Using Gamification and Serious Games for English Language Learning

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Abstract—**This study provides a taxonomy of prominent opportunities and challenges yielded by utilizing gamification and serious games for English language learning. A Delphi method is used to gather computer science students' opinions resulting from a SWOT analysis of the use of these two different game-based ways to learn English language. This study produced an ordered list of important adoption and entry issues to consider when gamifying the English language learning experience. Additional factors were identified through a discussion of these issues. Based on our findings, we further discuss the relevance and implications of opportunities and challenges associated with gamification and serious games.**

Keywords—gamification; serious games; English language learning; motivation; Delphi; exploratory study

I. INTRODUCTION

Using technology in education has become necessary to fortify learning experience in the 21st century. Most of the present-day students are digital natives, and they learn and process information differently [1]. Indeed, they have been exposed to information technology from birth; they are used to blogging, gaming and social networking. Based on this type of students plenty of teachers from different subjects, including English language teachers, are integrating gaming as a learning medium to educate students in several different disciplines.

Two different ways of utilizing games for education have been proposed, namely gamification and serious games. Gamification is the use of game elements and game design techniques in non-game contexts [2]. Gamification takes parts of games including points, badges, challenges, leaderboards, rewards, incentives, and so forth and applies them to pedagogy to motivate students to higher and more meaningful levels of engagement. According to the NMC-Horizon Report, gamification is building support in teachers; it established clearly that: "the gamification of education is gaining support among educators who recognize that effectively designed games can stimulate large gains in productivity and creativity among learners" [3]. On the other hand, serious games have also been created to educate but in different ways. According to [4] [5], serious games are designed to train and are used for stimulation and to educate in virtual environments with previously defined learning objectives

To set up a basic understanding of gamification and serious games opportunities and weaknesses, several questions need to be answered, including but not limited to: What might be inhibiting or enabling gamification and serious games as learning tools for English language? What might encourage or discourage universities to invest resources in gamification and serious games? What factors optimize the likelihood of successful gamification and serious games and high quality of outcomes?

To the best of our knowledge, a taxonomy of salient opportunities and challenges yielded by using gamification and serious games for English language learning has not been proposed. That is why we conducted a Delphi study to address this research gap. The Delphi method consisted of an initial brainstorm session, which was followed by a consolidation of key issues and a ranking of these issues. This resulted in a taxonomy of issues relevant to game-based tools for English language learning. We then expanded our findings by openly discussing these issues to ensure the relevance of the initial brainstorming results. Specifically, the current study was exploratory in nature and identified initial barriers and opportunities for gamification and serious games adoption.

Our findings may help universities to better prepare their venture into game-based learning tools by heightening their awareness of the major challenges of these emergent technologies. The relevant issues identified in this study also provide a starting point for better understanding and further researching factors that influence the optimal utilization of gamification and serious games to learn English language.

The remaining of this paper is organized as follows. Section 2 presents a literature review. Then we introduce our methodology for identifying the opportunities and challenges associated with gamification and serious games in English language learning. Section 4 details the results of the study. Section 5 is dedicated to the discussions of our findings and their implications with the support of a complementary qualitative study through an open discussion with participants.

The paper ends with a summary of the key findings, limitations, and directions for future research."

II. BACKGROUND

A. Gamification

Gamification is based on the success of the gaming industry. Indeed, games are everywhere; we play games when we are travelling, when we are relaxing and when we are at work. As stated by [6], 17% of the world's population is involved in playing games.

Gamification is the application of lessons learned from the gaming industry in order to change the stakeholders' behaviors and outcomes in non-game situations. As defined by [2], it consists of using game elements and game design techniques in non-game contexts.

Successful gamification uses three design principles: mechanics, dynamics, and emotions. Mechanics specify the goals, rules, settings, interactions, as well as the boundaries of the situation to be gamified. Giving the preset rules, different dynamics will emerge such as bluffing, cooperation and competition and personal triumph over adversity. When stakeholders partake in gamification dynamics, they may experience a wide range of emotions, for instance excitement, happiness, personal triumph over adversity, disappointment and sadness. These game design principles are intended to change stakeholders' outcomes or behaviors. Intended outcomes included such things as increased employee satisfaction, increased customer engagement and increased student performance [7].

There are two key parties involved in gamification: players and designers. Players are those individuals who participate in a gamified experience itself. Designers are those individuals who create the gamified experience. Different players want different things from a gamified experience. Therefore, understanding these different players is a key to creating successful gamification experience [7].

Nowadays, the concept of gamification is widely used thanks to the abundant use of social media and the accessibility of the Internet. Examples of use include employee motivation, conceptualization of the concept of energy preservation, to beat and understand diseases, create healthy competition, promote charitable donations, promote customer loyalty, among others. Several works have been proposed in the literature discussing how gamification can be applied to a wide range of activities including innovation management [8], marketing [9], human resources management [10], security [11], information technology management [12] Yu-Kai Chou lists over 90 examples of gamification instances, including statistics on Return on Investment (ROI) from the literature [13]. Other application domains suggested in the literature include mediating personal productivity [14], wellness and health [15] and sustainability [16] [17].

Furthermore, gamification is at the present time implemented with educational purposes as a strategy to foster student engagement in different content areas including English language learning [18]. According to the global education gamification market report, the analysts forecast the global education gamification market to grow at a CAGR of 66.22% during the period 2016-2020 [19].

The trend of gamification in education has been increasing by means of the technological advancements enabling more digitized learning environments as well as use of technical possibilities developed in relation to video games to create immersive and engaging learning experiences [20]. With its promise of positively engaging students and mediating their behavior, gamification is seen as a valuable tool which can be used to address some of the negative behaviors associated with students, such as shortened attention spans and the lack of time and/or skill they expend on engaging in the critical reflection required for developing in-depth knowledge

There is a growing literature that explores the impact of gamification across a range of disciplines such as Computer Science [21], Finance [22] and Risk Management [23]. The effect of gamification on skills development has been examined in areas such as financial literacy [22], information literacy [24] and second language learning [3].

B. Serious Games

The term "serious game" was firstly used by Abt in [25]. In a digital context, this term was firstly used in 2002, with the start of the Serious Game Initiative lead by David Rejeski and Ben Sawyer in the US [26].

Initially, serious games were proposed to train people for tasks in particular jobs, such as training army personnel. Then, they evolved with the proliferation of "non-hard" gaming and of new devices, such as smartphones, tablets and diverse types of consoles. As a matter of fact, a multiplicity of serious games has been implemented for applications/goals, including but not limited to: entertainment, government, military and defense, healthcare, education, corporate, religion, culture and art, ecology, politics, advertising and scientific research. Several academic works were interested in classifying serious games according to different criteria, such as application domains, purpose and audience.

In the education context, serious gaming is regarded as a particularly active, problem-solving, situated and social form of learning with rapid and differentiated feedback that also promotes the enjoyment of learning [27] [28] [29]. Educational aspect of serious games is one of their greatest assets. Indeed, they are promoting and opening new horizons for active learning and provide a learning by-doing experience [30]. The literature of serious games provides several games for language learning such as English pronunciation [31] or German learning [32].

As mentioned above, several pieces of academic works claim the positive effect of gamification and serious games on students' motivation [29]. However, there are also a number of reasons that such connections between gaming and learning should not be considered to be self-evident. We focus in this current paper on the effectiveness of game-based tools for English language learning. Indeed, while researchers have pointed out interesting and prominent opportunities and challenges of gamification and serious games to learn English language, no taxonomy of such opportunities and challenges

has been provided. Therefore, our contribution to the literature is to provide the cornerstones for such a taxonomy.

III. METHOD

In order to address the aforementioned research gap, we identified challenges and opportunities Jouf University may face when using gaming in the context of English language learning. We conducted a SWOT analysis from a brainstorming session as a preliminary exploratory study with students of the College of Computer and Information Science. This SWOT analysis is intended to present possible perceived Strengths, Weaknesses, Opportunities, and Threats of gamification in English language learning.

The SWOT analysis generated an organized set of factors which may help Jouf University to deepen its understanding of the costs and benefits of gamifying English language learning. These factors can help inform faculty members of the advantages to working in a gamified environment, as well as raise their awareness of the prospective threats inherent to gamification. To address these SWOT analysis categories, we considered the following questions:

- Strengths: What factors do you consider as major advantages of gamification and serious games?

- Weaknesses: What factors do you consider as major disadvantages of gamification and serious games?

- Opportunities: What potential opportunity does gamification and serious games offer in the context of English language learning?

- Threats: What potential threats does gamification and serious games pose in the context of English language learning?

To conduct our exploratory study, we used a Delphi approach. Delphi studies are regularly used in information systems studies when a consensus needs to be achieved among domain experts on a topic where ideas generation is required [33].

A. The Participants

In October 2018, students of the College of Computer and Information Science at Jouf University were invited to participate to our Delphi study. They were asked to do a SWOT analysis of gamification and serious games in English language learning. Demographics of the study participants are provided in Table I.

TABLE I. PARTICIPANT DEMOGRAPHIC DATA

Study Data	
Total participants	49
Youngest participant	21
oldest participant	26
Male participant	42
Female participant	7
Game Experience	Very often

B. The Brainstorming Process

The brainstorming process consisted of several activities in which the participants were asked to engage during a 360 minutes period. A summarized agenda and research process follow:

- After an introductory presentation on gaming and its "serious" use, students were asked to anonymously generate ideas around the four SWOT themes.

- Students were then assigned to four subgroups and asked to reduce, clarify and organize collectively generated ideas into unique statements around one of the four themes. Each subgroup was assisted in this task by a facilitator. The goal was to converge on similar ideas, remove nonrelated ones, and reword those insufficiently clear.

- Students then rejoined as a single group. Each subgroup facilitator presented and explained to the group which statements were selected for their respective theme.

- Students were then asked to individually and anonymously rate the relevance of each statement on a 10-point Likert-type scale, with '10' representing a very relevant statement and '1' a least relevant statement relating to each of the four SWOT themes.

- The voting scores were then presented to all participants in a raw format to stimulate a discussion of the results (proposal by proposal), and to allow the reformulation of proposals when necessary, to clarify ratings' standard deviations and so to build a collective consensus.

Finally, we conducted an open discussion for 90 minutes with the same students about the brainstorming results. We aimed to deepen and clarify their understandings of the statements' importance and their role to make gaming-based learning of English language successful. A list of guiding questions addressing these constructs was prepared to facilitate the discussion.

IV. RESULTS

During the initial brainstorming session, students produced a total of 167 ideas aiming to identify the four SWOT analysis components. Later the ideas were rephrased and reviewed and then reclassified as described in the brainstorming process. The statements were reduced to 36 (11 strengths, 7 weaknesses, 13 opportunities and 5 threats). In the aim to enhance the clarity of the statements, the overall results of the SWOT analysis were reviewed and paraphrased after the data collection. Finally, we invited the participants to answer some key questions about the statements in the aim to ensure ideas are well represented and classified:

1. Are the resulting statements possibly misclassified between strengths and opportunities or between weaknesses and threats?
2. Are the resulting statements appropriate and within the scope of gamification and serious games?
3. Are the resulting statements specific to a particular serious game?

After careful consideration, we organized and put the results in four tables, (SD = Standard Deviation).

TABLE II. ˮ STRENGTHS

Strengths	Mean	SD
Motivating, challenging and exciting environment	9.2	0.71
Sustaining the effort of learning	8.65	0.94
Varing skills for language practice: speaking, writing, listening and reading	8.73	0.66
Improving the responsiveness of the students.	8.08	0.76
Stimulating the student's instinct for achievement	8.69	1.33
Better students' involvement in classrooms	8.34	1.03
Focusing on the use of language rather than on the language itself	9.0	0,24
Learning, practicing, or reviewing specific language material	8.0	1.14
Enhancing students' performance	9.1	0.43
Breaking classroom routine	7.95	0.55
Encouraging students to interact and communicate and have fun	9.57	0.49

As result of the first part of the brainstorming section, participants listed relevant strengths. First, students stressed their need to "a motivating, a challenging and an exciting environment in the aim to get involved" in their classrooms. They established a strong link between this kind of environment and their motivation to learn. Participants highlighted the importance of gamified process as a break from the usual routine of the language class. They focused on the heavy aspect of English language classes. Such a ludic environment will leverage a new learning experience that sustains the effort of learning. It will allow students to better interact and communicate and have fun in the same time.

Consequently, this will diminish stress and help to increase students' responsiveness. Participants highlighted that such kind of learning ambiance will raise their concentration and stimulate their own instinct for achievement. Finally, serious games and gamification capture students' attention and bring better engagement and involvement. Students highlighted the importance of the use of ludic environment to practice, review specific language material and vary skills such as speaking, writing, listening etc. This kind of learning support may enhance students' performance.

TABLE III. ˮ WEAKNESSES

Weaknesses	Mean	SD
Lack of comfort due to different levels of competitivity between students.	7.12	0.99
Frustration caused by the misunderstanding of the game.	5.69	3.53
Game not adequate with the general class vibe.	6.36	1.46
Lack of control on the class due to the ludic ambiance	4.51	1.66
Discipline issues due to the ludic general ambiance	4.69	2.02
Distraction from the real goal of the game without learning	8.02	0.56
Precepting learning with games as unnecessary, waste of time, childish and immature	4.16	2.08

Second part of the brainstorming session concerned weaknesses. Participants pointed several drawbacks of language learning using gamification and serious games. First of all, students highlighted that they may not very comfortable with ludic environments due to the difference of competitivity between them and they may feel bored or distracted or frustrated if they misunderstand the game. As students have different learning styles, if "*the game didn't match their needs or if it's inadequate the general vibe of the class*", students will be distracted from the real goal of the game. In addition, students argued that the ludic atmosphere could engender "*hard discipline issues and provoke lack of control*". They even confirm that they may perceive games and gamified processes as "*childish, immature, unnecessary or even a waste of time*". Finally, students highlighted that ludic environment may lead them to miss the main purpose of the game and "*be distracted from learning without achieving the real goal behind the game*".

TABLE IV. ˮ OPPORTUNITIES

Opportunities	Mean	SD
Continuous self-learning	9.24	0.92
Continuous evaluation of the students	9.08	0.6
Complete freedom in acquiring knowledge	9.57	0.49
No gender or social discrimination	9.59	0.48
Expanding margin of freedom to error without any negative repercussions	9.85	0.25
Increase fun and joy in the classroom and creating pleasant ambiance for learning	8.36	0.76
Learning by different educational means	9.18	0.73
Linking education to real life and practical application	8.53	0.93
Providing an appropriate and unlimited set of tasks for students	9.08	0.52
Inspiring students to discover their own motivation for learning	8.18	0.64
Engagement of students	5.61	2.06
Redirecting the interests of students	6.02	1.21
Make education meaningful and leave an impact for the learner	8.30	1.31

In the third part of the brainstorming session, the participants identified several opportunities of the use of gamification and games in English language learning. First of all, students highlighted that ludic environments allow learners to acquire continuous self-learning and evaluation with possibility of experiencing appropriately. In addition, ludic ambiance will provide students the complete freedom in acquiring knowledge. Participants stressed how games and gamified learning materials will "*allow students to express themselves without any fear or shyness or negative repercussions*". They argued that that this learning atmosphere will eliminate any gender or social discrimination. Consequently, students will feel more comfortable to learn more freely which will enhance their engagement and performance. Indeed, Games and gamified learning material will insert joyful ambiance and create pleasant and relaxed place for learning. Students will be attracted to learn and feel better involved in the classroom. According to students, using high technologies as a learning material makes them feel as if

language courses are following the technological frame and better fit their own needs, they may foster creativity and makes discover their own motivation to learn. These new learning materials "*will not only attract student and make them involved to learn but also they will capture and redirect students' attention and interest to their language course*". One participant asserts "*these new materials may make us very focused so better involved in what we are doing*". Another student stressed that "*they may make the educational process more attractive, up to date and leave better impact on our spirits so courses will be a moment of enjoyment without stress or boredom*". Finally, the participants argued that game will open the door to an "*evolved automated learning more coherent with new generations*". According to them, several current educational materials such as video projector, blackboard, chalk, etc. should be replaced by more smart equipment or software.

TABLE V. THREATS

Threats	Mean	SD
Degrading marks due to negligence	5.61	1.96
Degrading class values	5.24	1.49
Amotivation caused by excessive loosing.	7.36	1.29
Boredom and lack of involvement in learning	5.69	1.77
High dependency on machine reliability	7.44	1.74

The last stage of the brainstorming activity was related to threats of serious games and gamification as learning material in English language learning. Students identified a set of threats that they judge worthy for a close focus. First, they highlighted the risk on class values and marks to degrade regarding the use of ludic learning materials. Indeed, according to participants, games and gamification may bring negligence and distraction to the values of education. One student said "*it will be hard to manage a playing classroom; I think the classroom will be out of control and the professor will not be able to supervise what they are doing*". In addition, social loafers will benefit from this situation and the professor will not be able to recognize them. Second, students stressed that the misunderstanding of games may engender a state of boredom and distraction. Finally, participants highlighted that games and gamification may lead to a state of harmful dependency to machines.

V. DISCUSSION AND CONCLUSION

Games and gamification are becoming new ways to leverage knowledge. They are taking an increasing place and invading our educational system. The evolution in education is non-evitable since students are becoming very technophile and have the tendency to reject traditional learning material or find them out of date. They need new learning means aligned with their own requirements. Researchers have two opposite opinions about the efficiency of games as a learning material. They express their hype from gaming in education [34] [35] [36] [37]. In this perspective, researchers assert that games are superficial activities that may not contribute to learning. The second perspective, researchers focused on the assets of games and gamification and present them as evolutive and promoting way to an engaging and effective learning [38] [30] [39] [31] [32].

Our study listed several crucial advantages and opportunities they are encouraging to consider using serious games and gamification in classrooms. On the other hand, it identified a set of threats and drawbacks that should be considered in the aim to overcome.

This study is a preliminary exploratory study in a research program. In future research, we plan to conduct a quantitative study examining the relationship the key success factors of the use of ludic learning materials and students' performance. It is our hope that this research will address and spawn further research questions surrounding universities' use of serious games and gamification.

REFERENCES

[1] M. Prensky, Digital natives, digital immigrants, part II: do they really think differently?. 2001, 2011.

[2] K. Werbach et D. Hunter, For the win: How game thinking can revolutionize your business, Wharton Digital Press, 2012.

[3] J. F. F. Flores, «Using gamification to enhance second language learning,» Digital Education Review, n° %127, pp. 32-54, 2015.

[4] J. T. Kim et W.-H. Lee, «Dynamical model for gamification of learning (DMGL),» Multimedia Tools and Applications, vol. 74, n° %119, pp. 8483-8493, 2015.

[5] A. Ypsilanti, A. B. Vivas, T. R{\"a}is{\"a}nen, M. Viitala, T. Ij{\"a}s et D. Ropes, «Are serious video games something more than a game? A review on the effectiveness of serious games to facilitate intergenerational learning,» Education and Information Technologies, vol. 19, n° %13, pp. 515-529, 2014.

[6] B. Kim, «. The Popularity of Gamification in the Mobile and Social Era,» Library Technology Reports, vol. 51, n° %12, pp. 5-9, 2015.

[7] K. Robson, K. Plangger, J. H. Kietzmann, I. McCarthy et L. Pitt, «Is it all a game? Understanding the principles of gamification,» Business Horizons, vol. 58, n° %14, pp. 411-420, 2015.

[8] S. Roth, D. Schneckenberg et C.-W. Tsai, «The ludic drive as innovation driver: Introduction to the gamification of innovation,» Creativity and Innovation Management, vol. 24, n° %12, pp. 300-306, 2015.

[9] S. P. Walz et S. Deterding, The gameful world: Approaches, issues, applications, Mit Press, 2015.

[10] S. Dale, «Gamification: Making work fun, or making fun of work?,» Business information review, vol. 31, n° %12, pp. 82-90, 2014.

[11] K. Boopathi, S. Sreejith et A. Bithin, «Learning cyber security through gamification,» Indian Journal of Science and Technology, vol. 8, n° %17, pp. 642-649, 2015.

[12] E. Prakash et M. Rao, «Transforming Learning and IT Management through Gamification, International Series of Computer Entertainment and Media Technology,» Switzerland: Springer International Publishing, 2015.

[13] Y.-k. Chou, «A Comprehensive List of 90+ Gamification Cases with ROI Stats,» [En ligne]. Available: https://yukaichou.com/gamification-examples/gamification-stats-figures/. [Accès le 1 October 2018].

[14] M. G. Myhre, «Gamification in Mobile Language Learning: Improving User Satisfaction for Norwegian Immigrants,» 2015.

[15]" C. Lister, J. H. West, B. Cannon, T. Sax et D. Brodegard, «Just a fad? Gamification in health and fitness apps,» JMIR serious games, vol. 2, n° %12, 2014.

[16]" J. McGonigal, Reality is broken: Why games make us better and how they can change the world, Penguin, 2011.

[17]" A. L. Negru{\c{s}}a, V. Toader, A. Sofic{\u{a}}, M. F. Tutunea et R. V. Rus, «Exploring gamification techniques and applications for sustainable tourism,» Sustainability, vol. 7, n° %18, pp. 11160-11189, 2015.

[18]" P. Buckley et E. Doyle, «Individualising gamification: An investigation of the impact of learning styles and personality traits on the efficacy of gamification using a prediction market,» Computers \& Education, vol. 106, pp. 43-55, 2017.

[19]" TechNavio, «Global Education Gamification Market 2016-2020,» Research and Markets, 2016.

[20]" J. K. J. H. Jenni Majuri, «Gamification of education and learning: A review of empirical literature,» chez 2nd International GamiFIN Conference, Pori, Finland, 2018.

[21]" K. Browne et C. Anand, «Gamification and serious game approaches for introductory computer science tablet software,» chez Proceedings of the First International Conference on Gameful Design, Research, and Applications, 2013.

[22]" L. deCos et others, «Opportunity for banks to utilize gamification as a tool to promote financial education to children,» 2015.

[23]" J. Garvey et P. Buckley, «Teaching the concept of risk: Blended learning using a custom-built prediction market,» Journal of Teaching in International Business, vol. 21, n° %14, pp. 346-357, 2010.

[24]" P. Buckley et E. Doyle, «Using web-based collaborative forecasting to enhance information literacy and disciplinary knowledge,» Interactive Learning Environments, vol. 24, n° %17, pp. 1574-1589, 2016.

[25]" C. C. Abt, Serious games, Viking Press, 1970.

[26]" A. De Gloria, F. Bellotti et R. Berta, «Serious Games for education and training,» International Journal of Serious Games, vol. 1, n° %11, 2014.

[27]" R. Garris, R. Ahlers et J. E. Driskell, «Games, motivation, and learning: A research and practice model,» Simulation \& gaming, vol. 33, n° %14, pp. 441-467, 2002.

[28]" S. Tobias, J. Fletcher, D. Y. Dai et A. P. Wind, «Review of research on computer games,» Computer games and instruction, vol. 127, p. 222, 2011.

[29]" N. Iten et D. Petko, «Learning with serious games: Is fun playing

[30]" R. Berta, F. Bellotti, E. van der Spek et T. Winkler, «A tangible serious game approach to science, technology, engineering, and mathematics (STEM) education,» Handbook of Digital Games and Entertainment Technologies, pp. 1-22, 2016.

the game a predictor of learning success?,» British Journal of Educational Technology, vol. 47, n° %11, pp. 151-163, 2016.

[31]" W. Trooster, S. L. Goei, A. Ticheloven, E. Oprins, G. van de Boer-Visschedijk, G. Corbalan et M. Van Schaik, «The Effectiveness of the Game LINGO Online: A Serious Game for English Pronunciation,» chez Simulation and Serious Games for Education, Springer, 2017, pp. 125-136.

[32]" Y. Alyaz, D. Spaniel-Weise et E. Gursoy, «A study on using serious games in teaching German as a foreign language,» Journal of Education and Learning, vol. 6, n° %13, p. 250, 2017.

[33]" M. Keil, A. Tiwana et A. Bush, «Reconciling user and project manager perceptions of IT project risk: a Delphi study 1,» Information Systems Journal, vol. 12, n° %12, pp. 103-119, 2002.

[34]" J. Gosen et J. Washbush, «A review of scholarship on assessing experiential learning effectiveness,» Simulation \& Gaming, vol. 35, n° %12, pp. 270-293, 2004.

[35]" H. F. O'Neil, R. Wainess et E. L. Baker, «Classification of learning outcomes: Evidence from the computer games literature,» The Cirriculum Journal, vol. 16, n° %14, pp. 455-474, 2005.

[36]" S. Egenfeldt-Nielsen, «Third generation educational use of computer games,» Journal of Educational Multimedia and Hypermedia, vol. 16, n° %13, pp. 263-281, 2007.

[37]" L. L. Garber, E. M. Hyatt, {. \. Boya et B. Ausherman, «The association between learning and learning style in instructional marketing games,» Marketing Education Review, vol. 22, n° %12, pp. 167-184, 2012.

[38]" S. a. D. V. H. a. R. H. M. a. I. S. de Sousa Borges, «A Systematic Mapping on Gami-fication Applied to Education.,» chez Proceedings of the 29th Annual ACM Symposium on Applied Computing, 2014.

[39]" A. C. Graesser, «Reflections on serious games,» chez Instructional Techniques to Facilitate Learning and Motivation of Serious Games, Springer, 2017, pp. 199-212.