research within Cyberculture (Santos, 2014) as a method that does not isolate scientific research teaching, understands the other and itself in process and learns the phenomena of Cyberculture as objects of study.

The method follows orientations, not moorings, and in this way it can be developed when progressing, considering events, unforeseen and errors. The basic premise is not to separate the researcher from the trainer, that is, while there is a formative environment proposed by the teacher, he is researching the educational movements that take place, researching his own teaching praxis, developing and being shaped in exchange with the others. It is a method that relies on the implication of the researcher, unlike basic premises of modern science that foresee the detachment of the researcher from the research object.

The context of the research is the Cyberculture, approach formative devices of online education, with a proposal to construct interactive learning objects, in hypermedia narratives and using information and communication technologies linked to education. Cyberculture is a context and phenomenon to be researched, since many of the research questions seek to understand the uses made by cyberculture practitioners.

The research stems from teacher's dilemmas, the relationship with the student, the tensions with the curricular practices or with the political processes; the methodological options of the research are a political and positioning act. This uneasiness causes study questions and then the teacher triggers research devices (courses, projects or other formative environments) to find data. The research device is configured in the development of an activity aiming at which narratives are manifested; the researcher will analyse these narratives, contributing to the understanding of the phenomenon under study.

The research was developed in the second semester of 2018, during the course "Training of Teachers for Online Education", in the Federal Institute of Rio de Janeiro. The course seeks the continuing teachers training in the Metropolitan region of Rio de Janeiro, especially in the Baixada Fluminense. Researchers are teachers or education professionals with a complete tertiary education, with varying age groups and backgrounds. The proposal is to build with practitioners' projects to implement online education in their everyday realities.

The research device had three moments: initially, the practitioners played the Comenius Game in its digital format; in the second moment, there was a class on gamification in online education; and in the third moment, face-to-face, the board game with the whole class. The didactic proposal was to experience the difference between the two formats of the game, the sensation of the students passing through a gamified period in its formative processes and the learning about media and education.

Operating epistemologically, in to what concerns research with experience (Macedo, 2015), we consider narrative as a foundation and as the act of describing experiences. "It is here that the gathered tools, that is, of the work of understanding comprehensions are cantered on the narrative as a process of communication of experience and of the constitution of the very subject of the experience through narration" (Macedo, 2015, p. 21). After the educational processes, the narratives (imagery, audio-visual, sound and text) emerge, transforming themselves into data, so that the researcher can analyse and understand a phenomenon that crosses it; for this it is necessary to mobilize knowledge that will be described next:

> Coding of the analysed elements; regrouping of the elements by subsumption notions, textual systematisation of the set; production of a meta-analysis or a new interpretation of the studied phenomenon; establishment of relations and/or connections between subfunctors notions and their elements (Santos, 2014, p. 114).

From the analysis described, the research stems from the combination of the field narrative, bibliographical reference and the experiences of the researcher, in the form of subsumption notions. The subsumpyion notion is the textual

systematisation of the whole set, the production of the phenomenon new interpretation studied according to theoretical contributions, field experience and the narratives of the practitioners (which can be their productions, speeches and questions in person or online, until even the silences can draw the researcher's attention to some fact). The subsumption notion that emerged from the present research was experiential training for the game in online education.

Experiential training to game in online education

> The phenomenon of training that takes place in curricular notions and in the valued emergence of meaningful learning, a complex human realization, insofar as they present as a process that is built up in the experience of the subject, mediated by its existential, social and institutional relations , implying ethical, political, aesthetic, cultural transversality, from its conception to the realm of the formative experiences themselves. (Macedo, 2014, pp. 15-16).

Training is considered by Macedo (2014) as the founding phenomenon of education. It is by it and for it that curricular acts are elaborated, guided by problematised, contextualised and critical knowledge for antropossocial practices. There is no explanation for the training, we can explain the conditions and the devices triggered so that it can happen, since it is an individual process and the experiential scope, that is, it happens from the experiences of those involved. With this, a personal characteristic is assumed, a point of view of the practitioner in training, something that crosses and mobilizes him.

This individual construction of the practitioner influences his training process, and society as a whole. Macedo (2014) asks "how would we train ourselves to better understand training?" (Page 60). And responds by stressing the importance of understanding training in its complexity, concreteness and reflection, in a critical way, in order to intervene in the world, build a better place and transform society through education. It was from this perspective that the present research developed, seeking the mobilization of knowledge in games and gamification in Online Education.

We understand Online Education, according to Santos (2014, p.63), as "the set

of teaching-learning actions, or curriculum acts mediated by digital interfaces that enhance interactive, hypertextual and mobile communication practices". We consider online education as one of the phenomena that Cyberculture originated, demanding research that stimulates practices, reflections and understandings, as an open work willing to co-author among those involved.

> Online education is not defined exclusively by digital technologies, it is also supported by interactivity, affectivity, collaboration, co-authorship, meaningful learning, among others. Seeking the insight that we learn qualitatively in exchanges and joint constructions. Establishing digital media-mediated knowledge communities in online spaces and in cyberspace, online education assumes a paradigm that brings together the communicational, technological and pedagogical perspective (Martins, 2017, pp. 55-56).

For educational professionals concerned with training and experiences, it is important to investigate the uses of online education, to value and reflect on how teachers produce, to understand the symbolic referential, codes and practices of that universe and for what purpose they are used in cyberspace. When thinking about games and gamification, Online Education emerges as a path, due to its inherent characteristics: collaboration, engagement, co-authoring, meaningful learning, dialogic relationship, immersion, interactivity and experiential formation.

The experience is related to a perception that has affected and marked in a singular and isolated way, producing senses, thoughts and transformations. Or as Macedo (2015, p. 25) states: "experience is not something that happens, it is what implies us; therefore, it affects us, touches us, mobilizes us and also imposes us, commits us. The experience never leaves us unaffected". The experience is lived, thought, implied and provides reflection, thus provoking formative processes. "As far as training is concerned, highlighting and mobilizing experience in the understanding of training means recognizing that the activity is energized in a continuous and intense process of understanding the world" (Macedo, 2015, p.36).

This understanding mentioned by Macedo (2015) was what we seek in our research, comprehending that understanding is what we can do regarding

the experiences, because they are not verifiable, explicable or felt by another person. We are interested in the perception that practitioners of the research had when experiencing Comenius Game, appreciating what they experienced, comprehending Cyberculture that transversalises the Education currently, since understanding is to learn together (Macedo, 2015). We present some teacher's opinions:

> **Cristiano Andrade -** Comenius is, for me, more than a game. It is a tool to support teachers. With Comenius, the teacher may be able to prepare standard procedures to be adopted in his classes, for example, the impossibility of using a certain space, using some procedure or media. By being aimed at a specific audience, the game involves deeply the player. The activities of the game and the steps to achieve the objectives of each goal, take the player to reflect their practice in the classroom promoting social interaction among the target audience.
>
> **Rosângela Batista -** I found the game very interesting and attractive, because while I did not finish the module 1 I couldn't stop playing. The game on the computer gives us the possibility to take a virtual tour of the city with some specific destinations like museum, cinema, library, school and the return home I found very creative and pleasant this possibility of interaction with other places and test some knowledge related to the environment and what it represents. The game on the board has a more dynamic and competitive footprint that is stimulating and attractive at the same time making us look for pedagogical strategies for any challenges that may arise during the game. It opens a range for more players in the game and this leads to a social interaction creating a space conducive to the development of this process.
>
> The game has, I believe, objectives aimed at a specific target audience of teachers with clear rules and without much complexity, online feedback is very enlightening and direct

participation is voluntary and stimulating.

Gabriela Farah - Since the subject is quite interesting to the target audience, at least for me, the game has managed to keep my concentration all the time. Firstly, it is necessary for the player to get familiarized with the rules, but then the game flows normally step by step. The challenges appear as the skills of the player are developed. For me the outcome of a game must depend exclusively on the player's actions, I do not like to draw cards, play dice or any other external factor / luck that influences the result. In my opinion, this discourages a more applied student and simply eludes the just pranksters when the game works some didactic content.

Vanea Santos - Comenius Game, I finally got access to the game. What I found interesting was to bring the game to the role and discover the possibility of creating a game from this new vision that I had of transferring the media from paper to video.

Diego Cordoba - This game is light, enjoyable and practical. Even with these characteristics, it allows reflection. I did not feel at any point, bothered to concentrate and considered this positive for my proposal. Life is a challenge and it becomes even more exciting in games. The difference between a hobby and a game is the pro-win challenge. The experience of the classroom game in the course, showed that people quickly adapted to the basic desire to win and / or overcome. I believe that because it is a game for the purpose of professional development, some rules, possibilities and questions that arise in the game, favour the development of professional knowledge. As much as in the face-to-face experience I felt challenged and began to pay attention, I did not immerse myself as I have experienced in other games. I consider that to be positive. Non-immersion is different from disinterest.

From the narratives we can reflect on some questions to analyse the use of games in an experiential way in Online Education: “The game involves the player more deeply”; “Takes the player to reflect his practice in the classroom”; “The game on the board has a more dynamic and competitive footprint that is stimulating and attractive at the same time making us look for pedagogical strategies for any challenges that may arise during the game”; I was focused all the time”; “The challenges appear as the skills of the player are developed”; “I discovered the possibility of creating a game based on this new vision I had on media transfer”; “Life is a challenge and it’s even more exciting in games.”

The researcher’s narratives provided an understanding of how the game can contribute to education by reflecting on its own formative processes - the research initial goal. The researcher’s desire to provide experience, training and consequent original creation by the practitioners allowed us to reflect on how to untie the common ties and engagements in the traditional educational dynamics: one of the answers is by game.

> The act of mobilising is defined by Charlot [2013] as an internal movement of the learner seeking to learn. The author further states that people only learn when carrying out an intellectual activity, but for this a meaningful activity must be found. So, we only learn when finding some form of pleasure in the act of learning [Charlot 2013]. The pleasure associated with the act of learning does not distance itself from desire. Therefore, the school should be understood as a mobilizing space of the act of learning. To understand what is going on in classrooms, or what is happening to the student, we cannot neglect him as a subject of desire [Charlot 2013]. The student is an individual who has longings, who interprets the world and who is included in a culture that identifies him (COUTINHO; RODRIGUES; ALVES, 2015, 47).

From topics raised by practitioners, such as: deep involvement, reflection of practice, stimulating and attractive game, concentration and challenges, we can perceive the potentialities that a game can add to the training process, mainly in stimulating our students to resume pleasure to study, to consider their desires to

think their formative course, as mentioned by Coutinho, Rodrigues and Alves (2015). In order to provide visibility to the teachers' creation, the opinion "discovering the possibility of creating a game based on this new vision that I had of the media transfer" emphasizes that the experience with the game instigated new practices that can cause positive echoes.

The game contribution to approach today student's culture is enormous. Comenius Game is a great opportunity for the teachers training, the game provides analyses on the foundational issues of contemporary education "that is to adapt to the new digital world, globalized, participatory culture, maintaining its educational function, but in a compensatory way , as a critical and resistant space for the formation of citizenship "(CRUZ, 2018, p.12).

The free and open online gaming initiative enables its use for other purposes, from a perspective of open educational resources, available at http://gamecomenius.com. The open and accessible scientific production that the Game Comenius producers assumed can provide practices consistent to our students. The experiences with games potentiate the education in Cyberculture, demanding pedagogical practices that can reinforce the interactivity between the subjects, with pleasure to learn and attributing senses and meanings to knowledge production that occurs in our schools.

Final remarks

The game presents itself as a potential for education in Cyberculture. It will act as a pedagogical procedure for curricular contents, for learning technological interfaces, for immersion in some reality to be studied, for socialisation and interpersonal relationships, problem-solving, project development, and so many other possibilities.

Therefore, it is necessary to reflect on the training of teachers to contemplate these perspectives. From this restlessness, we sought to conduct a Research-training in Cyberculture that provided formative experiences with games and chose Comenius Game, an educational game developed by researchers of the Research Group EDUMÍDIA: Education, Communication and Media from the Federal University of Santa Catarina and reflections on teacher education with, over and

through the media.

The data presented occurred during the Training of Teachers course for Online Education at the Federal Institute of Rio de Janeiro. The training of the practitioners was dialogical and experiential, for the mobilisation of knowledge through games. The proposal of the training device sought the practitioners to experience games, reflecting on the potential that they have to provide a more and better teaching and learning processes.

From the experiences in the field, emerged the subsumption notion Experiential training for the game in online education, making it possible to achieve the goal of understanding with practitioners how game contributes to online learning through reflections about their training processes. By operating epistemologically concerning experience research (Macedo, 2015), the practitioners' narratives provided an understanding of the game's contributions to education.

Some highlights: "Deep involvement"; "Reflect your practice"; "More dynamic and competitive footprint";" stimulating and attractive" game; "concentration"; "Developed skills" and "Life is a challenge, and it's even more exciting in games". The researcher's narratives relate their experiences with Comenius and provide an understanding of how the game can contribute to education, especially in online learning. Online education assumes the premise of interactivity, collaboration, engagement, other characteristics that are bewildered with the fundamental conceptions of the game.

In this way, one can conclude, reflecting on the contributions of the game to education, that from the Cyberculture the relationship with knowledge has a new meaning and, currently, students have unique ways of learning, relating to information and entertainment. Ensuring engagement, involvement, concentration, and motivation are critical to new ways of learning and teaching. The game proved to have these abilities, producing significant senses, feelings and experiences, essential for contemporary education. Investing in the construction of an educational project more coherent with society launching new looks for the experiential practices for and by the game in Cyberculture.

References

ANDRADE, Luiz Adolfo de. **Jogos digitais, cidade e (trans)mídia**: a próxima fase. 1. ed. Curitiba: Appris, 2015.

CAROLEI, Paula; MUNHOZ, Gislaine; GAVASSA, Regina; FERRAZ, Luci. **Gamificação como elemento de uma política pública de formação de professores**: vivências mais imersivas e investigativas. Anais do XV Simpósio Brasileiro de Games. São Paulo, 2016.

COUTINHO, Isa; RODRIGUES, Patricia; ALVES, Lynn. Jogos eletrônicos, redes sociais e dispositivos móveis: reflexões para os espaços educativos. Anais do XI Seminário Jogos Eletrônicos, Educação e Comunicação SJEEC. Salvador, 2015.

CRUZ, Dulce. **Jogar para ensinar a ensinar?** A formação para as mídias em um jogo digital. Anais do XV Congresso Brasileiro de Ensino Superior a Distância. Natal, 2018.

_____. **Game Comenius**: uma proposta digital e lúdica de mídiaeducação para licenciandos e professores. Anais dos Workshops do V Congresso Brasileiro de Informática na Educação. Uberlandia, 2016.

LARROSA, Jorge. Notas sobre a experiência e o saber da experiência. **Revista Brasileira de Educação**. Rio de Janeiro, N. 19, p. 20-28, 2002. Disponível em: http://www.scielo.br/pdf/rbedu/n19/n19a02.pdf . Acesso em: 19 jul. 2017.

LEMOS, André. Jogos móveis locativos: Cibercultura, espaço urbano e mídia locative. **REVISTA USP,** São Paulo, n.86, p. 54-65, junho/agosto 2010.

MACEDO, Roberto S. A pesquisa e o acontecimento: compreender situações, experiências e saberes acontecimentais. 1. ed. Salvador: EDUFBA, 2016.

_____. **Atos de currículo, formação em ato?**: para compreender, entretecer e problematizar currículo e formação. 2. reimpressão. Ilhéus: EDITUS, 2014. 170 p.

_____. **Etnopesquisa crítica, etnopesquisa-formação**. 2ª ed. Brasília: Liber Livro Editora, 2010.

_____. **Pesquisar a experiência compreender/mediar saberes experienciais**. 1. ed. Curitiba: CRV, 2015.

MARTINS, Vivian. **Os cibervídeos na educação online**: uma pesquisa-formação na cibercultura. 2017. 178 f. Dissertação (Mestrado em Educação) – Faculdade de Educação, Universidade do Estado do Rio de Janeiro, Rio de Janeiro, 2017.

MINHO, Marcelle; ALVES, Lynn. **Jogar, experimentar e criar**: relatos de experiências formativas gamificadas para professores da educação profissional. Anais do Simpósio Brasileiro de Jogos e Entretenimento Digital. São Paulo, 2016.

MONT'ALVERNE, Adelino C. Jogos móveis locativos: uma proposta de classificação. **Revista Contemporânea.** Rio de Janeiro. ed.19, vol.10. n1, 2012.

MORIN, Edgar. **Ciência com consciência**. 8. ed. Rio de Janeiro: Bertrand Brasil, 2005.

SANTOS, Edméa. **Pesquisa-formação na cibercultura**. 1. ed. Santo Tirso: Whitebooks, 2014. V. 1. 202p.

STENHOUSE, Lawrence. Investigación y desarrollo del curriculum. Madri: Morata, 3a ed., 1991.

Chapter 12

ESCAPE ROOM IN EDUCATION: GAMIFY LEARNING TO ENGAGE STUDENTS AND LEARN MATHS AND LANGUAGES

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Introduction

To enrich the teaching and learning process teachers must have a sense of creativity and innovation. They should also be able to use a variety of learning methodologies and strategies to be adapted to the contexts and needs of the students. For example, when a teacher uses a strategy, such as an Educational Escape Room during the teaching and learning process, it needs to be applied by the teacher effectively. Not only for the pedagogical need, i.e, to meet the characteristics and training needs of the new generation of students, but also for the efficient fulfilment of the educational purposes.

What is an Escape Room? An Escape Room is a gaming experience that challenges participants to leave a room where they are locked. To accomplish that, they must overcome a varied set of tests and challenges, in order to find the exit door key. Escape Room experiences in an educational context are becoming more numerous, but not many are rigorously documented. What has been observed is that practices based on Escape Room games can be part of a classroom management strategy, in different school contexts. For some experts, this practice is part of the methodology of game-based learning, for others it is seen as a gamification experience[1], because it includes essential elements of this strategy, such as progress, autonomy, feedback, and a narrative, among other mechanisms.

1 Use of techniques and game dynamics in non-game contexts.

Because it presents specific characteristics, Classroom Escape Room is different from other similar experiences, such as BreakOut Edu or the Gymkhana. It is not a resource to use every day, as it requires a lot of preparation work, it can be used whenever you feel more suitable.

Despite being a new field under study, some empirical research has emerged in different areas. Among the different definitions of the concept applied to Education, we highlight the definition presented by Lamas (2018: 9) for considering Educational Escape Rooms "as a creative learning environment that can be designed for any educational level and uses the design features of escape rooms to which specific educational elements and purposes must be incorporated."

Hermanns et al. (2017) conducted a qualitative descriptive research to study the approach of the Escape Room concept in the area of Medicine. The results show a great involvement of students in learning activities, the development of communicative skills and problem solving, while learning the curricular contents and applying them. These authors recommend this approach in areas that traditionally require a lot of reading and memorization, helping students' self-confidence and academic success. Borrego et al. (2018) present the very positive results of an Escape Room-based teaching experience with higher Education computer students to increase motivation and improve learning. Lamas (2018) presents a practical case in the Music subject and a guide to the design of an Educational Escape Room. Macías (2017) conducted a study in English with high school students using an Escape Room. The results show the educational value of this strategy, as it presents itself as an effective stimulator for students' involvement in curricular activities. Nicholson (2016) presents the results of a survey conducted by people who provide Escape Rooms around the world, documenting the current state of this trend outside Education.

The Educational Escape Room can be integrated into educational practices for different reasons. First of all, because it fosters pedagogical activity and puts the students into action. It allows to include any curricular content, through challenges, puzzles and instructions. Students can design their own Escape Rooms (Moura, 2018) and participate in the organization of the space where the activity

will take place. The formation of groups will provide collaboration and teamwork, as students have to solve problems by trial and error and find ways to progress to the solution. In this process different interactions are generated among the members of the team and appeal to the creativity of the students. To advance in the game, students have to make decisions, propose hypotheses, try to execute them, and these procedures help to develop skills essential to succeed in the future work world. During the different phases of the game, students have to communicate, exchange ideas, structure the speech, and all of these actions help to improve students' verbal competence. Dealing with the challenges and trials, with more or less difficulty, teams have to persevere once and again and go forward until the enigmas are resolved.

Feedback in Education is essential and in this practice students receive immediate response when they unravel a mystery, contributing to the assimilation of curricular contents. In addition, students learn to communicate, to organize themselves and to discover general methods that they can then apply in new situations. By observing the students in action, teacher discovers that they are able to transfer content and mechanics and deduce strategies to solve new challenges, providing the development of deductive thinking. Usually there is a set time to solve the game, just like any real project. Thus, as time goes by the pressure increases and emotions soar, increasing resilience and concentration.

Materials and Methods

According to Wiemker, Elumir and Clare (2015) Portuguese Literature and MatPorBib Escape Rooms contain puzzles that are categorized as a mental approach because they are based on the use of reasoning and logical thinking of the students. These are guided by an approach that is fundamentally multilinear since they consist of several puzzles that can be performed in a parallel, albeit sequential manner.

The two experiences presented here took place in two primary and secondary schools in the north of Portugal, in the 2018/2019 school year. The participants were 44 students in the 11th grade of Professional Education and 60 students in 7th grade.

Portuguese Literature Escape Room

This experiment is not new for us, because we made, last year, a first experience of applying the concept of Escape Room in Education (Moura, 2018), thus turning the students into original creators of curricular contents. The results were very positive. So, we decided to apply this pedagogical strategy again, but in a different context. The educational Escape Room that we present here was a learner practice developed during the study of the novel "Amor de Perdição" by Camilo Castelo Branco, a required reading of the Portuguese Language 11th Year syllabus.

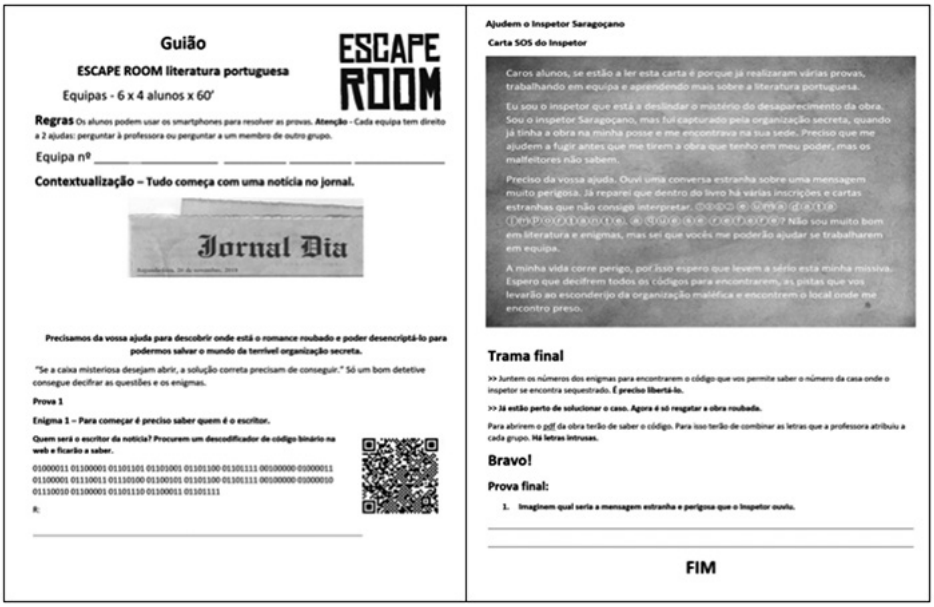
Participants

A total of 44 students participated in the Portuguese Literature Escape Room. The majority (75%) of students were male with ages between 16 (46.5%) and 18 (3%). The remainder (44.2%) were 17 years old. These students belong to two classes of Professional Education courses: Computer Programming and Sports.

Procedures

With this activity, we wanted to promote in students the motivation for action, to facilitate immersion in learning and to help learn how to think. For the introduction to the study of Module 5, the students watched the film "Amor de Perdição" by António Lopes Ribeiro, released in 1943, in order to reinforce the understanding of the work to be studied. As it is based on a literary work of the 19th century, we believe that the Escape Room strategy could be the right choice to motivate students to love reading the biography of the author, his literary work and its study. So, we started by creating a motivational video[2] to introduce students to the Escape Room concept and prepared them for the learning and understanding aims. We mapped out the intended educational goals and created a script, with the quizzes and riddles, for the students to decide which was to be distributed on paper (Figure 1). The students worked in teams of four and the classroom was prepared in advance.

2 https://www.youtube.com/watch?v=W5qs38PB0wI



Guião

ESCAPE ROOM literatura portuguesa

Equipas - 6 x 4 alunos x 60'

Regras Os alunos podem usar os smartphones para resolver as provas. **Atenção** - Cada equipa tem direito a 2 ajudas: perguntar à professora ou perguntar a um membro de outro grupo.

Equipa nº _____

Contextualização – Tudo começa com uma notícia no jornal.

Jornal Dia

Precisamos da vossa ajuda para descobrir onde está o romance roubado e poder desencriptá-lo para podermos salvar o mundo da terrível organização secreta.

"Se a caixa misteriosa desejam abrir, a solução correta precisam de conseguir." Só um bom detetive consegue decifrar as questões e os enigmas.

Prova 1

Enigma 1 – Para começar é preciso saber quem é o escritor.

Quem será o escritor da notícia? Procurem um descodificador de código binário na web e ficarão a saber.

01000011 01100001 01101101 01101001 01101100 01101111 00100000 01000011 01100001 01110011 01110100 01100101 01101100 01101111 00100000 01000010 01110010 01100001 01101110 01100011 01101111

R: _____

Ajudem o Inspetor Saragoçano

Carta SOS do Inspetor

Caros alunos, se estão a ler esta carta é porque já realizaram várias provas, trabalhando em equipa e aprendendo mais sobre a literatura portuguesa.

Eu sou o inspetor que está a desvendar o mistério do desaparecimento da obra. Sou o inspetor Saragoçano, mas fui capturado pela organização secreta, quando já tinha a obra na minha posse e me encontrava na sua sede. Preciso que me ajudem a fugir antes que me tirem a obra que tenho em meu poder, mas os malfeitores não sabem.

Preciso da vossa ajuda. Ouvi uma conversa estranha sobre uma mensagem muito perigosa. Já reparei que dentro do livro há várias inscrições e cartas estranhas que não consigo interpretar. Acho que uma delas é importante, a que se refere? Não sou muito bom em literatura e enigmas, mas sei que vocês me poderão ajudar se trabalharem em equipa.

A minha vida corre perigo, por isso espero que levem a sério esta minha missiva. Espero que decifrem todos os códigos para encontrarem as pistas que vos levarão ao esconderijo da organização maléfica e encontrem o local onde me encontro preso.

Trama final

>> Juntem os números dos enigmas para encontrarem o código que vos permite saber o número da casa onde o inspetor se encontra sequestrado. **É preciso libertá-lo.**

>> **Já estão perto de solucionar o caso. Agora é só resgatar a obra roubada.**

Para abrirem o pdf da obra terão de saber o código. Para isso terão de combinar as letras que a professora atribuiu a cada grupo. **Há letras intrusas.**

Bravo!

Prova final:

1. **Imaginem qual seria a mensagem estranha e perigosa que o inspetor ouviu.**

FIM

Figure 1 - Escape Room guide (own authorship)

We carefully programmed the educational practice, taking into account the curricular content addressed (Camilo Castelo Branco's biography and the introduction to the novel "Amor de Perdição"). We created a narrative to engage the students in the game serving as a guideline during its development. The students take a detective role because they would have to find the stolen literary work. The challenges presented were intended to motivate students and keep them involved in an ongoing process of learning, with different activities and levels of difficulty (beginners, medium and advanced), requiring a cognitive complexity. We were careful to add some degree of fun through various surprise elements. Each challenge had a new feature. We used different materials such as highlight different codes (Morse, binary, ASCII), Egyptian script, QR codes, puzzles, crosswords, etc. (Figure 2). We also bought two digital padlocks and two wooden safes to simulate a real escape room and make the activity more challenging.

Figure 2 - Development of the Escape Room in a group (own authorship)

The guideline was divided in two parts. The first one with ten puzzles and the second one with five, with a higher degree of difficulty. There was still a final plot with two tasks. The time allowed to solve the puzzles was 90 minutes. Thereby the students had to reorganize themselves in the collaborative resolution of the tasks. The space used was the classroom and the outcome to close the narrative was to find the code to decrypt the pdf document with the stolen literary work. Students could use their smartphones to solve puzzles and find the key to the full completion of the game[3].

MatPorBib Escape Room

The MatPorBib Escape Room was held in the 2018/2019 school year and was carried out based on the Mathematics, Portuguese and Writing Workshop's inter-disciplinary, with the support of the School Library and the Autism Unit (integrated in the school context).

3 https://sites.google.com/view/fugasala/

Participants

The participants were 60 students from two 7th school year classes. The majority (54, 5%) of students were female with ages between 12 years (64.9%) and 13 years (35.1%).

Procedures

We started by introducing an initial challenge to all the students, consisting in creating different narratives. The motto was found after a selection of the most original narrative. It was on the basis of these that we created a scenario of abduction [of the Maths teacher] in which the students were asked to help in the release of the victim. The MatPorBib Escape Room integrated Mathematics and Portuguese subjects, as its name suggests, in the curriculum of the 7th school year, and was included in the School Library Activities Plan. The puzzles related to the subject of Algebra (within the scope of Mathematics) and to the literary work of Sophia de Mello Breyner[4], in particular the novel "O Cavaleiro da Dinamarca" (within the Portuguese subject). Simultaneously, an exhibition allusive to this author was held at the School Library.

We created, in each of the classes, 6 teams with 5 students, naming them according to their suggestions.

Unlike the *Portuguese Literature Escape Room* the teachers had never done any similar activity. Following the review of the scenario and the rules, the activity began with the distribution of two packets and a guideline to each team. Each packet contained different puzzles.

Each group was able to use a tablet provided by the School Library and a students´ smartphone to support the resolution of the puzzles, resulting from diversified activities such as deciphering codes and alphabets, access to websites, QR codes, crosswords, gap-filling, etc. (Figure 3). Each group had two aids, one provided by one of the teachers and another by an element from another group.

4 Sophia de Mello Breyner was a 20th century Portuguese author.

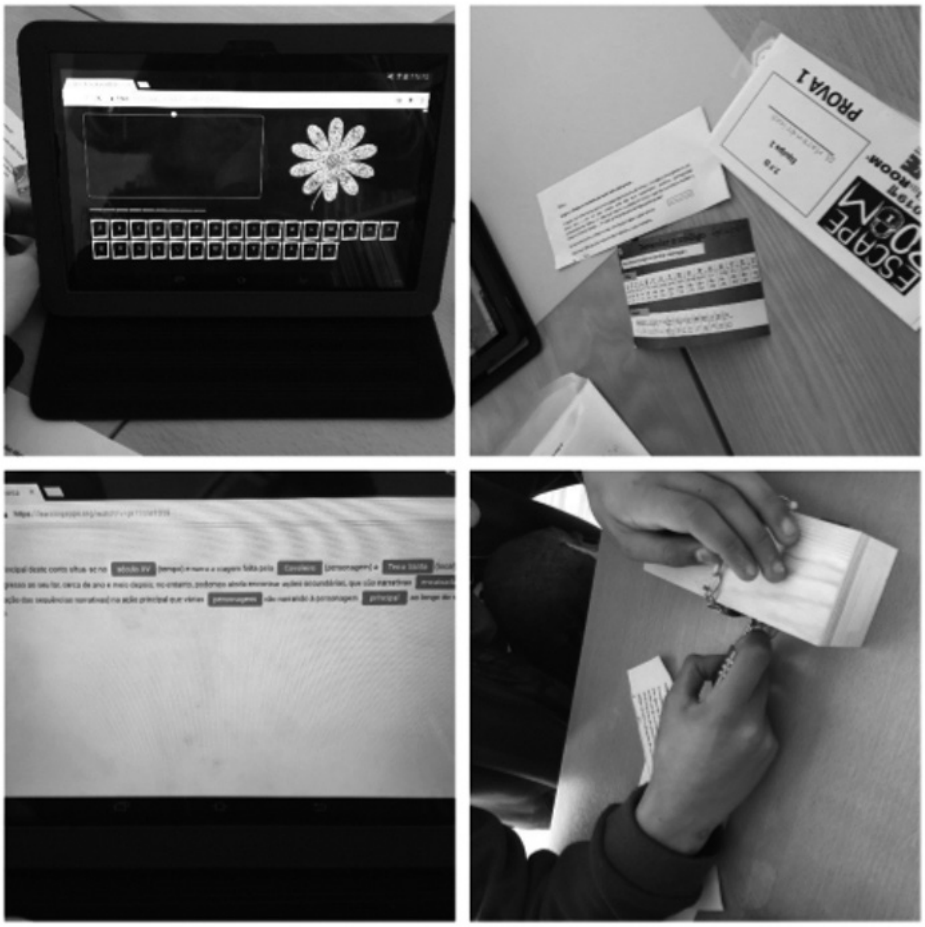


Figure 3 - Different types of puzzles (own authorship)

A guideline was drawn up, with four challenges, divided into 15 puzzles and distributed to each team in packets, sequentially. As they solve the challenges they are given a new one. The exception occurred at the beginning of the Escape Room with the distribution of challenges numbers 1 and 2, divided by 9 puzzles (Figure 4).

Figure 4 - Puzzles of challenges numbers 1 and 2 (own authorship)

After the completion of these two challenges, they were given a third, with 4 puzzles. Finally, the last challenge, with the final enigma “Exit Door” that led to the key that means “liberation” … the “scape”. Setting at this stage meant that the team had managed to solve all the puzzles in the time frame and consequently had won the Escape Room. We would like to emphasize that the six keys were created by the autistic students who are part of an Autism Unit, integrated in the school (Figure 5).

Figure 5 - Keys created by the students of the autism unit (own authorship)

Results and discussion

Portuguese Literature Escape Room

In the next Escape Room class, students responded to an anonymous online questionnaire, created with Google Forms, with closed Likert-scale questions and open-ended questions. All students answered the questionnaire. Almost all of them (97.7%) enjoyed solving the Escape Room. Regarding the degree of difficulty, 84% of the students consider it an intermediate difficulty game, 9% advanced and 7% beginner's level.

Through the open answers, the students pointed out some aspects that complete the answers obtained in the closed questions. As benefits of this pedagogical approach students emphasized teamwork and interaction.

> "I like teamwork because it is more interactive and interesting." (P2)
>
> "Because I have been able to interact with my colleagues so I can solve the questions proposed." (P8)

> "It was very interactive and fun and good to learn, a way to get out of the rut" (P9)
>
> "Because it was good for socialising with my classmates." (P11)
>
> "Because it prepares us to work as a team that will be our future if we follow the area." (P22)

The totality of the students said they would like to repeat this experience, because they enjoyed it, not only for the novelty, but also for promoting the curricular learning.

> "Because it was a fun and different class." (P10)
>
> "It was a very educational and different experience." (P23)
>
> "The students are very committed to solving the Escape Room and memorize the subjects better." (P36)
>
> "Because as I said, it's a good way to learn." (P39)
> "Because I've never done it and found it to be a very good experience." (P40)
>
> "It helps us to develop the mind better, and we have grasped the subjects to study better." (P41)

Other students emphasized the feeling of team, the group cohesion, and the competition that the game generates in the different elements of the teams, because they all work together and compete for the victory.

> "I loved the fun that some challenges generate." (P3)
>
> "It was entertaining and everyone was in the game." (P13)
>
> "We were all attentive to be the first to respond." (P32)
>
> "This activity was very competitive." (P33)

We believe that with this activity we can improve students' motivation for contents and increase the learning of different curricular subjects. The students

mentioned that this methodology can be applied in different curricular subjects.

> "Yes, for example in Mathematics, I think it made sense, solving puzzles with mathematical problems." (P5)

> "It can be used by other teachers to motivate students." (P6)

> "It is a good activity to learn any subject." (P14)

> "It can be done in different ways and with various materials." (P18)

In the survey, we also wanted to know the less positive aspects of the methodology. While most of the students reported having nothing negative to point out, some responses call attention to things like improving the slow Internet connection, lack of time to respond, and some enigmas being more challenging than others.

After these practices, we believe that with this methodology we are also helping students in developing of values such as perseverance, ability to work as a team or promote proactivity.

MatPorBib

After completing the Escape Room, students filled an online questionnaire on Google Docs. We obtained almost all the answers (95%).

All students enjoyed solving the Escape Room together with their colleagues. From the answers presented, the advantage of teamwork was obvious.

> "We develop teamwork and make it easier to respond." (P1)

> "Thanks to teamwork, it was easier to solve the puzzles." (P6)

> "I enjoyed solving the Escape Room with my colleagues because I think it is very important, and besides, it promotes group work and cooperation." (P13)

Regarding the degree of difficulty of MatPorBib Escape Room, 8.8% of the students considered it as Advanced; 15, 8% of the students considered it as Beginners, while the majority (75.4%) of the students considered it with a degree of intermediate difficulty.

The students enjoyed this activity and unanimously suggested it to other teachers from other subjects. They highlighted History (51%), Physical-Chemistry (30%), English (23%), Geography (21%), Natural Sciences (19%), French (18%), Physical Education and Visual Education, both with 9%, Arts and ICT Workshop, both with 2%. Finally, 18% of students felt that they recommend this activity for all subjects.

The greatest advantages are concerned to learning to work in a team, to interdisciplinarity and also to learn and apply the knowledge acquired in a different and more entertaining way.

> "The change in school routine for something more fun. It helps us to work better as a team." (P4)
>
> "We learn to listen to each other while we learn." (P15)
>
> "The fact that it comprises several subjects, which led us not only to think of Mathematics but also of Portuguese" (P10).
>
> "Tested our knowledge and trained our abilities." (P25)
>
> "It's a fun way to learn." (P52)

Although some students considered that there was a no less positive factor, there were others that highlighted the technological problems (Internet access was very slow), lack of organization and collaboration by some elements of their team and the place where the Escape Room took place.

> "The Internet is very slow which has delayed the whole process." (P13)
>
> "The time we had to wait to load the pages." (P46)
>
> "It was a disadvantage the fact that at the beginning we sometimes could not get organized in our team." (P21)
>
> "The class is all together in the same space." (P36)

Almost all participants (98.2%) in this study would like to repeat the experience, considering the activity as:

> "A different way to learn. It is also a way to get along more as a group and to work with new classmates. "(P10)
>
> "Interesting and original." (P12)
>
> "Very interesting, appealing and exciting. I think all the students would like to repeat, because it was a moment of joy in the Escape Room. "(P22)
>
> "Having fun and helping us in our concentration and learning." (P39)
>
> "It was a fun experience, we all worked together and learned to work in a team." (P50)

Only one student said that he would not like to repeat it because he thinks that the activity was "a bit boring" (P16), didn't enjoy some of the puzzles and working within a team.

Conclusion

After our literature review and from the studies carried out we have concluded that it is essential that a paradigm shift, from the traditional classroom approach, occurs and that answers to the emerging challenges underlying current and future teaching and learning contexts (Santos & Carvalho, 2018).

Experiences such as the two presented here can foster greater student involvement. We believe that it is crucial to create not only a "good story" but also puzzles that are appropriate and thought-provoking challenges that can engage students.

> The players are involved in the story, and the puzzles, challenges, and locks are elements to help tell the story. (…) These games can have elements where the players have to make a choice with implications, and by doing so, create moments where the player is involved. (Nicholson, p.48, 2018).

We consider that the activities performed were very positive and that there were moments of meaningful learning. The students actively participated in solving the different puzzles. Besides the students felt that this activity served

to evaluate the knowledge acquired in the subjects involved and other skills were developed. Moreover, there were teamwork, effective communication and discussion of ideas, as well as analytical and critical thinking.

Few students had participated in a similar experiment and almost all expressed a wish to repeat it.

We conclude, therefore, that an Escape Room has enormous potential to be used in teaching and learning contexts (Borrego et al., 2017; Kinio et al., 2019; Lamas, 2018; Moura, 2018; Wiemker et al., 2015).

References

Borrego, C., Fernández, C., Blanes, I., & Robles, S. (2017). Room escape at class: Escape games activities to facilitate the motivation and learning in computer science. *Journal of Technology and Science Education, 7*(2), 162-171. Available at http://dx.doi.org/10.3926/jotse.247

Lamas, A. Patricia Sánchez (2018). Escape Rooms educativas: ejemplo práctico y guía para su diseño. Universitat Oberta de Catalunya. Available at http://hdl.handle.net/10609/76505

Hermanns, M. L., Deal, B. J., Campbell, A. M., Hillhouse, S., Opella, B., Faigle, C., & Campbell, R. H. (2017). Using an "Escape Room" toolbox approach to enhance Pharmacology Education. Journal of Nursing Education and Practice, 8(4), 89–95. Available at http://hdl.handle.net/10950/632

Kinio, A. E., Dufresne, L., Brandys, T., & Jetty, P. (2019). Break out of the Classroom: The Use of Escape Rooms as an Alternative Teaching Strategy in Surgical Education. *Journal of Surgical Education*, 76(1), 134-139. Available at https://doi.org/10.1016/j.jsurg.2018.06.030

Moura, A. (2018). Escape Room Educativo: os alunos como produtores criativos. In Afonso, Maria Elisete Conde P., Ramos, António Luís, *Livro de Atas - 2018, III Encontro de Boas Práticas Educativas*, CFAE Bragança Norte, pp-117-123.

Nicholson, S. (2018). Creating engaging escape rooms for the classroom. *Childhood Education* 94(1). 44-49. Available at https://doi.org/10.1080/00094056.20 18.1420363

Chapter 13

GAMIFICATION IN HIGHER EDUCATION: THE LEARNING PERSPECTIVE

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Introduction

During the last decades there has been a great development of utilitarian systems, applied to the most varied areas, in which games are found. Digital games (or video games) entered everyday life at an increasing rate and became a popular form of entertainment enjoyed by people of all age and social groups (Williams et al., 2009). The first videogames came from a playful reappropriation of oscilloscopes (Tavinor, 2009). Since then, there has been a wide spread of game consoles (from Pong in 1972 to Xbox in 2002, etc.) as well as other video game applications. For example, in 2011, Gartner predicted that gamed-in information systems and services would become an integral part of organizational systems such as consumer goods marketing and customer loyalty with 70 percent of the largest organizations, according to (Burke, 2011) to have at least an application with principles of gamification. These forecasts went even further and the entrance of the gamification extended to the most diverse areas, namely Healthcare, Education, Finance, Wellness, and Corporate Governance. The use of gamification in unlikely areas such as politics, it is a growing trend as described in (Angelovska, 2019) "*this coincides with the beginning of the 2020 US political campaigns*."

Despite hype and growth expectations, several applications fail with gamification, leading to the appearance of designations like "*game over for gamification*" (Smith, 2015). This situation is justified by the way the gamification was used and one of the examples illustrating this same misuse is the experience of motivating housekeepers to become more efficient at Disneyland and at the Paradise Pier Hotels. The failure was related to the existence of public monitors that showed placards with efficiency numbers in green for the fastest employees, and red for the others. However, despite the unsuccessful experiences, gamification continues to be seen as a "tool" with great potential, as companies continue to invest in gamification projects, with estimates suggesting a market growth of 48% by 2019 (Technavio, 2015), and with values in 2016 of 4.91 billion US dollars to nearly 12 billion in 2021 (Statista, 2018).

Games are particularly known for their ability to engage and excite players, often leading them to seek to master techniques in order to reach higher levels, to develop skills, to feel pleasure; players usually immerse themselves in the context of the game (Huotari & Hamari, 2017), all of which are intrinsic characteristics of motivation in the human being. The particularity of the games is the autonomous nature of the activity, as well as the engagement and pleasure of the activity that encourages the player. This is the nature of the games that gamification technology tries to capture, harness and implement in contexts that generally have a more instrumental purpose (Vesa et al., 2017). When starting a game, a player challenges himself or herself against the final result; however, and due to the characteristics of the player, this process is often developed not only by challenge and competition but by pleasure, regardless of the outcome (Malaby, 2007). Incorporating the engagement and pleasure of the game process into activities outside the traditional area of the games is one of the principles of gamification. This approach allows the application and use of game elements to different types of systems, with the purpose of providing game experiences in non-entertainment areas, namely teaching-learning process (TLP) (Huotari & Hamari, 2017).

In the current context of teaching, one of the key challenges is how to engage students and increase their involvement in achieving the objectives of the proposed learning activities. One of the suggested solutions is to combine learning

strategies that involve active methods in combination with traditional methods (Moreira et al., 2018). Higher education institutions (HEIs), due to their characteristics, should make an effort when it comes to providing new teaching-learning methodologies, the need to adapt to new means (González Tardon 2015) and, especially, the students who present today different characteristics (Ma et al., 2016). Thus, in this framework active learning methodologies have been implemented, diversified and progressively improved. Gamification is one of those methodologies that, when applied, has had a positive result, as the literature (Urh et al., 2015; Gates & Kalczynski, 2016) demonstrates, and contributes to improving students' skills development for the 21st century.

Current context of the TLP in higher education

We live in a highly digitalized society, with continuous access to direct and indirect technology regardless of age, education, or profession. In order to evolve and create a real information society, people, and of course our students, must have basic technological competences that allow them to access sources of knowledge and permit them to benefit from those sources by recognizing their quality and reliability. Modern society's technological bias makes learning necessary for all groups to get a job, learn an activity, or simply communicate with other people and be informed. This implies a need to access technological devices and possess a set of basic abilities to interact with technological elements and their applications (Fonseca et al., 2018).

The literature points out that the correct use of most technologies stimulates the learning environments and promotes student motivation and engagement being these important factors, determinants for learning. This is because attracting and motivating NetGen people constitutes challenges for educators around the world (Kapp, 2012). The integration of technological innovations with the new practices can enable significant advantage. On the other hand, the present students, named Gen Z, who reach HEI, force a disruption in teaching process. In this context, it is justified the need to introduce new paradigms in the TLP.

As referred the characterization of generations over time has been conditioned

by the development of digital technologies and their application / use in everyday life by these same generations. Ma et al. (2016) present a study in which this reality is evidenced clearly and unequivocally. Table 1 summarizes some of the characteristics that describe / characterize the different generations. From the analysis of the mentioned table one can verify that the so-called traditional system of education does not conform to the current generations; so that there must be disruption in order for success in higher education.

Table 1. Characterization of generations over time (Ma et al., 2016)

Generation	**Greatest / Silient**	**Baby Boomers**	**Gen X**	**Millennials**	**Gen Z**
% relative to the global population	5%	15%	20%	27%	32%
Communication style	Letter	Phone	Email/SMS	Instant Message	Emojis
Main technology	Car	Television	PC	Smartphone	Virtual / Augmented Reality
Digital Proficiency	Pre-Digital	Digital Immigrants	Early Digital Adopters,	Digital Natives	Digital Innates

However, this need for disruption is not linear, since there is a lot of resistance on the part of the HEIs themselves (Buckley, 2015). Furthermore, the expectation of change is directly related to the fact that the expository experiences centered on the performance of teachers in the classroom still present a predominant style (Walker et al., 2008). Therefore, the need to reinvent education is latent, since this instructional model, consolidated in the nineteenth century, "*has now also to meet the demands and needs of a democratic and inclusive society, permeated by differences and guided by the inter, multi and transdisciplinary knowledge, with which we live in this early 21st century"* (Araújo, 2011). This change is necessary because as stated by Chickering and Gamson "*Learning is not a spectator sport.*

Students do not learn much just by sitting in class listening to teachers, memorizing prepackaged assignments, and spitting out answers. They must talk about what they are learning, write about it, relate it to past experiences, apply it to their daily lives. They must make what they learn part of themselves" (Chickering & Gamson, 1987).

In order to meet this need, in the last decade, according to Freeman et al. (2014) classes that resort to active learning have attracted a great deal of attention, since they stimulate students' motivation to seek to build higher competences. According to Fraser et al. (2014) "*In the context of new pedagogical trends, the Active Methodology is one of the possible strategies, for which the student is the central protagonist, that is, responsible for his/her educational trajectory and the teacher is as a facilitator of the experiences related to the learning process". However, "literature rarely identifies the key elements of pedagogical innovations or explains how to implement them in the classroom.*" (Maia et al., 2012).

The active learning methodologies (Bonwell & Eison, 1991; Davis, 2009; Wentzel & Wigfield, 2009; Felder & Brent, 2009) are, in turn, student-centered approaches that they transfer to those the responsibility over the management of their learning experience. It is advised to place students often in a situation of collaboration with classmates. In an active learning situation, teachers assume the role of facilitators or mediators rather than information providers in a unidirectional way. The presentation of facts, often introduced through direct reading, is mitigated in favor of class discussion, problem solving, cooperative learning and writing exercises (classified and unclassified). Other examples of active learning techniques include role-playing, case studies, gamification, group projects, or role-reversal dynamics such as think-pair-share, peer teaching, debates, Just-in-Time Teaching, small practical demonstrations followed by class discussion and gamification.

HEI's policy regarding the improvement of TLP is to encourage the adoption of active methodologies because, on the one hand, it is believed to be the most adequate for success in the acquisition of competencies and, on the other hand, meet the characteristics of the students who are coming to HEIs, with the aforementioned.

The need to involve the generation of students who are coming to HEIs leads teachers to make an effort to change their pedagogical practices that have sometimes followed for many years. This is because the generation of students who, as referred to, attend HEIs have a very great attention deficit when they are confronted with classes that use the expository-active method. Thus, it is necessary to interrupt the knowledge transmission stream and create alternative activities that lead them to refocus along the sessions in the classroom context.

Engagement, Motivation and Innovation in TLP

Looking back at the different challenges in higher education, new student centered approaches to the TLP has been defined to enhance student engagement and motivation in classrooms as referred in the above section.

The definition of students engagement according to the Glossary of Education Reform (2014) is *"...the degree of attention, curiosity, interest, optimism, and passion that students show when they are learning or being taught, which extends to the level of motivation they have to learn and progress in their education."* In this context, it can be stated that student engagement is a key factor that influence your academic success.

According to Sinatra, et al. (2015) student engagement has been classified as "*holy grail of learning*". Generally engagement refers to the extent to which students invest or commit to learning (Zhang & Hyland, 2018). Engagement is by itself a generic term but it has brought together students' attention, curiosity, interest and willingness to use their learning skills to progress towards the acquisition of new skills, both technical and behavioral.

Student engagement is a multidimensional (multifaceted) construct that can be measured with all the dimensions dynamically interrelated. Student engagement typically includes three dimensions (Martin & Torres, 2016) (Figure 1):

- Behavioral engagement – Students who are behaviorally engaged would

typically comply with behavioral norms, such as attendance and involvement, and would demonstrate the absence of disruptive or negative behavior.

- Emotional engagement – Students who engage emotionally would experience affective reactions such as interest, enjoyment, or a sense of belonging.
- Cognitive engagement – Cognitively engaged students would be invested in their learning, would seek to go beyond the requirements, and would relish challenge.

Figure 1 – Dimensions of students' engagement.

In this context, the student engagement is considered as a psychosocial process, influenced by institutional and personal factors inserted in a wider social context, integrating the sociocultural perspective with the psychological and behavioral visions.

The literature when analyzing engagement includes motivation. However, Bergdahl et al. (2018) state that engagement and motivation theories are closely

related, and motivation theories can inform studies of engagement, and vice-versa, but these are different constructs. According to the authors, the motivational theories can be intrinsic in nature, such as student interest, and/or extrinsic, for example notes or expectations created by parents. Intrinsic motivation to learn is a more effective strategy to get and keep students interested. However, to Stipek (2002) "…*most realistic people in the field say that you've got to have both… You can rely entirely on intrinsic motivation if you don't care what ... learn, but if you've got a curriculum and a set of standards, then you can't just go with what they're interested in*." Moreover, van Roy & Zaman (2018) argue that it is the kind of motivation that drives behavior and performance. On the other side is demotivation, a situation in which a person has no intention to perform a given behavior, yet according to the authors there is a continuum with four types of motivation ranging from intrinsic to extrinsic and finally to amotivation (Figure 2).

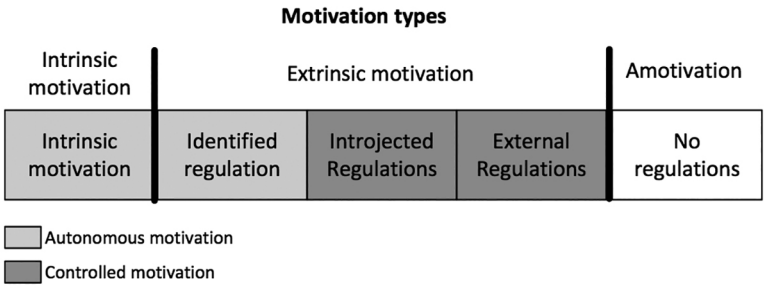

Figure 2 – Motivational types (van Roy & Zaman, 2018).

However, the literature shows that motivation alone is not sufficient for the student to continue learning. Boekaerts (2016) suggests that while students are not ready to employ self-regulatory, they still engage. Moreover, innovation must be part of the TLP of the students in order to motivate and engage them and consequently succeed in acquiring new skills.

According to Serdyukov (2017) to innovate is to look beyond what is currently being done and to develop a new idea that will help to accomplish the work in a

new way. The purpose of any invention is therefore to create something different from what we have done, whether in quality or quantity, or both.

In education, innovation may appear as a new pedagogical theory, methodological approach, teaching technique, instructional tool, learning process or institutional structure that, when implemented, produces a significant change in TLP leading to student success. Thus, innovations in education must result in significant improvements in the efficiency, effectiveness, or quality of outcomes (Australian National Audit Office, 2009).

If we focus on educational innovation, based on the ideas expressed in Vanderlinde and Van Braak (2010), it can be described as the process of changing teaching or learning activities that produce improvements in student performance. However, in order to consider this process educational innovation should respond to certain needs it should: be effective and efficient; be sustainable over time; and produce transferable outcomes beyond the particular context in which it arose. In order to assess the needs identified, we can define other variables to be studied, namely the relationship between student motivation, degree of satisfaction, and the user experience; or student perceptions of their interaction with and teaching of applied collaboration (Sun & Hsu, 2013; Giesbers, et al. 2010).

Gamification

Gamification concept

The term gamification, originally introduced by Nick Pelling in 2002, began to gain popularity in academic circles only in 2010. One of the first, and most popular, definitions is that provided by Nacke et al. (2011), which simply define gamification as "*the use of game design elements in non-game contexts*". This definition describes the means (use of game design elements) and the context of application (non-play) of gamification in broad terms. Some subsequent definitions describe more specific means, objectives and application contexts of gamification. In the various definitions found it is possible to highlight the following:

- "*adding game elements to an application to motivate use and enhance the user experience.*" (Fitz-Walter et al., 2011);

- "*Gamification can motivate students to engage in the classroom, give teachers better tools to guide and reward students, and get students to bring their full selves to the pursuit of learning. It can show them the ways that education can be a joyful experience, and the blurring of boundaries between informal and formal learning can inspire students to learn in lifewide, lifelong, and lifedeep ways…. [However,] by making play mandatory, gamification might create rule-based experience that feel just like school. Instead of chocolate and peanut butter, such projects are more like chocolate-cover broccoli.*" (Lee & Hammer, 2011).

- "*a process of enhancing a service with affordances for gameful experiences in order to support user's overall value creation*" (Huotari & Hamari, 2012);

- "*the use of game design elements (e.g., points, leaderboards and badges) in non-game contexts ... to promote user engagement*" (Mekler et al. 2013);

- "*the use of game-based elements such as mechanics, aesthetics, and game thinking in non-game contexts aimed at engaging people, motivating action, enhancing learning, and solving problems*" (de Sousa Borges et al., 2014).

From the various definitions presented the common points that emerge are: the need for gamified systems to have specific user engagement objectives; and instrumental goals are how to achieve them through the selection of game design elements. What is not indicated in these definitions is how to select those design elements for specific tasks, and how they interact with each other and create the user's intended interactions in order to promote user engagement and lead it to the intended instrumental objectives.

According to Deterding et al. (2011) the characteristics of Gamification are:

1. It is easy with null cost.
2. No need to generate new contents, it only improves the way of learning.
3. Step by step implementation of an experiment.
4. There are no chances of losing the game.

Games used on a day-to-day basis not only serve to entertain users, but also help shape their behavior. The dynamism and engagement of the user should be increased in teaching in general and in e-learning training in particular, as mentioned by Dichev et al. (2014), since the difficulty of establishing commitments between students and the platforms is more difficult due to the characteristics of the distance courses. Muntean (2011) shows that gamification can be strongly used in students' learning behavior because it positively increases the development of solutions to problems, but in a more playful way.

The development of gamification solutions must take into account the users extrinsic and intrinsic behavior. Extrinsic motivation is related to motivation triggered by gifts, while intrinsic motivation is the motivation that arises from self-interest (Surendro & Raflesia, 2016) as referred to in section 3.

Gamification and the main motivational and engagement mechanisms

To create a gamification instruction it is necessary to understand the behavior / profile of the student in general, and in particular, the best way to achieve their engagement. In this sense, Zepke & Leach (2010) identified four key perspectives to categorize actions that improve student engagement: motivation and agency, transactional engagement, institutional support, and active citizenship.

The use of game attributes will affect the student's learning behavior and attitude. Tu et al. (2015) consider that gamification is not just an application, but is a thought process as it provides a better learning experience and an instant feedback environment. This strategy included a rewards system for the successful completion of a task / challenge.

According to Silpasuwanchai, et al. (2016) gamification is not just a matter of adding the most common PBL (Points, Badges and Leaderboards) elements to any digital task, but rather carefully designing the gamified systems that promote the desired behaviors (Burke 2012). To answer this question Dixit et al. (2018) propose five steps to be performed in gamification: (i) understanding of students' abilities as well as the context that defines instruction; (ii) definition of course

learning objectives; (iii) before implementing gamification, it is mandatory to formulate teaching experience with details of execution (individuals, groups, class size, face-to-face, online); (iv) identify points that may pose obstacles; (v) how resources will be used - decide whether to use an existing game, or whether to create and use a new game, before implementing the game. Additionally, Saputro et al. (2017) show that the various elements of the game can be used to encourage increased intrinsic student motivation. Their research results in a set of intrinsic motivational elements along with game elements, as shown in Table 2.

Table 2. Elements of the game in the intrinsic motivational elements (Saputro et al., 2017).

Elements of intrinsic motivation	**Appropriate gaming elements**
Autonomy	Level, unlock a level, meaningful choice, progress bar, Skill tree, Avatar World, narrative, leaderboards, onboarding, quests, mission, lives.
Competence	Badges, Leaderboards, performance graphs, points, XP, grades, level, dashboards.
Relatedness	Collaborative work, competition, badges, social status, leaderboards, quests, storyline, avatar, teammates.
Purpose	Virtual Map.

The elements of intrinsic motivation can be used as a reference to determine the right elements of the game to encourage the creation of students' intrinsic motivation to participate, for example, in distance learning courses. However, it is necessary to study in depth how to integrate the elements of the game into learning along with the steps that must be organized in the solutions defined. Any solution that uses gamification must be validated by experts in the fields of technology and psychology, because according to (Zichermann & Cunningham, 2011) "*gamification is 75 percent psychology and 25 percent technology*." This validation must be performed in such a way that the elements of the game can be implemented correctly in a Learning Management Systems (LMS), such as Moodle.

When the gamification from the point of view of psychology is observed Sailer, et al., (2014) suggest that the common elements of gamification (PBL, Progress bars and charts, quests e meaningful stories and avatars) are mapped in the six main motivational mechanisms, as shown in table 3.

Table 3. Gamification elements mapped on the six main motivational mechanisms (Sailer, et al., 2014)

Perspective	**Users …**	**Elicited by …**
Trait	will be more likely to be motivated if they experience achievement, success, progress, control and membership	Badges Leaderboards
Behaviourist Leaning	are more likely to be motivated when immediate positive feedback is received in the form of rewards	Points Badges
Cognitive	are more likely to be motivated by clear and achievable goals, demonstrates the importance of a user's action and encourage the mastery of skills and goals	Badges Progress bars and charts Quests
Self-Determination	are motivate by felling of competence, autonomy and social relatedness	Badges Leaderboards Meaningful stories and avatars
Interest	are motivated by interests in the situational context, clear goals and adapting the level of difficulty to the user's skill level	Points Badges Progress bars and charts Quests Meaningful stories and avatars
Emotion	are more likely to motivated by decreasing negative feelings, such as fear, envy and anger, an increasing positive ones, such as sympathy and pleasure	Meaningful stories

Gamification in TLP in higher education

The Potential of gamification

In educational processes there is the possibility of adapting, as a teaching tool, interest, attraction and motivation in order to strengthen the learning process (Herranz & Colomo-Palacios, 2012). The effect of applying gamification techniques lies in influencing students' behavior to achieve specific learning objectives, having an appropriate alignment between the objectives of the game and the learning objectives. If such alignment is achieved, gamification improves the student's experience, following the goal of motivating, reaching, promoting and maintaining greater participation in the TLP and, in turn, promoting collaboration between students and teachers during the game (Payne et al. al., 2008). In short, gamification is a practice that favors the co-creation of knowledge and allows a closer relationship between teaching and learning.

The creation of mutual knowledge or co-creation is related to the perspective of open innovation, in terms of cooperation to combine knowledge between students and teachers, defining a teaching-learning strategy that values the general contributions. This implies, in line with the question posed by Lichtenthaler & Ernst (2006), to develop three main activities through play: (i) to acquire knowledge; (ii) integrate knowledge; and (iii) explore knowledge. In this sense, with regard to the co-creation of knowledge, it is useful to consider the notions systematized by Sobrino (2014), which addresses the differences between the concepts of interaction and interactivity in their contribution to learning processes, in which interactions involve the development of the ability of individuals to influence each other, while interactivity is restricted to the incorporation of means and tools into the process, which ultimately should improve cooperative learning.

Following the approaches of Herranz and Colomo-Palacios (2012) in the application of gamification as strategy, it is also necessary to consider a set of considerations, in the perspective of giving meaning and sustainability to the incorporation of games as teaching-learning method. However, it is important to highlight that according to Geymonat (2014), there are many teachers who

consider the use of games as a strategy to improve the development of knowledge, skills and attitudes, to motivate learning and skills development.

Gamification experiments with LMS Moodle

As discussed earlier, games have characteristics that exert fascination on people. Vianna et al. (2014) consider that the relationship between the mechanisms of games and human behavior are understood more deeply when studied the profiles of players and the motivations that sensitize each one of them. Zichermann & Cunningam (2011) explain that players are motivated to play for different purposes, and that these purposes lead to different behaviors within the context of the game. By analyzing players' different motivations and behaviors, they summarize player profiles in four broad groups: Killers, Explorers, Achievers and Socializers.

In this context, it is necessary to identify the tools that can be used to create a course with gamification techniques. For this purpose, both the native LMS tools (Edmodo, Moodle, Blackboard, etc.) and the external plug-ins contribute. It is important to note that even tools that were not originally developed for gamification can be adapted to this, provided that the LMS have integration mechanisms. This occurs because the gamification process is not necessarily linked to the functionality of a tool, but to the way it is used.

In LMS Moodle, for example, in addition to all the advantages, resources and activities (videos, activities, forums, research, library, chat, among others), it is possible through gamification to observe the performance of each student according to their score and the competitive behavior of students to remain in first place in a ranking.

For the identification of native tools and plug-ins, gamification elements of the Octalysis frameworks (Chou, 2014) and The Periodic Table of Gamification Elements (Marczewski, 2016) were used. In addition, a relationship between tools and player profiles is made (Bartle, 1996), indicating some possible ways to use tools for student motivation through gamification. Table 4 summarizes available tools and related profiles for native Moodle elements and external plug-ins.

Table 4. Native tools and Plug-ins of Moodle for gamification

(adapted from (Silva, 2018)).

Tools / Killers		Player Profiles			
		Explorers	Achievers	Socializers	
Native	Blog		X		X
	Chat				X
	Forum	X	X		X
	Medalhas	X			
	Quis	X		X	
	Wiki		X	X	
Plug-ins	Leaderboarad	X			
	Level Up!	X	X	X	
	Progress Bar			X	
	Checklist			X	
	Stash		X	X	

As mentioned, the gamification in education is presented as a solution that aims to promote students' interest through collaboration, participation and fun (Bardo, 2013). The use of gamification systems has as main objective to keep individuals involved in their activities, and therefore teaching has been one of the main fields of experimentation of gamification (de Quadros, 2013).

The LMS Moodle is one of the most popular virtual learning environments in the world (Capterra, 2017), and has evolved as a tool, making it a platform in which application of gamification is a reality. Some developers have created plugins to facilitate the application of gamma strategies in the referred LMS. An example of applied scoring in learning in virtual environments is Mozilla Open Badges[1]. The system issues digital badges and medals to reward skills and achievements of user activity from a course created in LMS Moodle. As of version 2.5, the platform included the possibility of using badges through the Open Badges Infrastructure (OBI).

1 https://openbadges.org/

The use of Moodle as a platform for the application of gamification in higher education is now a reality, as can be seen from the several examples presented in the most recent literature. Among the various published experiences, the following set out stands out.

Jucá et al. (2014) present an example of gamification, which was used with the intention of engaging students in higher education. The authors used game design strategies such as challenges, goals, points and badges in an entrepreneurship course. These strategies had as theoretical principle the "Gamification Design Framework" (Werbach & Hunter, 2012), and the result was quite positive.

Serra, et al. (2016) used a plugin for Moodle called BlockRanking. The objective of the researchers and teachers was, besides increasing the resources of gamification in the courses, to carry out a continuous monitoring of the students through the analysis of their scores.

The work presented by Tuparov et al. (2018) aimed to develop a framework to identify gamification characteristics through the use of Moodle, based on a case study for the implementation of gamification in peer assessment and self-assessment activities. The results were relatively positive because they failed to implement the peer assessment.

In (Kermek et al., 2018), an experience of utilization of gamification in higher education for 2 years is presented. In this study, it was verified on the one hand that the results obtained were positive in some activities, such as surveys and self-assessment test. And, on the other hand, it was found that the materials made available had a significant increase in their use. As a less positive aspect, it was the decrease in student interest over the semester.

The teaching of programming always presents a great challenge, since the students reach the HEI without having developed the necessary skills to adapt to this paradigm that is the programming. Jen and Said (2018) conducted an experiment with application of gamification in teaching the Java programming language. The authors incorporated game elements for the purpose of engaging, providing feedback, and defined homework to encourage informal learning. The results show

that most of the students felt motivated to learn programming after participating in gamification activities.

Oliveira et al. (2018) propose a framework for applying structural gamification in Moodle for the online training of TRT-2 members and civil servants. From their experience, the authors states that Moodle has several features to gamify a course: activity completion, restricted access, progress bar, badges, score (to add games made with software like Storyline) and grade. With experience, the authors were able to improve TLP with high student satisfaction.

Jurgelaitis et al., (2019) present a research work regarding the teaching of the Unified Modeling Language (UML). The authors, in the course development, used gamification techniques through the use of some gratification elements (coins, items, and badges), the leaderboard, content locking and trading. The obtained results confirm that the student classifications can increase as a result of the application of the gamification in the TLP, as well as its motivation.

Synthesis

This article focuses on gamification. The gamification emerges as another methodology, within the active methodologies, that in the context of TLP contributes to promote student motivation and engagement. Digital students for whom the so-called traditional methods - expository classes - fail to create a sufficiently motivating learning environment and consequent school success so desired by teachers and demanded by society.

From the foregoing it can be seen that gamification alone does not represent an addition, gamification has to be based on scientific principles both in its conception and in its operation and must be innovative. Finally, it can be verified that the gamification when used in the TLP following the above contributed to the students' academic success, increasing and solidifying their technical and behavioral skills.

References

Angelovska, N. (2019) Gamification Trends For 2019: Making Room For Game-Elements In Politics, https://www.forbes.com/sites/ninaangelovska/2019/01/20/gamification-trends-for-2019-making-room-for-game-elements-in-politics/#7c57b1082a77

Araújo, U. F. (2011). The fourth educational revolution: the change of times, spaces and relations in the school from the use of technologies and social inclusion, *ETD – Educação Temática Digital*, 12(1), pp. 31-48.

Australian National Audit Office, (2009). Innovation in the public sector: Enabling better performance, driving new directions, *National Audit Office*, Canberra, Commonwealth of Australia.

Bartle, R. (1996). Hearts, clubs, diamonds, spades: Players who suit MUDs. *Journal of MUD research*, *1*(1), 19.

Bergdahl, N. Fors, U., Hernwall, P. & Knutsson, O. (2018). The Use of Learning Technologies and Student Engagement in Learning Activities. *Nordic Journal of Digital Literacy*, 113.

Bonwell, C. C. J. and Eison, J. A. (1991). Active learning: Creating excitement in the classroom, ASHE–ERIC Higher Education Rep. No. 1, Washington, DC: The George Washington University, School of Education and Human Development.

Boekaerts, M. (2016). Engagement as an inherent aspect of the learning process. *Learning and Instruction*, 43, pp. 76–83.

Buckley, R. (2015). *Why the education sector is ripe for digital disruption,* https://www.icio.com/management/insight/item/why-education-sector-is-ripe-for-digital-disruption

Burke, B. (2011). Gamification Primer: Life Becomes a Game, *Gartner Inc*.

Burke, B. (2012). Gamification: Engagement Strategies for Business and IT, *Gartner Inc*.

Capterra. (2017) Top 20 LMS *Software*. *Capterra*. http://www.capterra.com/learning-management-system-software/#infographic

Chou, Y. K. (2015). *Actionable gamification: Beyond points, badges, and leaderboards*. Octalysis Group.

Chickering A. W. & Gamson, Z. F. (1987). Seven Principles for Good Practice, AAHE *Bulletin*, 39, pp.3-7.

de Quadros, G. B. F. (2012). Gamificando os processos de ensino na rede. In *Anais do Congresso Nacional Universidade, EAD e Software Livre,* 2(3).

Davis, B.G. (2009). Tools for teaching, 2nd ed. San Francisco: *Jossey-Bass Publishers*.

Dichev, C., Dicheva, D., Angelova, G., & Agre, G. (2014). From gamification to gameful design and gameful experience in learning. *Cybernetics and Information Technologies*, *14*(4), pp. 80-100.

de Sousa Borges, S., Durelli, V. H., Reis, H. M., & Isotani, S. (2014, March). A systematic mapping on gamification applied to education. In *Proceedings of the 29th annual ACM symposium on applied computing* (pp. 216-222). ACM.

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

Dixit, R., Nirgude, M., & Yalagi, P. (2018, December). Gamification: An Instructional Strategy to Engage Learner. In *2018 IEEE Tenth International Conference on Technology for Education (T4E)* (pp. 138-141). IEEE.

Fardo, M. L. (2013). A gamificação aplicada em ambientes de aprendizagem. *RENOTE*, *11*(1).

Felder, R.M. and Brent, R. (1996). Navigating the bumpy road to student centered instruction, http://www4.ncsu.edu/unity/lockers/users/f/felder/public/Papers/Resist.html

Fitz-Walter, Z., Tjondronegoro, D., & Wyeth, P. (2011, November). Orientation passport: using gamification to engage university students. In *Proceedings of the 23rd Australian computer-human interaction conference* (pp. 122-125). ACM.

Fonseca, D., Conde, M.Á. & García-Peñalvo, F.J. (2018) Improving the information society skills: Is knowledge accessible for all?, *Univ Access Inf Soc (2018*), 17(2), pp. 229-245 https://doi.org/10.1007/s10209-017-0548-6

Fraser, J. M., Tinman, A. L,. Miller, K., Dowd, J. E., Tucker, L. and Mazur, E. (2014). Teaching and Physics Education Research: Bridging the Gap, *Reports on Progress in Physics*, 77, pp. 1-17.

Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H. and Wenderoth, M. P. (2014). Active Learning Increases Student Performance in Science, Engineering, and Mathematics, *Proceedings of the National Academy of Sciences of the United States of America*, 111(23), pp. 8410–8415.

Gates, A. E., & Kalczynski, M. J. (2016). The oil game: Generating enthusiasm for geosciences in urban youth in Newark, NJ. *Journal of Geoscience Education*, *64*(1), pp. 17-23.

Geymonat, N. (2014). Videojuegos en seis escuelas de tiempo completo: puente entre lo sociocultural y lo didáctico pedagógico. *Cuadernos de Investigación Educativa,* 5(20), pp. 71-93.

Giesbers B, Rienties B, Tempelaar D and Gijselaers W (2013). Investigating the relations between motivation, tool use, participation, and performance in an e-learning course using web-videoconferencing. *Computers in Human Behavior*, 29(1), pp. 285-292.

González Tardon, C. (2015). Comunicación corporativa gamificada en la universidad. Gamificación en redes sociales, experiencias, oportunidades y desventajas. *communication papers*, *Media Literacy and Gender Studies,* 4(8), 11-20.

Herranz, E., & Colomo-Palacios, R. (2012). La Gamificación como Agente de Cambio en la Ingeniería de Software. *Revista de Procesos y Métricas de las Tecnologías de la Información*, pp. 30-56.

Huotari, K., & Hamari, J. (2012, October). Defining gamification: a service marketing perspective. In *Proceeding of the 16th international academic MindTrek conference* (pp. 17-22). ACM.

Huotari, K., & Hamari, J. (2017). A definition for gamification: Anchoring gamification in the service marketing literature. *Electronic Markets, 27*(1), pp. 21–31.

Jen, L. S., & Said, S. H. M. (2018). Application of gamification in introduction to programming: A case study. *PEOPLE: International Journal of Social Sciences*, *4*(3).

Jucá, P. M., & Rolim, G. (2014). Aplicação da Gamificação na Disciplina de Empreendedorismo. In *XXII Workshop sobre Educação em Computação (WEI 2014)*.

Jurgelaitis, M., Čeponienė, L., Čeponis, J., & Drungilas, V. (2019). Implementing gamification in a university-level UML modeling course: A case study. *Computer Applications in Engineering Education*, *27*(2), pp. 332-343.

Kapp, K. (2012). The Gamification of Learning and Instruction: Game-Based Methods and Strategies for Training and Education, *John Wiley & Sons*.

Kermek, D., Novak, M., & Kaniški, M. (2018, May). Two years of gamification of the course—Lessons learned. In *2018 41st International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO)* (pp. 0754-0759). IEEE.

Lee, J. J., & Hammer, J. (2011). Gamification in education: What, how, why bother?. *Academic exchange quarterly*, *15*(2), 146.

Lichtenthaler, U., & Ernst, H. (2006). Attitudes to Externally Organising Knowledge Management Tasks: a Review, Reconsideration and Extension of the NIH Syndrome. *R&D Management*, pp. 367-386.

Ma, B., Naha, S. & Tran, F. (2016). Future Reality: Virtual, Augmented & Mixed Reality (VR, AR & MR) Primer, BofA Merrill Lynch, http://www.alexboch.com/uploads/3/0/9/6/30960525/future_reality_sep_2016.pdf

Maia, E.R., Júnior, J. F. L., Pereira, J.S., Eloi, A.C., Gomes, C.C. and Nobre, M.M.F. (2012). Validation of active teaching-learning methodologies in the promotion of child food health, *Rev. Nutr.*, 25(1), pp. 79-88.

Malaby, T. M. (2007). Beyond play: A new approach to games. *Games and Culture, 2*(2), pp. 95–113.

Marczewski, A. (2015). Even Ninja Monkeys like to play. *London: Blurb Inc*.

Martin, J. & Torres, A. (2016). User's Guide and Toolkit for the Surveys of Student Engagement: The High School Survey of Student Engagement (HSSSE) and the Middle

Grades Survey of Student Engagement (MGSSE). *National Association of Independent Schools*. https://www.nais.org/Articles/Documents/Member/2016%20HSSSE-report-full-FINAL.pdf

Mekler, E. D., Brühlmann, F., Opwis, K., & Tuch, A. N. (2013, April). Disassembling gamification: the effects of points and meaning on user motivation and performance. In *CHI'13 extended abstracts on human factors in computing systems* (pp. 1137-1142). ACM.

Moreira, F., Ferreira, M. J., & Cardoso, A. (2018, November). ECLECTIC approach applied to data transformation curriculum course. In *Proc. 11th anual International Conference of Education, Research and Innovation* (ICERI 2018), (pp. 6021-6029).

Muntean, C. I. (2011, October). Raising engagement in e-learning through gamification. In *Proc. 6th International Conference on Virtual Learning ICVL* (Vol. 1).

Nacke, L., Khaled, R., Dixon, D., & Deterding, S. (2011). From game design elements to gamefulness: defining" gamification". In *Proceedings of the 15th International Academic MindTrek Conference*.

Oliveira, L. C., Trovão Cavalli, V., Machado Dias, Á., & de Oliveira, M. A. (2018). Gamification for Online Training of Court Professionals in Alabour Court in São Paulo, Brazil (Trt -2): What Can Beimplemented in Moodle 2.5. Eccos - Revista Científica, (46), pp. 171–190.

Payne, A. F., Storbacka, K., & Frow, P. (2008). Managing the Co-Creation of Value. *Journal of the Academy of Marketing Science*, pp. 83-96.

Sailer, M., Hense, J., Mandl, J., & Klevers, M. (2014). Psychological perspectives on motivation through gamification. *Interaction Design and Architecture Journal*, (19), pp. 28-37.

Saputro, R. E., Salam, S. B., & Zakaria, M. H. (2017). A review of intrinsic motivation elements in gamified online learning. *Journal of Theoretical & Applied Information Technology*, *95*(19).

Serdyukov. P. (2017). Innovation in education: what works, what doesn't, and what to do about it? *Journal of Research in Innovative Teaching & Learning*, (1), 4.

Serra, I. M. S., Araújo, E. F. M., Calvet, K. D. S., & Araújo, W. M. (2016). Acompanhamento dos alunos dos cursos em ead da uema, por meio de técnicas de gamificação. TICs e EaD em Foco, 2(1).

Silpasuwanchai, C., Ma, X., Shigemasu, H., & Ren, X. (2016, June). Developing a comprehensive engagement framework of gamification for reflective learning. In *Proc. 2016 ACM Conference on Designing Interactive Systems* (pp. 459-472). ACM.

Silva, L. H. (2018). Avaliação de Elementos de Gamificação em Ambientes Virtuais de Aprendizagem.

Smith, F. (2015). Report: Is it game over for gamification. *EdTech Magazine*.

Statista (2018). Value of the gamification market worldwide in 2016 and 2021 (in billion U.S. dollars). https://www.statista.com/statistics/608824/gamification-market-value-worldwide/

Stipek, D. (2002). Motivation to learn: From theory to practice (4th edition). *Needham Heights*, MA: Allyn & Bacon.

Sun, J. and Hsu, Y. (2013) Effect of interactivity on learner perceptions in Web-based instruction, Computers in Human Behavior, 29(1), pp. 171-184.

Surendro, K., & Raflesia, S. P. (2016). Designing game-based service desk towards user engagement improvement. *Indonesian Journal of Electrical Engineering and Computer Science*, *1*(2), pp. 381-389.

Tanaka, S., Vianna, M., Vianna, Y., & Medina, B. (2013). Gamification, Inc.: como reinventar empresas a partir de jogos.

Tavinor, G. (2009). *The art of videogames.* Malden, MA: Wiley-Blackwell

Technavio.(2015). Global Gamification Market 2015-2019, *Technavio Report*, December.

The Glossary of Education Reform (2014), https://www.ewa.org/glossary-education-reform

Tu, C. H., Sujo-Montes, L. E., & Yen, C. J. (2015). Gamification for learning. In *Media rich instruction* (pp. 203-217). Springer, Cham.

Tuparov, G., Keremedchiev, D., Tuparova, D., & Stoyanova, M. (2018, April). Gamification and educational computer games in open source learning management systems as a part of assessment. In *2018 17th International Conference on Information Technology Based Higher Education and Training (ITHET)* (pp. 1-5). IEEE.

Urh, M., Vukovic, G., & Jereb, E. (2015). The model for introduction of gamification into e-learning in higher education. *Procedia-Social and Behavioral Sciences*, *197*, pp. 388-397.

Van Roy, R., & Zaman, B. (2018). Need-supporting gamification in education: An assessment of motivational effects over time. *Computers & Education*, 127, pp. 283–297.

Vanderlinde, R. and Van Braak J (2010). The gap between educational research and practice: views of teachers, school leaders, intermediaries and researchers. *British Educational Research Journal*, 36(2), pp.299-316.

Vesa, M., Hamari, J., Harviainen, J. T., & Warmelink, H. (2017). Computer games and organization studies. *Organization Studies, 38*(2), pp. 273–284.

Walker, J. D., Cotner, S. H., Baepler, P. M. and Decker, M. D. (2008). A Delicate Balance: Integrating Active Learning into a Large Lecture Course, *CBE-Life Sciences Education*, 7, pp. 361–367.

Wentzel K.R. and Wigfield, A. (2009). Handbook of Motivation at School, *Taylor and*

Francis -library.

Werbach, K., & Hunter, D. (2012). *For the win: How game thinking can revolutionize your business*. Wharton Digital Press.

Williams, D., Consalvo, M., Caplan, S., & Yee, N. (2009). Looking for gender: Gender roles and behaviors among online gamers. *The Journal of Communication, 59*(4), pp. 700–725.

Zhang, Z. & Hyland, K. (2018). Student engagement with teacher and automated feedback on L2 writing. Assessing Writing, 36, pp. 90–102.

Zepke, N., & Leach, L. (2010). Improving student engagement: Ten proposals for action. *Active learning in higher education*, *11*(3), pp. 167-177.

Zichermann, G., & Cunningham, C. (2011). *Gamification by design: Implementing game mechanics in web and mobile apps*. "O'Reilly Media, Inc.".

Chapter 14

LEARNING SQL WITH GAMES: PEDAGOGICAL INNOVATION WHEN STUDENTS ARE WILLING TO MENTOR OTHER STUDENTS

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Introduction

This work presents a peer learning project that combines innovative pedagogical strategies, centred on game-based tasks and narratives conceived, under the supervision of lecturers, by former students of a course unit who are willing to support their peers. It presents a brief theoretical introduction to the topics of peer-teaching and mentorship. To understand the context of this teaching and learning experimentation the formal course unit scenario is presented, followed by the organization and procedures of the project. The game dynamics of a mentoring session is illustrated by a detailed description of the session's activities with some results supported by the feedback of students.

Peer-teaching

> "Education is not an affair of 'telling' and being told,
> but an active and constructive process (…)".
> Dewey (1916, p.46)

Dewey's quotation highlights principles that are still debated nowadays, namely the importance of giving students the chance to access knowledge through interaction with others as well as through reflection as opposed to unidirectional, knowledge telling situations, according to which students are

mere recipients instead of co-creators of their learning process. For instance, these principles are also mirrored in some of the 21st century skills, more specifically, "creativity and innovation, critical thinking and problem solving", both under the component "learning and innovation" (Johnson, 2009, p.11). Camacho & Esteve (2016, p.50-51) emphasize that the development of key competencies like self-initiative, teamwork, creativity, and digital literacy is crucial and facilitated by digital technologies towards more "individualized, inclusive, flexible and deep" learning. According to Rotherham & Willingham (2009, p.19), "21st century skills favor student-centered methods (…) that allow students to collaborate, work on authentic problems, and engage with the community". As an educational practice, peer learning is a student-centred approach that shares social constructivism principles based on collaborative work, knowledge sharing, and the promotion of students' autonomy, creativity and sense of responsibility (Falchikov, 2001; Stigmar, 2016). Besides, it can be applied to different educational scenarios and is flexible enough to combine innovative teaching and learning strategies. Based on its features, peer learning offers both teachers and students ideal conditions to facilitate and improve their teaching and learning practice. It has been widely implemented either as a learning strategy, in class, or as an educational framework for peer learning programs complementary to curricular practice in the basic, secondary and, more significantly, in the higher education sector, namely in the fields of Physics, Chemistry, Engineering, Mathematics and Astronomy, mostly in the case of introductory courses (Crouch, Watkins, Fagen, & Mazur, 2007; Stigmar, 2016).

The potential of learning through teaching has been recognized since Ancient Greece (e.g., by Aristotle) and studied by renowned theorists of Education such as John Pestalozzi, Lev Vygotsky or Jean Piaget. More recently new trends of peer learning have arisen, which has become clear by the numerous terms used to name it (e.g., "peer tutoring", "peer teaching", "reciprocal teaching", "peer instruction", "peer assisted learning", "team-based learning", "peer tutoring", "education through student interaction", and "peer mentoring"), according to the context, the status and the role of the actors involved (Falchikov, 2001; Sturdivant & Souhan, 2011; Williams & Fowler, 2014). Peer learning programs can be "same level" or "cross level", depending on whether peer teacher student and

peer learner are the same age or not, but most importantly is to consider that both actors share the status and might therefore communicate with each other more efficiently (Falchikov, 2001, p.5) . Variables like the age of the participants, their motivation and proficiency level, the nature of the tasks involved and the support of their teachers and schools are vital to the success of any peer learning program (Ayşe, 2014). When peer teacher student and peer learner interact with each other, tasks like peer discussion, reflection as well as the act of deconstructing and processing knowledge, especially important in the case of peer teacher students, contribute to the development of students' metacognitive skills and autonomy (Johnson, 2015, p.36). Also relevant is to avoid knowledge telling processes of sharing content, and to stimulate peer learners to access knowledge through reflection (Duran, 2016, p.3).

The extensive benefits of peer learning have been clear under the cognitive, affective and social dimensions (Andre, Deerin & Leykum, 2017; Burton, 2012; Duran, 2016; Fisher & Stanyer, 2018; Goodrich, Bucura & Stauffer, 2018; Johnson, 2015; Liu & Devitt, 2014; and Stigmar, 2016), in distinctive fields, among which Computer Science (Malan, 2009; Wang & Murota, 2016) and Physics (Crouch & Mazur, 2001; Lasry Mazur & Watkins, 2008; Mazur, 1997) are subject areas where "peer instruction" has been reported for its significant impact on students' academic performance. Wang & Murota (2016, p. 504-505) emphasize its flexibility to different pedagogical contexts and its adequacy to promote students' engagement and the teaching and learning of challenging content. As a matter of fact, "peer instruction" was introduced by Harvard Physics Lecturer Eric Mazur (Mazur, 1997) as an instructional strategy used in Physics lectures, in order to address students' learning problems, and decrease student attrition in introductory Physics courses (Lasry et al., 2008). Similarly, Harvard Computer Science 50 (CS50) Lecturer David Malan refers to peer instruction for it being a key element of the restructuring of CS50 course operated since 2007 and one of the reasons for its success, showing an enrollment rate increase of 156% between 2007 and 2009 (Malan, 2010, p.2). According to Malan (2009, p.1) the positive evolution of CS50 course has continued to be noticeable, especially due to the fact that 46% of the students enrolled in the course assume having "little" and 44% mentions having "no prior programming experience". The author (n.d., p.2)

believes that a course is a "support network", where students should rely on their classmates all over the learning process, and that outward events like "lunches, office hours, CS50's hackathon and fair" or elements like course t-shirts or stress balls all contribute to "instill a sense of community", resulting in "collective accomplishment". According to Velez, Cano, Whittington & Wolf (2011, p.46), the trusting relationship between peers facilitates the "self-disclosure of ignorance and misconception", contributes to students' ability to share doubts and overcome learning problems, and to reinforce their sense of belonging to the group.
Notwithstanding, overall there is still little scientific evidence of peer learning impact on learner's academic performance, mainly due to the complexity of isolating teaching and learning variables (Stigmar, 2016; Williams & Fowler, 2014).
The comprehensive benefits of peer learning, also among the development of generic skills, as well as others under the affective and social dimensions, more specifically students' self-esteem and self-confidence, motivation, sense of trust in their peers, sense of belonging to the group and their responsibility and commitment to learning (Ayşe, 2014; Fisher & Stanyer, 2018; Johnson, 2015; Goodrich et al., 2018; Stigmar, 2016), or interpersonal, collaborative and communication skills (Ayşe, 2014; Goodrich et al., 2018; Stigmar, 2016; Williams & Fowler, 2014) evince the potential of this educational approach to support teachers and learners and contribute to the success of learning experiences where learners have the chance to be co-creators of knowledge, developing their critical thinking and autonomy and reinforcing technical and generic skills that will be assets for their academic and future professional careers.

LabMM4 Course unit

This work describes a mentoring experience developed under the scope of Multimedia Lab 4 Course Unit of the degree in New Communication Technologies of University of Aveiro. This is a broadband degree course, where content from diverse scientific areas are lectured, namely, communication sciences, technology, design and management.
In every first of the five semesters of this degree course there is a course unit

named Multimedia Lab 1 to 5. These course units, with 10 ECTS credits each, assume a significant role, having a strong practical component, usually complemented by and articulated with other course units lectured in the same semester.

In the academic year reported, 2017/18, students had to follow the general syllabus of Multimedia Labs, as detailed below:

- Multimedia Lab 1: Design, prototyping and evaluation of Web interfaces;
- Multimedia Lab 2: Implementation of Web interfaces (HTML, CSS and Bootstrap);
- Multimedia Lab 3: Introduction to Programming (JavaScript)

In Multimedia Lab 4 students can opt for one of the following profiles:

- LabMM4-A: Web server-side programming and databases;
- LabMM4-B: 3D Modelling, Augmented and Virtual Reality.

LabMM4-A course unit is structured into two modules. In the first module students are introduced to the topic of relational databases. The initial part of the module focuses on the analysis and design of relational databases with Entity-Relationship (ER) models, using a visual tool (MySQL Workbench) to design the models and to automatically generate the databases. The second part of the module involves studying the Structured Query Language (SQL), and aims at giving students the chance to become fluent in writing queries with SQL. Data Query Language (DML) operations are studied, including INNER and OUTER JOIN operations, and Data Manipulation Language (DML). The second module of this course unit covers PHP language and its integration with Relational Database Management Systems (RDBMS).
According to the course outline, LabMM4-A syllabus requires high technical expertise, in a course attended by different student profiles, among which the majority has no particular skills for programming related matters. Hence, the lack of motivation to regularly follow the content of the course, which is critical to the syllabus, is common and academic results are unsatisfactory. These facts

require lecturers to constantly search for innovative pedagogical strategies that have the potential to transform this scenario into one where students are more involved and have better academic results.

AVILA Crew

Inspired by some ideas developed in the context of Harvard CS50 course, in academic year 2016/17, the challenge of gathering a team of mentors who were former LabMM4 students was issued. Requirements were to be willing to rethink pedagogical practices and support their peers who were attending this course unit at that time. The challenge posted on social media was answered by around 20 former LabMM4 students, mostly those who had stood out for their high level of expertise at programming. However, other students volunteered to help with alternative dynamics that proved to be similarly important. This group of volunteer students named themselves AVILA Crew, and was divided into the following teams:

- Mentors Team: gathering members with the level of expertise required to prepare pedagogical content and support LabMM4 students during AVILA Sessions;
- Communication Team: responsible for the most creative part of each AVILA Session. This team defines the topic and graphic image, produces the content to be posted for the events on Facebook and is in charge of making the media coverage of the sessions;
- Logistics Team: addresses the scenography needs of each AVILA Session.

Each mentoring event is called AVILA Session. Although AVILA Crew was given much freedom of choice to develop their ideas for these sessions, each event was planned according to a general set of procedures, briefly described as follows:

1. The course unit lecturers determine the syllabus content of each session based on their prior perception of students' weaknesses and progression all over the semester;
2. AVILA Crew meets in person to define the concept of the session and the

general outline of its different moments;

3. Collaborative work between mentors is promoted with the support of a shared folder on Google Drive and a Slack channel, which is especially important for them to specify and work on details of the session, including the challenges and their technical solutions. The course unit lecturers take part in the discussion and revise every content in order to grant scientific accuracy;

4. Communication Team supports the graphic design and some of the most creative components of each session. This work includes preparing for and advertising the event on a Facebook page;

5. Logistics Team suggests and produces the scenic component of the session;

6. If necessary, AVILA Crew meets in person a few days before each session to wrap up the last details;

7. On the day of the session, AVILA Crew starts to prepare for the session around 6 p.m. and a last meeting is arranged, mostly to discuss the details of the session with mentors who were not so involved all over the preparation stage;

8. Session starts around 9 p.m. and lasts for approximately two hours. It is followed by a final gathering that includes entertainment activities (e.g. arcade games, board games, table tennis, guitars, etc..), and some snacks shared by everyone. The time scheduled for the AVILA Sessions was chosen by mentors according to their availability, based on their own working timetables and students' weekly schedules;

9. Course unit lecturers attend the Session but are "forbidden" to participate in teaching and learning activities. Their presence is important to give mentors confidence and to help them with any unexpected occurrence;´

10. Session ends with the post of a feedback survey to assess final results, according to students' perceptions.

Throughout each AVILA Session the indication is that all teams of students are able to get to the final challenge proposed. Mentors adapt their level of support according to the progress of the teams and, if necessary, change locations with each other, so that students have the chance to listen to different viewpoints and concept explanations that may be more demanding for the team. For the quickest teams there are also some extra challenges that may be issued by mentors at the end of the session.

In academic year 2017/18 three AVILA Sessions were organized under the thematic framework "TV Series", as explained below:

- **"26 Reasons Why"**, with a narrative based on the series "13 Reasons Why", aimed at ensuring that students were able to install, understand and properly use an AMP environment (Apache, MySQL and PHP) on their personal computers. Number "26" results from the number of mentors that gave birth to AVILA Crew that academic year;
- **"El DeCA de Papel"**, based on popular series "La Casa de Papel", was designed to give students the chance to strengthen skills regarding the selection and manipulation of data from relational databases with queries in Structured Query Language (SQL);
- **"Array's Anatomy"** simulated the dynamics of an emergency service inspired by "Grey's Anatomy", where, through the manipulation of complex data structures based on arrays, teams were challenged to find a cure for a patient in critical condition.

Each AVILA Session has its proper dynamics that is supposed to be innovative and not repeated from previous sessions. Overall, game-based activities that act as competition triggers among students' teams are implemented. Previous registration is vital, so that resources regarding mentors and logistics are conveniently prepared and appropriate to the number of students enrolled. Session 'El DeCA de Papel' was chosen to illustrate the dynamics created in an AVILA Session as described in the following section.

El DeCA de Papel

"El DeCA de Papel" was based on the television series "La Casa de Papel", whose original narrative is related to the biggest assault in history, in the Royal Mint of Spain. On the original plot, the assault was planned by a group of eight people who kidnapped several persons inside the Royal Mint building, wearing a red suit and a Dalí Mask, with a mysterious man in charge – "The Professor".
The narrative behind the session "El DeCA the Papel" was also an assault and the kidnappers' team was featured by the mentors. There was also a mysterious Professor who gave the first clues by phone call, displayed at the beginning of the Session. The mentors had a Dalí Mask and after the Professor's phone call they handed in the first challenge to the students' teams.

The first exercise comprises some fictional statistical data presented on a table and a set of three queries. These queries used MAX(), MIN() and AVG() functions, and the result reveals the number of the next room, where teams would need to go to without any previous clue.
Once in the new room, the teams need to proceed to the check-in process, filling in an online form with the team name. At the Logistics Room - in which a group of logistics members were aware of check ins, a text message from Professor was sent to the team leader with new instructions: he wants to ensure that each team member was registered on the database. At that point, the team received the database logical model and it was important to analyze it in detail.
From this moment on, the teams had the possibility to make requests to the database by phpMyAdmin interface, always writing the query on paper first and asking a mentor to test it. This procedure intends to avoid accidental mistakes on the database, which was similar to all teams. It is important to mention that the database already contained some data, which would be useful to complete the tasks.
After completing the registration of each member and associating them with the corresponding team, the participants need to discover the next room. By observing the logical model, it was possible to identify the "tasks table", which included information about the different tasks to complete in each room.
At the new room, the check in process was repeated and the team leader received

another text message with new steps. The Professor gave clues about a new team member who probably could help them. It was a mentor previously registered as a member of the team. Once discovered who the right member was, the database contained some personal information such as the name, phone number and a secret code. The team needed to send a text message to the mentor asking for new information, but the mentor would only respond with new instructions if the message contained the secret code.

The remaining activities followed the same principle of completing tasks to achieve the next room, manipulating information of the database to cover all the content defined for the session. Although the challenge was the same for all teams, the final room was special to the first team achieving it, the Professor's room. The mysterious character was featured by the Department's Director, which was a familiar face to the participants but a big surprise at the final meeting. At this point, the Professor congratulated the winning team suggesting them to distract the attention of the other teams that were still playing. This final challenge had to be completed using a new query, which would update the final room to another location besides the Professor's room - the Department's Auditorium. Playing against the clock, the team completed the task and all other participants ran to that different room. Moreover, during the meeting between the winning team and the Professor, a member of Communication team took a photograph which was immediately displayed on the Auditorium's screen, so that all other teams could see that their attention was being diverted.

Results

As far as students' feedback is concerned, an online questionnaire was applied after each AVILA Session. Regarding "El DeCA de Papel" evaluation, the questionnaire was answered by twenty-one respondents, from which nineteen have participated in the session and two have not. The following analysis will consider the nineteen responses of participant students, since the other two respondents have only answered a specific section, which was intended to understand the reasons why they did not participate – which in both cases was related to the evening schedule for people who were not resident in Aveiro.

The questionnaire of "El DeCA de Papel" evaluation intends to gather the following information:

- An overall appreciation of the session;
- Assessment of the understanding of the syllabus content addressed in the session;
- The strengths and weaknesses of the session;
- The session impact to the following assessment moment of the course unit.

As this was the second Session of the year, it was also relevant to understand the students' opinion in a general way. For that reason, the questionnaire has two other questions, which intended to understand the impact of AVILA Sessions on students' satisfaction and motivation for the course unit and the favorite approach when comparing the "26 Reasons Why" (1st Session) with "El DeCA de Papel" Session.

The results of the overall appreciation were very positive, revealing that 84.2% has classified the session with level 4 and 15.8% with 3, in a 1 to 4 scale, in which 1 was labelled as "dislike" and 4 as "excellent". The session dynamics was pointed as the main strength, described as original and captivating by students. They have also mentioned the relationship between the television series "La Casa de Papel" and the narrative behind the session, with a mission and a final goal. Mentors' support and how they explained the content was also pointed as a strength, helpful to the following assessment moment of the course unit.

Regarding the understanding of content, participants classified the different topics in a 1 to 4 scale, in which 1 was "not understood" and 4 "clearly understood". The content under evaluation and the corresponding assessment was the following:

- Database Model: "clearly understood" (9); "well understood" (9); "understood with difficulties" (1);
- Simple SELECT: "clearly understood" (16); "well understood" (2); "understood with difficulties" (1);
- SELECT with JOIN: "clearly understood" (9); "well understood" (7); "understood with difficulties" (3);

- Data manipulation as INSERT, UPDATE and DELETE: “clearly understood” (15); “well understood” (4).

Concerning the question about the session impact to the following assessment moment of the course unit, 73.7% of the respondents classified it with maximum level (4), labeled as “very relevant”, and the other 26.3% with level 3.
The general questions of the survey, about the impact of AVILA Sessions to the students’ satisfaction and motivation for the course unit and their favorite approach regarding the two sessions already held, had the following results:

- 68.4% of respondents considered the impact as “very positive” (level 4) to their satisfaction and motivation and 31.6% classified it with level 3;
- All of the respondents assumed to prefer the game narrative and competition approach taken in “El DeCA de Papel”.

Conclusions

AVILA Crew is an example of a peer learning project that combines innovative pedagogical strategies, centred on game-based tasks and narratives conceived, under the supervision of this course unit lecturers, by former LabMM4 students who are willing to support their peers. Based on its features and the results from session “El DeCA de Papel”, it is clear that this project addresses relevant issues regarding how students learn, how they share their doubts and weaknesses, and how participating in the sessions affects the way they follow lectures content, their motivation and engagement for their own learning process while attending LabMM4-A course unit.
According to its principles and procedures, AVILA Crew is in line with a few European Union’s themes related to the Reference Framework on key competences for lifelong learning (2006, p.14), namely “critical thinking, creativity, initiative, problem solving, (...) decision taking, and constructive management of feelings”, and with what Rotherham & Willingham (2009, p.7) advocate as being the appropriate answers to meet students’ needs in the 21st century, as they mention:

"Familiar with technology and expecting to have a voice in their own learning, students are more than ever in need of the problem-solving, critical-thinking, and communication skills highlighted by the Partnership for 21st Century Skills (P21)...". While preparing for AVILA Sessions, mentors are given the chance to develop their creativity, critical thinking, problem-solving ability, autonomy, collaborative and communication skills, as well as their metacognitive skills, especially relevant when they revise content for AVILA Sessions challenges or design tasks, and their critical reflection skills, when they reflect on their performance after each session. LabMM4-A students are given the chance to develop interpersonal skills, when dealing with mentors and also with their peers in the sessions, to share their doubts in a less formal environment to that of lectures, and to access knowledge through peer discussion, relying on their ability to overcome challenges and work in teams, and after all improve their academic performance. Students' engagement, social interaction, motivation and results are therefore expected to improve. Additional elements of each session, such as the entertainment activities after the final challenge, and the t-shirts worn by all mentors contribute to reinforcing social and affective skills, namely the sense of belonging to the group, students' sense of trust in their peers, their self-esteem, responsibility and engagement, in line with what Malan (n.d., p.2) refers to as "sense of community" and "collective accomplishment".

Results from "El DeCA de Papel" post feedback survey show that the impact of the session on students' satisfaction and motivation for the course was highly positive, as 84,2% of the students assessed it with "excellent", and stressed the session dynamics as the strength of the event, followed by the relationship between the narrative behind the session and the TV series, mentors' support and explanation of content as well as the mission and final goal involving the challenge. As regards the understanding of syllabus content, the four items under assessment had at least 50% or more answers on the option "clearly understood" as opposed to lower rates regarding the option "understood with difficulties". Finally, overall, students considered the impact of the session to the following assessment moment highly significant, with 73,7% considering it "very relevant".

References

Andre, C., Deerin, J., & Leykum, L. (2017). Students helping students: vertical peer mentoring to enhance the medical school experience. *BMC Research Notes*, *10*(1). https://doi.org/10.1186/s13104-017-2498-8

Ayşe, D. M. (2014). The effects of peer teaching on the university students achievements in cognitive, affective, psychomotor domains and game performances in volleyball courses. *Educational Research and Reviews*, *9*(9), 262–271. https://doi.org/10.5897/ERR2013.1690

Burton, B. (2012). Peer teaching as a strategy for conflict management and student re-engagement in schools. *Australian Educational Researcher*, *39*(1), 45–58. https://doi.org/10.1007/s13384-011-0046-4

Camacho, M., & Esteve, F. (2016). Estudio: Dispositivos móviles en Educación y su impacto en el aprendizaje. Samsung Smart School 2015-16. Madrid: Samsung. ISBN: 987-84-945619-9-3.

Crouch, C. H., & Mazur, E. (2001). Peer instruction: Ten years of experience and results. *American Journal of Physics*, *69*(9), 970–977.

Crouch, C. H., Watkins, J., Fagen, A. P., & Mazur, E. (2007). Peer Instruction: Engaging Students One-on-One, All At Once. *Research-Based Reform of University Physics*, 1–55. https://doi.org/10.1364/OPN.9.9.000037

David Duran (2016). Learning-by-teaching. Evidence and implications as a pedagogical mechanism, Innovations in Education and Teaching International, DOI: 10.1080/14703297.2016.1156011

Dewey, J. (1916). *Democracy and Education. An introduction to the philosophy of education*. New York: The Macmillan Company.

European Union (2006). *Recommendation of the European Parliament and of the Council of 18 December 2006 on key competences for lifelong learning*. Available in https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32006H0962&from=EN

Falchikov, N. (2001). *Learning Together: Peer Tutoring in Higher Education*. London, England: Psychology Press.

Fisher, M., & Stanyer, R. (2018). Peer mentoring: Enhancing the transition from student to professional. *Midwifery*, *60*, 56–59. https://doi.org/10.1016/j.midw.2018.02.004

Goodrich, A., Bucura, E., & Stauffer, S. (2018). Peer mentoring in a university music methods class. *Journal of Music Teacher Education*, *27*(2), 23–38. https://doi.org/10.1177/1057083717731057

Johnson, E. (2015). Peer-teaching in the Secondary Music Ensemble. *Journal of Education and Training Studies*, *3*(5). https://doi.org/10.11114/jets.v3i5.906

Johnson, P. (2009). The 21st Century Skills Movement. Available in http://resolver.eb-

scohost.com/openurl?sid=google&auinit=P&aulast=Johnson&atitle=The+21st+century+skills+movement.&title=Educational+Leadership&volume=67&issue=1&date=2009&spage=11&site=ftf-live

Lasry, N., Mazur, E., & Watkins, J. (2008). Peer instruction: From Harvard to the two-year college. *American Journal of Physics*, *76*(11), 1066–1069. https://doi.org/10.1119/1.2978182

Liu, W., & Devitt, A. (2014). Using reciprocal peer teaching to develop learner autonomy: An action research project with a beginners' Chinese class. *Language Learning in Higher Education*, *4*(2). https://doi.org/10.1515/cercles-2014-0025

Malan, D. J. (2010). Reinventing CS50. *Proceedings of the 41st ACM Technical Symposium on Computer Science Education - SIGCSE '10*, 152. https://doi.org/10.1145/1734263.1734316

Malan, D. J. (s/d). Teaching Statement. Disponível em https://cs.harvard.edu/malan/statements/teaching.pdf

Malan, D. J. (2009). Virtualizing office hours in CS 50. *ACM SIGCSE Bulletin*, *41*(3), 303. https://doi.org/10.1145/1595496.1562969

Mazur, E. (1997). Peer instruction: Getting students to think in class. AIP Conference Proceedings. 399 981-988. DOI: 10.1063/1.53199

Rotherham, A., & Willingham, D. (2009). 21st Century Skills: The Challenges Ahead. Available in http://resolver.ebscohost.com/openurl?sid=google&auinit=P&aulast=Johnson&atitle=The+21st+century+skills+movement.&title=Educational+Leadership&volume=67&issue=1&date=2009&spage=11&site=ftf-live

Stigmar, M. (2016). Peer-to-peer Teaching in Higher Education: A Critical Literature Review, Mentoring & Tutoring: Partnership in Learning, 24:2, 124-136, DOI: 10.1080/13611267.2016.1178963

Sturdivant, R. X., & Souhan, B. E. (2011). Peer-to-peer teaching using multi-disciplinary applications as topics. *PRIMUS*, *21*(3), 283–293. https://doi.org/10.1080/10511970903039621

Velez, J., Cano, J., Whittington, M., Wolf, K. (2011). Journal of Agricultural Education Volume 52, Number 1, pp. 40–49 DOI: 10.5032/jae.2011.010 4

Wang, S., & Murota, M. (2016). Possibilities and limitations of integrating peer instruction into technical creativity education. *Instructional Science*, *44*(6), 501–525. https://doi.org/10.1007/s11251-016-9385-x

Williams, B., & Fowler, J. (2014). Can Near-Peer Teaching Improve Academic Performance? *International Journal of Higher Education*, *3*(4). https://doi.org/10.5430/ijhe.v3n4p142

Chapter 15

ABOUT GAMIFICATION PEDAGOGICAL VALUE

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Introduction

Designing learning in a gamified way, as if it were a game, has recently been presented as an alternative strategy to how teaching is traditionally organized, both in universities (Ortiz-Rojas, Chiluiza, & Valcke, 2019) and in vocational training or other training contexts.

It is for many a very promising strategy, especially in increasing students' motivation and involvement in learning, the new opportunities that are provided, such as interaction with the content to be learned and what this may mean and imply in terms of pleasure to learn (Csikszentmihalyi, 1990, 2014). Also, by increasing students' autonomy and control over their own learning process (Vanslambrouck et al., 2019).

From the educational point of view, game and ludic activity have been used to motivate, stimulate and transmit content from the earliest days of school, regardless the age of the students (Simões, Redondo, & Vilas, 2013). Game and ludic are to be enjoyed at all ages and in all situations, we wish to consider, and thus not a new educational strategy (Corona Martínez, & García, 2019).

Over time, game has been recognized as a source of pleasure (Sailer, Hense, Mayr, & Mandl, 2017), provoking in individuals positive emotions that cause them to focus and become emotionally involved in what they are doing (Dias, 2017), becoming more motivated and, possibly, more productive (Buckley & Doyle, 2016). It is, therefore, based on this potential of game and its playfulness (to learn in a fun way), that there has been a proliferation of gamification proposals, a concept that is still far from being consolidated and for which there are many definitions. Perhaps one of the most accepted, since simpler and more

effective in terms of ease of entry into the field, is what Deterding, Khaled, Nacke, and Dixon first suggest, presenting the concept as "the use of game elements in non-game contexts "(2011, p.2).

Aiming to respond to the strong demotivation for what school offers, largely due to a remarkably uniform and standardized teaching, in which the curriculum is worked, regardless the specificity of the individuals to whom it is addressed and the personal characteristics of each, the approach to learning by gamification is therefore a strategy that can contribute to change the current state of things, making the learning experience in school much more fun, interesting, appealing and, by doing so, more successful.

In practice, the gamification of learning turns out to be boosted and take advantage of the potential of digital technologies, both in personal and social development of individuals and in pedagogy (how it organizes the teaching and learning strategies) and didactics (how it responds to the specificity and scientific nature of the contents to be learned), offering the teacher a wide range of options to reconfigure the ways in which he usually works, i.e., how he traditionally organizes teaching, and in ultimately, how he organizes student learning.

The pedagogical value that we attribute to digital information and communication technologies, which we will also use to evaluate each element of game that are usually used in the gamification strategy, is not only related to learning opportunities that a teacher provides his students, but also, and mainly, as the higher or lower quality of the learning experiences that these students have. It is, therefore, a value associated not with technology itself, but with the way gamification is designed: to serve which learning objectives, to promote what type of action and student's involvement in learning, to stimulate the development of what abilities and what specific skills. At last, a question of an eminently curricular nature that makes sense to analyse in the light of curriculum theory and curriculum development. We intend to explore the pedagogical potential of gamification techniques (Nah, Zeng, Telaprolu, Ayyappa, & Eschenbrenner, 2018) that have been used in gamification experiments reported in the literature.

More recently inspired by the culture of digital games (Liu, Santhanam, &

Webster, 2017), and based on the strong youth participation in information and communication technologies, gamification is also increasingly present in other contexts and professional areas, especially in business and mainly using reward systems to appeal and retain customers (Zichermann & Cunningham, 2011). Companies like Amazon, Nike, eBay, or, more recently, Netflix, are some of the best-known examples in which any of us can easily witness the mechanisms used to interact with customers and thus keep them alert, interested and motivated to use the products they offer (Koren, Bell, & Volinsky, 2009). For some it is, in fact, in terms of the commercial or development objectives of the organizations (Barral, Ravaglia, Chaves, & Magnani, 2019) that a greater advance is observed, although still little documented in terms of literature the techniques of gamification. However, it is also promising the connection that the university can perform to this reality and to what happens in the world of work and business, namely in terms of studying and evaluating the effective potential of the different techniques used and the creation and consolidation of new knowledge in this area.

Continuing this brief introduction, we shall begin by presenting at the next topic an overview of the mechanics and gamification elements that have been the object of experimentation and reporting in literature. Then a detailed synthesis of the foundations stated with respect to the pedagogical value of each one, elements and techniques used in gamification for educational purposes. Even before the conclusion of the chapter, we invite the reader to briefly reflect on the limits, opportunities and challenges that gamification poses in terms of pedagogical design and which, hopefully, can be a starting point to consider in the creation and development of new learning experiences.

MECHANICS AND ELEMENTS OF GAMIFICATION

In literature, it is possible to identify many and diverse elements used in the design of digital games, to be used in educational purposes when preparing gamified learning experiences. We will try to make a brief presentation and description, as much as possible according to the mechanics in which they are inserted (Degirmenci, 2018; Liu et al., 2017), since, in practical terms, the elements of

the game will only gain their real meaning when integrated and understood in light of the dynamics in which they are combined and the specific objectives and learning at the service of which they were conceived. Also, as in any game, it is necessary to take into account the system of rules that defines, frames and targets the evolution of real dynamics and procedures (Liu et al., 2017). We could say that the ludic elements combined with these dynamics and rules are the basis of construction, but also analysis in any process of gamification.

In practice, just as in any game, the successful accomplishment of a given **task** or **challenge** is assigned a certain number of **points**, and the **score** achieved automatically in a **leaderboard** with its **classification** is automatically recorded. This rating allows each participant to compare the performance achieved with the performance of others in case there is more than one player. Once certain **levels** have been achieved, **medals** or other rewards are awarded, i.e., something that materializes, evidence, and documents the success achieved. With these medals, the player collects evidence of the different achievements, most of the times associated with the learning, i.e., skills and achieved **performances**. As it is easily understood and referred, these bold elements are used with the purpose of promoting the involvement of individuals in the proposed tasks, functioning as rewards and contributing to a sense of fulfilment and satisfaction that, in turn, assumes great importance in terms of motivation to approach new challenges and accomplish new tasks.

It will be precisely framed in this mechanics that articulates challenges, points, classifications and medals, which for many authors assumes particular importance the feedback that is provided to the player (Brown, Peterson, & Yao, 2016; Bullon, Encinas, Sanchez, & Martinez, 2018; Hassan, Dias, & Hamari, 2018). For these authors the feedback is assumed as a determining mechanism, since it plays a key role in the development of the game, by the feedback and updating of the information given to the players and by the stimulus that effectively constitutes to continue playing.

To conclude this point and to better understand the articulation between the different elements of the game, we recover and quote here an example in which

the mechanics of a certain pedagogical design are presented with the use of gamification. The work methodology was conceived by a higher education teacher in the gamification of a Mathematics curricular unit of the first year in an engineering course (Viamonte, 2018):

> When introducing gamification, the assessment was replaced by points that were awarded to students for completing the evaluation components and for their participation in classes and online activities. The students, as they enrolled in the CU, had 100 starting points and, from then on, everything they did, or left to do, gave them or took them points. Each 100 points corresponded to one level and there were 20 levels corresponding to grades from 0 to 20. A student with 1000 points was at level 10, which means that his grade at the time would be 10 points. During the semester there were several assignments or tasks to be carried out by the students, such as mini-tests in Moodle, challenges to be solved, 2 individual tests and some weekly assignments to be carried out in or out of classes. The medals were rewards attributed to the students for performing certain tasks, such as going to class, participating in forums, solving challenges, among others. Obtaining a medal awarded the student with a predetermined amount of points. "Bombs" were punishments attributed to students for not performing certain mandatory tasks such as homework, Moodle tests, among others. The Bombs penalized the students by taking a predetermined amount of points from them. A list of the tasks, mandatory or not, was published weekly in Moodle. It was also published weekly in the Moodle Leadership Board in the form of a list sorted in descending order of number of points. n this list the students placed in the first 15 places had a prominent position.

In addition to the identification of different elements of the game previously mentioned (points, levels, medals, leaderboards), in this example it is still possible to observe how the students are presented with the stimuli, that is, the activities they must carry out: missions, mini-tests and other diversified tasks such as taking part in classes, participating in forums, solving challenges, among others. In this example, it is also particularly interesting to observe

the correspondences that are made with the previous practice of this curricular unit (where it is said, for example: "Every 100 points corresponded to a level and there were 20 levels corresponding to grades from 0 to 20") and the natural "adaptations" that the teacher assumes to make in terms of assessment ("the evaluation has been replaced by points that were assigned to the students for completing the assessment components and for their participation in classes and online activities"). Many other examples may be the subject of analysis and this might be a good strategy to deepen the understanding of what the practitioners perceive by gamification as they approach the challenge of designing learning activities using the elements of the game , and, perhaps more importantly, the value that, from the pedagogical point of view, this type of strategies brings to the process of teaching and learning. This is the aspect that we will address at the next point, as previously mentioned.

ON THE PEDAGOGICAL VALUE OF THE ELEMENTS OF THE GAME

A possible strategy to study the pedagogical value of gamification is to do so based on the elements of gamification that are commonly reported in the literature, trying to identify the arguments to justify their use in a pedagogical design and the theoretical constructs underlying it. In this regard, and based on the most recent systematic review of literature, Tondello, Premsukh, and Nacke (2018) point out that to present and explain the use of game elements many authors make more use of the intended objectives with the use of each element rather than to specific principles from what might constitute itself as a general theory of gamification. Trying to take advantage of this interdependence between the stated objectives for the use of the game elements, as well as the particular role that each of these elements will play in the dynamics of the game learning situation, we will make the presentation of what is referred to as the pedagogical value of the different elements of the game previously presented and which, according to several authors, are the most popular when it comes to gamification for educational purposes (Dicheva, Dichev, Agre, & Angelova, 2018; Lister & College, 2015).

CHALLENGES

In any game, challenges are something the player must strive to achieve, something that the system itself encourages and must be overcome in order to progress towards a certain goal or previously known goals (Andrews, 2017). As in games, in most gamified learning experiences, challenges are all sorts of tasks or activities presented to students to take place at a specific time or during a specific time frame. They consist, therefore, in the actions that the students must successfully perform in order to be awarded, being therefore associated with the idea of achievement and personal fulfillment. According to some authors, the pedagogical importance of the challenges is to structure and organize the students' efforts (Barata, Gama, Fonseca, & Gonçalves, 2013) in a significant way (Shohieb, 2019). From the FLOW theory viewpoint (Csikszentmihalyi, 1990), this will correspond to what is called "optimal experience", that is, when in a given learning situation there is a balance between the proposed challenges and the individual's perception of the their ability to perform successfully (Nah, Eschenbrenner, Zeng, Telaprolu, & Sepehr, 2014; Nah et al., 2018). Intrinsic motivation and the need for achievement of individuals are perhaps the most salient theoretical constructs to take into account when it comes to the development of learning systems, although, as it has been emphasized, the pedagogical dimension related to the students' own challenges and their perception of their ability to overcome them.

LEVELS

The inclusion of levels, i.e. stumbling blocks that a player must overcome, is a strategy usually used in gamified learning systems. In this case, the levels are presented as a way to increase the competence of the students through the positive feedback that is provided in these moments, but also by the demonstration of progress that these achievements at levels will allow. According to Schoieb (2019), the existence of levels helps students to better understand when a certain goal or expected achievement has been achieved and provide an excellent opportunity for the design of informative and meaningful feedback, since, in particular, in relation to what remains to be achieved. The levels are thus closely

related to indicators of progression in learning and feedback that is provided to the student at different points in the learning path that the gamification system allows him to go through.

POINTS

The allotment of points is one of the strategies most used to reward the achievement of a certain accomplishment. In practice, points function as credits or, in other words, as a measure of successful achievement of a given academic challenge, task, or activity (Nah et al., 2018; Sailer et al., 2017). Usually represented in numerical form (Aldemir, Celik, & Kaplan, 2018), points can take different forms or configurations, as is the case, for example, of experience points (XP), which are usually earned by completing tasks, or of points that may correspond to the collection of artefacts or objects (rings or coins, for example) used in a game. Since they constitute almost immediate feedback, the points are commonly presented as a way of encouraging students to perform the exercises and also as an aid for learning regulation (Barata et al., 2013) as specific guidance for the expected performances (Shohieb, 2019). Being presented and used foremost as an external reward (Sailer et al., 2017), the idea underlying point assignment is to increase students' motivation, involvement, and competence through a direct and positive feedback system (Barata et al., 2016). Extrinsic motivation, need for achievement, feedback, progression and regulation of learning will be, in synthesis, the main theoretical constructs on which the pedagogical potential of this element of the game can be based on.

MEDALS

As a symbolic and visual representation of the goals achieved by the players (Aldemir et al., 2018), the medals, or badges, symbolize and allow to confirm the merits achieved by the students during a certain period of learning. As it happens with the points, the medals are presented as an external reward for the successful completion of certain tasks or challenges proposed, directly contributing to the social affirmation of the status and academic reputation of the student (Özhan

& Kocadere, 2019). For Barata et al. (2017), the publication of the medals won by the students contributes, in fact, to boost their sense of connection with the objectives of the course, thus increasing their motivation and the probability of participating in the activities and tasks that will be proposed to them in the future (Nah et al., 2018). Extrinsic motivation, social participation and reputation will be, in the case of this game element, the main underlying theoretical constructs to consider in the design or evaluation of gamified learning experiences.

LEADERBOARD

The leaderboard ranks the players according to their relative success, and to previously established rule (Aldemir et al., 2018; Özhan & Kocadere, 2019), helping to determine, in a group, who performs best in a given activity or set of activities (Crumlish & Malone, 2009). As in the previously presented elements of the game, the purpose of leaderboard is also to promote the sense of belonging to a given community (Barata et al., 2017). However, some authors state that rather than the sense of social belonging, what is mainly aimed at is the promotion of competitiveness among students (Al-Towirgi, Daghestani, & Ibrahim, 2018). In this case, the leaderboards are assumed as competitive indicators of progress, allowing to relate the performance of a player to the performance of other players (Sailer et al., 2017). Creating the need and sense of urgency in seeing their names next to the achievements reached in a table, turns out to be the differentiating element of this element of the game used to motivate the students. In practice, by stimulating competitiveness, the learning experience is expected to be more engaging. According to Kapp, Blair, and Mesch (2014), the leaderboard also contribute effectively to the demonstration of students' social capital, i.e. their reputation, especially in the case of those who hold the top positions, because, as other authors state, to avoid the demotivation of those who are at lower levels, the leaderboards usually exhibit only the 5 or 10 best markers (Nah et al., 2018). More related to student learning control, Barata et al. (2013) also highlight the possibility that the leaderboards give students the ability to monitor their own progress through access to their personal track record in terms of performance evolution. Sense of belonging to

the community, need for social approval, but also need for achievement, competitiveness, status and monitoring of the progression of learning, will therefore be the most salient theoretical constructs in the case of the use of leaderboard in pedagogical proposals.

COMPETENCE TREES

The competence tree is a game mechanism used to organize and present, in a branched way (hence the designation), a set of skills or competencies that a player is able to evidence during the execution of a game. Widely used in role-playing games, skills trees often start by providing one or more basic skills necessary for a particular class of characters, allowing the player to take a previously established course from scratch. In practice, once basic competencies or skills are achieved, they unfold (branch out) into increasingly specialized skills or into higher-level skills or abilities, as the case may be. For a magician, for example, basic skills can be a spell on each of four elements (e.g. fire, water, ice, and earth). The player can then focus his spells on one or more of these elements, or concentrate on learning all the skills without focusing on one area only. These skills or competencies may be blocked and opened only after completion of the necessary prerequisites to be able to obtain a new skill or ability and so on. For this reason, some authors designate this content unlocking mechanism (Lopez & Tucker, 2018), or unlocking levels (Özhan & Kocadere, 2019; Simões et al., 2013). In the gamification experiments described by Barata et al. (2017), for example, the main objective of using the tree of competences was to give students more autonomy to make choices, allowing different paths according to the preferences of each one. Providing alternative ways and allowing students to do more than they like or what interests them at a given moment, allowing them to repeat the challenges and assigning extra points to certain achievements, was therefore a deliberate strategy for the purpose of students can simultaneously learn from failure and be able to control their learning pace. Providing decision-making capacity, granting autonomy in learning and, thus, stimulating the taste for learning, may be important dimensions for the pedagogical design or evaluation of gamification experiences associated with competence trees.

FEEDBACK

Information that, during a game, is provided to the player about his performance is considered of great importance (Aldemir et al., 2018). Zichermann and Cunningham (2011) argue that instant feedback turns out to be the most important element in the mechanics of a game, since it allows the player to receive immediate gratification for their performance. This will effectively contribute to the player's confidence, which, in turn, maximizes the likelihood of feeling involved and willing to continue playing. Also, in gamification of learning strategies, this element is well referenced in the literature, assuming a prominent role not only from the motivational point of view, but also from the pedagogical point of view. As a motivational tool, feedback seems to have a positive impact on motivation levels when provided at the right time and in an appropriate way (Hassan et al., 2018). That is, providing one with relevant information that allows to progress and to carry out the proposed tasks effectively. The analysis of the way in which feedback strategies are included in practice, what strategies these are and what their concrete results have been, in fact, has been one of the topics that most attention has deserved on the part of the scholars in this area, although they are not yet very conclusions on the most effective ways of implementing it with the help of the digital information and communication technologies available today.

HORIZONS AND LIMITS OF GAMIFICATION

From the exposed we have just made on each of the different components of the game that are most commonly used in gamification proposals in an educational context, perhaps the most striking aspect is the fact that, for the most part, the stated purposes are not directly related to the actual learning that the students are supposed to do (the learning foreseen in the curriculum).

In fact, the elements of the game are in most cases introduced and presented, on the contrary, with the function of creating conditions favourable to the abstract realization of these same learning experiences.

It is, in practice, the creation of external conditions, tending to configure the environment in which this same learning will occur. Conditions that work mainly as

an incentive for learning, as an extrinsic motivation in relation to what students are expected to learn. As we alluded to in the Introduction, it seems to be mainly about using the potential of digital technologies in response to a standardized, uninteresting and tedious school for the students who attend it. Through the provision of more or less challenging stimuli and the creation of more or less enveloping dynamics, with playful and challenge-filled characteristics that students will have to overcome, depending on certain goals to be achieved, the basic idea is for students to adhere, engage actively and participate with pleasure in these same dynamics. To the set of these dynamics, which Lopez and Tucker (2019) call persuasive strategies, we would say that the elements of the game may be opposed, which in some way may fit and be used mainly in a logic of adaptation to diversity that, in a given context, the students themselves constitute. That is, what the same authors designate customization strategies, more concerned, therefore, with the differentiation of strategies according to the personal characteristics of the students. In other words, with the customization of the stimuli offered to them and the paths they will have to go through, with the adjustment of the regulation that in each case is provided, finally, with the adjustment that can be made in terms of goals to achieve.

If in the first group we can include components of game such as points, medals or leaderboard, for example, by the external stimulation and reward that they essentially contain, already in the second group it seems to us that it will be legitimate to include components of game such as tasks or challenges that are posed, tree competences and especially feedback. In the first case, by the differentiation they allow in terms of what will be offered to the student to solve or respond. Differentiation, for example, depending on the personal characteristics that in a particular context can be considered important for learning to succeed (approach to learning, ability to self-regulate, etc.). Or differentiation in function of answers that the student gives to the stimuli with which he is being confronted along a certain sequence of learning.

In the case of competence trees, for the pedagogical potential that this element of the game may allow in terms of differentiated supply, also, alternative paths depending, for example, on the degree of difficulty of the challenges posed or other

variables to consider in the analysis of the student profile. As the play component is considered an important dimension in strategies of gamification in education, it is legitimate to introduce in this equation the variable that is associated with the type of player that the students are. Take into account, for instance, whether they like to play or not, what are their experience as players, what type of games they prefer, etc.

In the case of feedback as an element of the game, by the importance that, from the curricular point of view, this dimension can assume in terms of monitoring and regulating learning. Being vast and consolidated the knowledge in this specific area of the organization of teaching and learning, we believe that here may lie, in synthesis, the most determinant of the components to consider in the design of proposals of gamification for educational purposes. Feedback for validation of the acquired learning at a given moment, retroactive regulation for correction of the errors verified based on the careful and continuous observation of the academic performances that each student obtains, or proactive regulation, with a view to the reorientation and adaptation of the subsequent challenges in function of this same academic performance, are examples of approaches that any gamification process cannot fail to explore and deepen to the limit of what artificial intelligence can offer.

In this scenario, the creation of multidisciplinary teams involving, in particular, computer specialists and specialists in education sciences, seems to be an approach that can guarantee that these will undoubtedly be the paths to be pursued in order to explore and reflect on what might be the configuration of the school in the future.

Conclusion

Strong adherence, particularly by young people, to digital games has motivated, as we have previously mentioned, the adoption of the principles of the game for activities that go beyond entertainment. Although gamification is a concept still used in a very inconsistent way (Seaborn & Fels, 2015), it is commonly accepted as the selective incorporation of elements of the game into any context or product that is not in itself a game (Deterding et al.,2011). Corresponding to approximately a decade of development and research, it is an area that slowly begins to gain importance as a strategy to promote learning, with many experiences of

gamification for educational purposes reported in the literature. In general, the term gamification is used in this context precisely to describe the characteristics of an interactive system that is mainly aimed at motivating and involving students in learning. Although convergence with the underlying theoretical foundations is still very weak, efforts have been made to identify the benefits of this strategy in motivational terms. Initiatives that, in one way or another, find scientific support in conceptual structures based on fundamental psychological theories, such as the theory of self-determination, motivation theory or flow theory. As we mentioned in Introduction, we believe that gamification may also represent an excellent opportunity for exploration as an object of study under curriculum theory. It is in this path that this text must be understood as a first approach to a field that seems fertile if we consider the potential that technologies can bring in terms of diversification of working strategies, and in particular in terms of personalization of learning.

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References

Al-Towirgi, R., Daghestani, L., & Ibrahim, L. (2018). Increasing Students Engagement in Data Structure Course Using Gamification. *International Journal of e-Education, e-Business, e-Management and e-Learning Increasing*, *8*(4), 193–211. https://doi.org/10.17706/ijeeee.2018.8.4.193-211

Aldemir, T., Celik, B., & Kaplan, G. (2018). A qualitative investigation of student perceptions of game elements in a gamified course. *Computers in Human Behavior*, *78*, 235–254. https://doi.org/10.1016/j.chb.2017.10.001

Andrews, D. (2017). *Gamification systems development: a practical guide*. Birmingam: The Advanc ed Services Group. https://doi.org/10.17036/PUBLICATIONS.ASTON.AC.UK.00000001

Barata, G., Gama, S., Fonseca, M. J., & Gonçalves, D. (2013). Improving student creativity with gamification and virtual worlds. *Proceedings of the First International Conference on Gameful Design, Research, and Applications - Gamification '13*, 95–98. https://doi.org/10.1145/2583008.2583023

Barata, G., Gama, S., Jorge, J., & Gonçalves, D. (2013). Engaging Engineering Students

with Gamification. An empiricasl study. *ieeexplore*. Obtido de http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=6624228

Barata, G., Gama, S., Jorge, J., & Gonçalves, D. (2017). Studying student differentiation in gamified education: A long-term study. *Computers in Human Behavior*, *71*, 550–585. https://doi.org/10.1016/j.chb.2016.08.049

Barata, G., Gama, S., Jorge, J., S., Gonçalves, D. (2016). Early Prediction of Student Profiles Based on Performance and Gaming Preferences. *IEEE Transactions on Learning Technologies*, *9*(3), 272–284. https://doi.org/10.1109/TLT.2016.2541664

Barral, C., Ravaglia, C., Chaves, R., Reis, A., & Magnani, T. (2019). As Organizações potencializam a gamificação como estratégia para gestão do conhecimento. *Bazilian Journal of Development*, *5*(6), 6460–6476. https://doi.org/10.34117/bjdv5n6-147

Brown, G. ., Peterson, E., & Yao, E. (2016). Student conceptions of feedback: Impact on self-regulation, self-efficacy, and academic achievement. *British Journal of Educational Psychology*, *86*(4), 606–629. https://doi.org/10.1111/bjep.12126

Buckley, P., & Doyle, E. (2016). Gamification and student motivation. *Interactive Learning Environments*. https://doi.org/10.1080/10494820.2014.964263

Bullon, J., Encinas, A., Sanchez, M., & Martinez, V. (2018). Analysis of student feedback when using gamification tools in math subjects. *2018 IEEE Global Engineering Education Conference (EDUCON), Global Engineering Education Conference (EDUCON), 2018 IEEE*. https://doi.org/10.1109/EDUCON.2018.8363455

Corona Martínez, D., & García, J. (2019). Using Malone's Theoretical Model on Gamification for Designing Educational Rubrics. *Informatics*, *6*(9), 1–13. https://doi.org/10.3390/informatics6010009

Crumlish, C., & Malone, E. (2009). *Designing social interfaces. Principles, Patterns, and Practices for Improving the Use Experience*. Cambridge: O'Reilly.

Csikszentmihalyi, M. (1990). Flow: The Psychology of Optimal Experience. Em *Academy of Management Review* (pp. 636–640). https://doi.org/10.5465/AMR.1991.4279513

Csikszentmihalyi, M. (2014). *Applications of Flow in Human Development and Education*. New York: Springer. https://doi.org/10.1007/978-94-017-9094-9

Degirmenci, K. (2018). Toward a Gamified Mobile Application to Improve Eco-Driving : A Design and Evaluation Approach, (2017), 1–5.

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). From game design elements to gamefulness. *Proceedings of the 15th International Academic MindTrek Conference on Envisioning Future Media Environments - MindTrek '11*, 9. https://doi.org/10.1145/2181037.2181040

Dias, J. (2017). Teaching operations research to undergraduate management students: The role of gamification. *International Journal of Management Education*, *15*(1), 98–111. https://doi.org/10.1016/j.ijme.2017.01.002

Dicheva, D., Dichev, C., Agre, G., & Angelova, G. (2018). Gamification in Education: A Systematic Mapping Study. *Educational Technology & Society*, *18*(3), 75–88.

Hassan, L., Dias, A., & Hamari, J. (2018). How motivational feedback increases user's benefits and continued use: A study on gamification, quantified-self and social networking. *International Journal of Information Management*, *46*(July 2018), 127469. https://doi.org/10.1016/J.IJINFOMGT.2018.12.004

Kapp, K., Blair, L. and Mesch, R. (2014). The gamification of learning and instruction fieldbook: Ideas into practice, John Wiley & Sons.

Koren, Y., Bell, R., & Volinsky, C. (2009). Matrix factorization techniques for recommender systems. *IEEE Computer Society*, *42*(8), 30–37. https://doi.org/10.1109/MC.2009.263

Lister, M. & College, H. (2015). Gamification: The effect on student motivation and performance at the post-secondary level. *Issues and Trends in Educational Technology, 3*(2), 1–22.

Liu, D., Santhanam, R., & Webster, J. (2017). Toward meaningful engagement: a framework for design and research of gamified information systems. *MIS Quarterly*, *41*(4), 1011–1034. Obtido de http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=125996703&site=eds-live

Lopez, C. E., & Tucker, C. S. (2018). SC. *Computers in Human Behavior*. https://doi.org/10.1016/j.chb.2018.10.005

Lopez, C., & Tucker, C. (2019). The effects of player type on performance: A gamification case study. *Computers in Human Behavior*, *91*, 333–345. https://doi.org/10.1016/j.chb.2018.10.005

Nah, F., Eschenbrenner, B., Zeng, Q., Telaprolu, V. R., & Sepehr, S. (2014). Flow in gaming: literature synthesis and framework development. *International Journal of Information Systems and Management*, *1*(1/2), 83. https://doi.org/10.1504/IJISAM.2014.062288

Nah, F., Zeng, Q., Telaprolu, V., Ayyappa, A., & Eschenbrenner, B. (2018). Gamification of Education : A Review of Literature. *Computers in Human Behavior*, *87*, 192–206.

Ortiz‐Rojas, M., Chiluiza, K., & Valcke, M. (2019). Gamification through leaderboards: An empirical study in engineering education. *Computer Applications in Engineering Education*, (April), cae.12116. https://doi.org/10.1002/cae.12116

Özhan, Ş. Ç., & Kocadere, S. A. (2019). The Effects of Flow, Emotional Engagement, and Motivation on Success in a Gamified Online Learning Environment. *Journal of Educational Computing Research*, 073563311882315. https://doi.org/10.1177/0735633118823159

Sailer, M., Hense, J. U., Mayr, S. K., & Mandl, H. (2017). How gamification motivates: An experimental study of the effects of specific game design elements on psychological need satisfaction. *Computers in Human Behavior*, *69*, 371–380. https://doi.org/10.1016/j.chb.2016.12.033

Seaborn, K., & Fels, D. I. (2015). Gamification in theory and action: A survey. *Inter-*

national Journal of Human Computer Studies, *74*, 14–31. https://doi.org/10.1016/j.ijhcs.2014.09.006

Shohieb, S. (2019). A Gamified e-Learning Framework for Teaching Mathematics to Arab Deaf Students : (Supporting an Acting Arabic Sign Language Avatar). *Ubiquitous Learning: An International Journal*.

Simões, J., Redondo, R., & Vilas, A. (2013). A social gamification framework for a K-6 learning platform. *Computers in Human Behavior*, *29*(2), 345–353. https://doi.org/10.1016/j.chb.2012.06.007

Stott, A., & Neustadter, C. (2013). *Analysis of Gamification in Education*. Surrey, BC, Canada. Obtido de http://clab.iat.sfu.ca/pubs/Stott-Gamification.pdf

Tondello, G., Premsukh, H., & Nacke, L. (2018). A Theory of Gamification Principles Through Goal-Setting Theory. https://doi.org/10.1057/9780230594647_8

Vanslambrouck, S., Zhu, C., Pynoo, B., Lombaerts, K., Tondeur, J., & Scherer, R. (2019). A latent profile analysis of adult students' online self-regulation in blended learning environments. *Computers in Human Behavior*, *99*(April), 126–136. https://doi.org/10.1016/j.chb.2019.05.021

Viamonte, A. (2018). Uma experiência de gamificação no ensino superior. Em M. J. Costa (Ed.), *CNaPPES 2018 – Congresso Nacional de Práticas Pedagógicas no Ensino Superior* (pp. 17–23). Braga.

Zichermann, G., & Cunningham, C. (2011). *Gamification by design: Implementing game mechanics in web and mobile apps*. Canada. Obtido de www.it-ebooks.info

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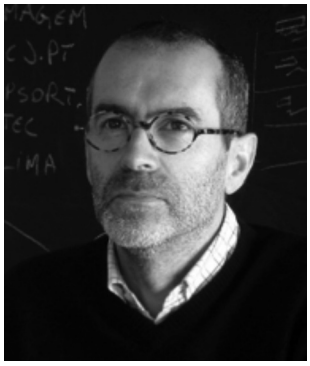

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The book **Experiences and perceptions of pedagogical practices with Game-Based Learning & Gamification** is an intellectual output of the Games2Learn&Gamification2Engage project funded by the Portuguese National Agency for the Erasmus Plus Programme. The *Agupamento de Escolas da Maia* (Portugal), the *Istituto Comprensivo di Sestu* (Italy) and *Szkola Podstawowa nr 41* (Poland) participated in this European project, with the partnership of researchers from the Research Centre on Education of the University of Minho (Portugal).

For the completion of the book, we invited experts (from Portugal, Spain and Brazil) who have been studying the use of games and gamification in education, and they have prepared papers with unquestionable merit. Thus, the book comprises fifteen chapters that present experiences conducted by the schools involved in the project and by those experts. Topics covered in this book range from a systematic literature review (in Portugal and Spain) to pedagogical experiences with games and gamification, concluding with a reflection article on the pedagogical value of gamification.

We believe that this book, although intended primarily for teachers and researchers, may also please the general public interested in reflecting on the potential and pedagogical value of Games and Gamification in education. This book, for its themes and narratives of pedagogical experiences, can be an estimable source of inspiration for teachers to make innovative use of Games and Gamification in the educational process.

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