A FRAMEWORK FOR GAMIFIED ACTIVITIES BASED ON MOBILE GAMES PLAYED BY PORTUGUESE UNIVERSITY STUDENTS

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ABSTRACT

This paper starts by reporting the findings of a survey of Portuguese university students concerning their game habits and preferences. An online questionnaire was developed and 1101 answers were collected, 626 were mobile game players. The results from the survey indicate that the games most played by university students are essentially casual and puzzle games, existing differences between female and male students' preferences. Then, learning principles were identified according to Gee (2003) and game mechanics on the students' preferred games. Finally, based on these results we propose a framework for gamified interactive activities to university students, to get them engaged in learning with their mobile devices.

KEYWORDS

Mobile Games; Interactive Activities; University students, Learning Principles, Gamification.

1. INTRODUCTION

Students are playing mobile games everywhere: in the bus, train, at home, on campus, some even in the classroom with the sound turned off without the teacher's permission. We know that we can learn different skills with video games based on the type of game and gameplay characteristics (Connolly et al., 2012; Gee, 2007; Squire, 2011; Klopfer, 2008; Zimmerman, 2008) and "good video games incorporate good learning principles" (Gee, 2003, p.114). It was based on this idea of Paul Gee (2003) that we designed a research project called "From games to mobile-learning interactive activities".

This project intends to create interactive mobile learning activities based on students' mobile game preferences. The target population is students from K5 to Master's students. However, in this paper we focus on Portuguese university students, their game preferences and their playing habits. We analyze them and their game preferences according to Gee's (2003) learning principles and identified the games' mechanics. Finally, we propose a framework for gamified interactive activities that can help teachers to select the digital tools that can be more engaging to students.

2. THE SURVEY

The research questions focused on this paper are the following: (i) Which mobile games do students prefer? (ii) Which learning principles and game elements are embedded in students' preferred games?, and (iii) Which learning principles and game elements can be applied to develop interactive activities running on mobile devices?

To answer the first question, a survey (Babbie, 1997) was conducted in Portugal. A questionnaire was developed containing four dimensions: 1) Student characterization, 2) Mobile game habits (games played in each mobile device and time spent in gaming), 3) Game preferences (the games most played, reasons to play that game, the importance of some game characteristics in continuing to play it, whether they like to play alone or with others, and if they would like to use games for learning in class), 4) If they were to create a

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game, what kind of characteristics would it have? Most of the items were multiple choice questions, but some were open ended questions. The instrument was validated by experts. The questionnaire was available online on a Google Drive Form.

A survey was carried out with university students from different Portuguese Universities. The responses were received from 21st May to 16th September 2013. We collected 1101 responses, although only 626 of them (56.9%) are mobile gamers.

Table 1. Respondents and Gamers

Subjects Gender	Respondents [All students]		Mobile gamers		The sample	
	f	%	f	%	f	%
Female	693	62.9	363	52.4	363	58.0
Male	408	37.1	263	74.5	263	42.0
Total	1101	100.0	626	56.9	626	100.0

The female sample is slightly larger (58.0%), and this corresponds to the female majority among university students in Portugal (PORDATA[1]). In terms of levels, undergraduate students (65.3%) form the majority of our sample, also reflecting the Portuguese university population, where there are 231.230 undergraduate students and only 117.125 Master's students (PORDATA[2]). The majority of the students are under 23 years of age (70.8%), the most common age to complete a Master's degree in Portugal.

2.1 Results

Students mentioned 177 games. The top 5 played games are Candy Crush, Angry Birds, The Sims, Bubbles, and ranking in 5th place are Flow, Fruit Ninja and Solitaire (Table 2).

At the time of the survey, Candy Crush Saga was the game most played by university students in Portugal. This is a worldwide tendency, as it was the most downloaded portable game in 2013 in both the iOS App Store and in Google Play. Fruit Ninja was the 5th most downloaded portable game in 2013, Angry Birds the 6th and Hill Climb Racing the 7th. (App Annie, 2014). Newzoo (2014) also reported that Candy Crush Saga ranked 1st in France and Germany. Four of the games most played by Portuguese students appear in the worldwide ranking: Candy Crush Saga, Angry Birds, Fruit Ninja, and Hill Climb Racing.

In Table 2 we can see gender differences in what concerns the most played games. The only game common to both is Angry Birds, which ranked in 1st place for male and 3rd place for female players.

Table 2. Games Most Played by Portuguese University Students (All Students and Female Vs Male)

Ranking of games	All Students	Female Players	Male Players
1 st	Candy Crush	Candy Crush	Angry Birds
2 nd	Angry Birds	The Sims	League of Legends
3 rd	The Sims	Angry Birds	Football Manager
4 th	Bubbles	Bubbles	Pro Evolution Socce
5 th	Flow	Fruit Ninja	Flow
	Fruit Ninja		Hill Climb Racing
	Solitaire		

Angry Birds has been able to mix the action and strategy of launching objects with the cuteness of the characters and the environments. Characters are highly friendly, and at the same time combative.

As with the mix seen in Angry Birds, we could say that Sims, played by females, and League of Legends, played by males, optimize each side of the mix. In Sims everything is related to the characters, to their lives, relations, cuteness and friendliness. On the other hand, in League of Legends, everything is related to the system of weapons and dependencies inside the game. Playing Sims is like managing a family, with no

[1] More information in:
http://www.pordata.pt/Portugal/Alunos+matriculados+pela+1.a+vez+no+ensino+superior+total+e+por+sexo-1047
[2] More information in:
http://www.pordata.pt/Portugal/Alunos+matriculados+no+ensino+superior+total+e+por+nivel+de+formacao-1023

specific goals nor victories, while playing League of Legends is more like managing a battalion: the players are all motivated by very specific objectives and a final victory.

The other games played by female players are Fruit Ninja and Bubbles, which are similar to Candy Crush. All these games work around highly rewarding systems. Each action carried out in the game, even the easiest one, will be rewarded with some kind of gratification. Throughout these games, the goal is never to achieve an end, or to be the best, but instead to be cheered, to be praised about your skills, and to feel good while playing.

Only male students report playing soccer games - 3rd and 4th in the male's preferences - which suggests the predominantly male orientation of this theme. Most of the sport games are played mostly by males. These games have well defined objectives, attainable through effort. To demonstrate the male player's love for systems (sets of structures, behaviors and connectivities within specific spatial and temporal boundaries), we just need to look into games like Flow, one of the mentioned top 5 titles by male players. A game where we are asked to find the best route within a space, and for this we need to use all our ability to create abstract systems in our mind, to be able to respond to the game requests. The goal here is not to be rewarded, but to be able to meet the challenge posed. The same applies to Hill Climb Racing, where one's skills are challenged to maintain control of the car.

Figure 1 shows that games are mostly played in the devices for which they were initially launched. For instance, The Sims was created for PC as well as Solitaire, both are mostly played in laptop computers despite the existence of versions for other devices. The same happens with Angry Birds and Flow which are mostly played on smartphones and tablets. Only Candy Crush Saga which has integration with multiple platforms over Facebook is used both in tablets and laptop computers.

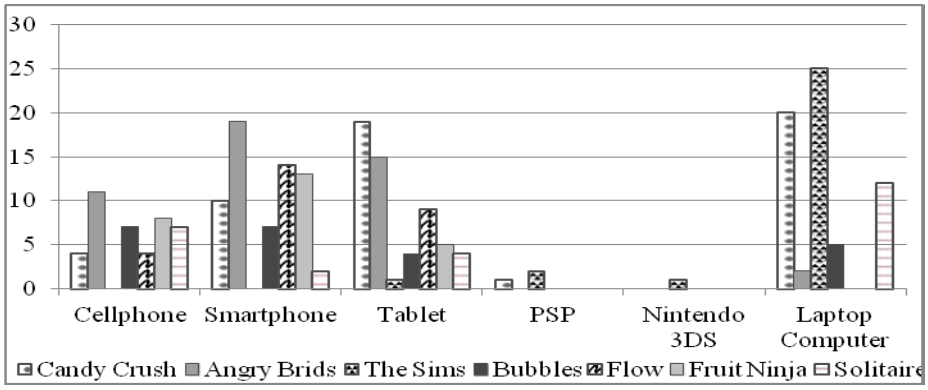

Figure 1. Mobile Device Used For Playing the Games Most Played (n=206)

One of the aims of our project is to figure out which are the most important characteristics of a game that keeps students playing it. This information will be important for the development of interactive activities that will be created in the project.

From Figure 2 we conclude that the most important characteristic of a game for university students is the gameplay, followed by scenarios, graphic effects and animations, story, and characters. The sounds and music are the less considered characteristics. Like Squire (2011) refers, today with so many graphical experiences it is understandable that our students are drawn to those features.

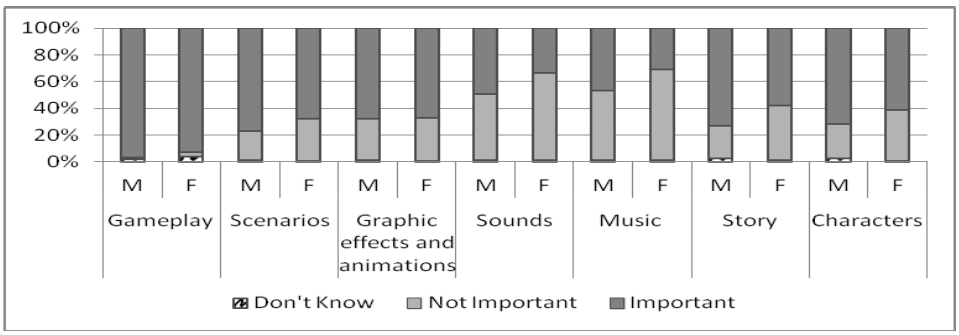

Figure 2. Importance of Some Game Characteristics to Continue Playing by Gender

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One questionnaire item asked why they like to play those specific games. Based in Sherry et al. (2006) we tried to classify the answers of the students using the six dimensions: Arousal, Challenge, Competition, Diversion, Fantasy, and Social Interaction. But these dimensions were insufficient to classify all the answers so it was necessary to add three dimensions: Genre (type of game), Game Features (characteristic of the game design: music, scenarios, graphics, actions, story, rewards…) and Learning (the game helps to learn something).

It is possible to see in Figure 3 that the motives most mentioned are Genre (38.4%), Game Features (35.0%) and Diversion (18.9%). For these students the characteristics and type of game are the most important reason to play them, followed by diversion.

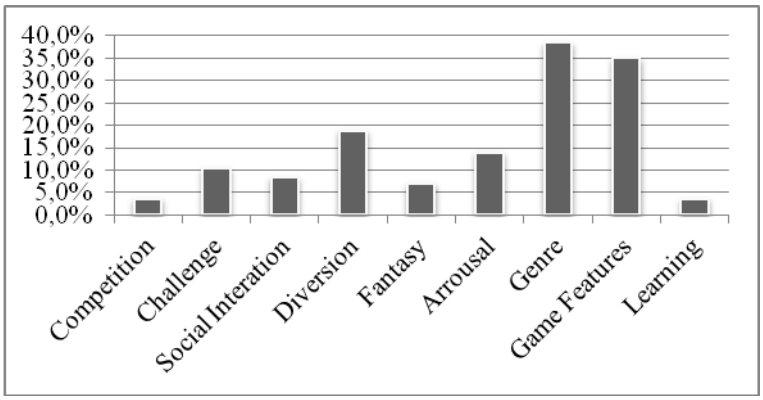

Figure 3. Motives for wanting to play the games

2.2 Playing Alone or with Others?

It is important to point out that most respondents prefer to play alone (71.6%), although the figure varies according to gender, 82.1% for female players and 57.0% for male players (Table 3). Those who prefer to play with others online (28.4%) choose to play mostly in teams rather than one to one.

Table 3. Preference for Playing Alone or With Others Online

Playing games		%	Female (%)	Male (%)
Alone		71.6	82.1	57.0
With others		28.4	17.9	43.0
	In teams	12.4	6.3	20.9
How	One to One	6.4	6.3	6.5
	Both	9.6	5.3	15.6

2.3 Playing Games to Learn at University?

We also questioned students if they would like to play games as a learning complement to their classroom activities. Most of them answered positively (78.12%), and there is a similarity between female (78.5%) and male (77.6%) opinions.

We inquired which game genre they would like to play. A list based on Connolly et al. (2012)'s work was available: Action, Adventure, Sports, Strategy, FPS, Casual games, Racing game, Sandbox, Board game, Fighting, Platform, Puzzle, Role-playing and Simulation.

In Table 4 the results are presented for all the positive respondents (n=489) about using games to learn academic issues. The most chosen game genre was strategy (72.8%) followed by simulation (58.7%) and action (41.9%). Other genres were rated below 50%.

Table 4. Preferred Game Genre to Learn

Game Genre	Total (f= 489)	Gender	
		Female (n=285)	Male (n=204)
Action	41.9	35.4	51.0
Strategy	72.8	77.5	66.2
Simulation	58.7	60.7	55.9

There is a similarity between female and male game genre preferences for learning. However, female students pointed out strategy games - a type of game that they do not usually play - as appropriate for learning. On the other hand, male students mentioned types of games they play or used to play as suitable for learning. Some examples are League of Legends which is a Real-time strategy with role-playing elements, or Football Manager and Pro Evolution Soccer which are games of sports and simulation.

The contrast between type of games they like to play for leisure and the type of games they would prefer for learning is more evident with female students.

3. IDENTIFICATION OF LEARNING PRINCIPLES AND GAME MECHANICS IN STUDENTS' PREFERRED GAMES

Gee (2003) presents 36 learning principles which it is possible to find in video games. It is important to note that he considers only games with long and intense play, in other words, video games that must be played for some hours to complete the tasks. The majority of games chosen by university students being short ones, only a few learning principles were identified from Gee's list. For the most played games seven learning principles were identified:

"6. Psychosocial Moratorium Principle - Learners can take risks in a space where real-world consequences are lowered." (p.67)

"10. Amplification of Input Principle - For a little input, learners get a lot of output." (p.67)

"11. Achievement Principle - For learners of all levels of skill there are intrinsic rewards from the beginning, customized to each learner's level, effort, and growing mastery and signaling the learner's ongoing achievements." (p.67)

"14. Regime of Competence Principle - The learner gets ample opportunity to operate within, but at the outer edge of, his or her resources, so that at those points things are felt as challenging but not "undoable"." (p.71)

"22. Intuitive Knowledge Principle - Intuitive or tacit knowledge built up in repeated practice and experience, often in association with an affinity group, counts a great deal and is honored. Not just verbal and conscious knowledge is rewarded." (p.111)

"25. Concentrated Sample Principle - The learner sees, especially early on, many more instances of fundamental signs and actions than would be the case in a less controlled sample. Fundamental signs and actions are concentrated in the early stages so that learners get to practice them often and learn them well." (p.137)

"35. Affinity Group Principle - Learners constitute an "affinity group", that is, a group that is bonded primarily through shared endeavors, goals, and practices and not shared race, gender, nation, ethnicity, or culture." (p.212)

Learning principles 6 and 10 are expected in almost all games, i.e., in a game the player is expected to take risks without consequences and to see things happening more quickly than in real life, as explained by the author.

Three others learning principles, 11, 14 and 22, are about the players' perceptions of skills. For each achievement in the game the player feels a pleasure, an intrinsic reward and the player knows that he is mastering a skill. The game manages the balance between challenge and player's skills, which with practice enables the player to go further. It is this practice that gives the player the "intuitive knowledge" to solve some tasks without being able to explain how it was done. These three learning principles made these players feel that they are capable of doing something, that they are in control.

For the 25th learning principle, rules of the game and possible actions are presented early on in the game. So they are learned faster, making the rest of the game easier and simpler.

Finally the last learning principle is about the players as a team. This interaction with others gives the player a sense of competition, but not face to face, they compete for the best score.

This information is about learning principles; we also need information about game design for the development of interactive activities we want to propose. In this study the students considered the following characteristics as the most important when playing a game: gameplay, scenarios, graphic effects and animations, story, and characters. Gameplay can be understood by the game mechanics used in the game. For Adams & Dormans (2012) there are five types of mechanics: Physics, Internal economy, Progression, Tactical maneuvering and Social interaction. The authors present a table that relates the type of game with the type of mechanics. Based on that, we can identify the types of mechanics in the genre of games mentioned by students for learning, presented at an early stage. Action and Simulation games have three types of game mechanics: Physics ("Detailed physics for movement, shooting, jumping, etc"), Internal economy ("Power-ups, collectables, points and lives" and "managing of resources") and Progression (Predesigned levels with increasingly difficult tasks, storyline to set players goals"), and Strategy games have all the five types of mechanics.

Looking to the genre of games most played we have puzzles (Candy Crush, Angry birds, Flow and Solitaire), simulation (The Sims) and arcade (Bubbles and Fruit Ninja). Puzzles involve the physics and progression type of mechanics, simulation games have the three mentioned previously and arcade genre do not appear in Adams & Dormans (2012), but we can infer that this genre has the physics and progression types of mechanics.

Based on Manrique (2013)'s identification of 35 gamification mechanisms, we analyzed the games most played to identify the game mechanics that are common, namely: Equipment; Power up; Trading Systems; Quest; Time events; Levels; Progress HUDs; Achievements; Social Standings; Punishments. These are related to the Internal economy and Progression types of mechanics proposed by Adams & Dormans (2012).

Scenarios of the most played games are unrealistic, they are based on the story of the game and look like cartoons. Graphic effects and animations give a positive feedback to the player, making him feel that he is proficient in that game. This way it promotes the player's self-efficacy and motivates him/her to go further.

Stories are simple. They typically have a short introduction to the game and motivate the player to play it (as in Candy Crush, Fruit Ninja, Angry Birds), or instead the player has to do the quests to find a bit more of the story (as in Bubbles). Sims has a more complex story, but it is the player that decides what will happen. Solitaire and Flow do not have a story.

As far as the characters are concerned, most of them are like cartoons and unrealistic; they make funny movements when the player achieves something. They are a fun element in the game. But these characters also show sadness when we lose. Showing feelings to increase the player's empathy and commitment gets the player engaged in the game.

4. A FRAMEWORK FOR GAMIFIED ACTIVITIES

As Kapp (2012, p.10) asserts "Gamification is using game-based mechanics, aesthetics and game thinking to engage people, motivate action, promote learning and solve problems." Based on students' mobile game preferences, game learning principles according to Gee (2003), and keeping reuse of students mobile devices in mind, we considered several aspects for the creation of gamified activities (Manrique, 2013; Adams & Dormans, 2012) that may motivate students to learn anytime and anywhere. In figure 4, we outline our framework for gamified activities based on all information retrieved from the analyses described above. This framework will be used to design and develop gamified activities to apply in class.

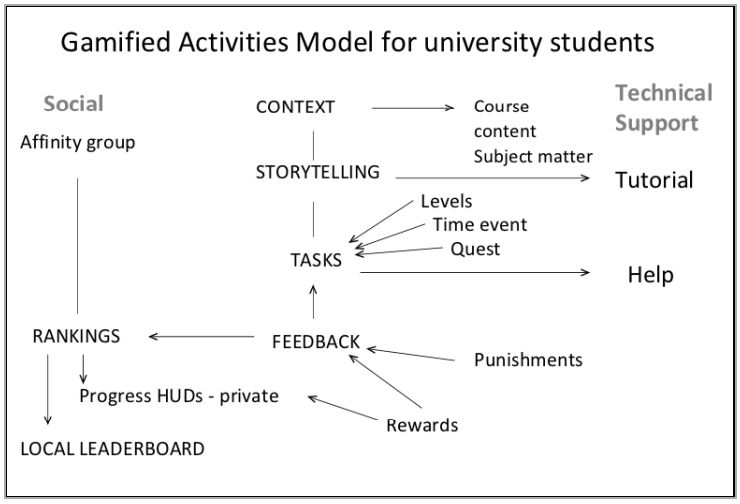

Figure 4. Framework for Gamified Activities

The gamified learning activities have to be related to the CONTEXT of the course content and particularly the subject matter to be learned, which will be the theme of the storytelling.

The students will have to solve several TASKS or missions. These tasks are related to LEVELS of difficulty or to different themes of the subject matter. Each task has a deadline for submission or accomplishment, some may have a time event to challenge students, and others may be a quest. The degree of difficulty should be moderate but challenging enough to get students engaged, keeping their interest and involvement (Csikszentmihalyi, 1992). There may be help mechanisms to support the student in difficulty, even help from the affinity group.

The tasks or missions will be devised to respect the following learning principles proposed by Gee (2003): Psychosocial Moratorium Principle, Amplification of Input Principle, Regime of Competence Principle, Intuitive Knowledge Principle Concentrated Sample Principle, and Achievement Principle.

FEEDBACK is very important in learning, particularly immediate feedback. Positive feedback has to be fun and it will make the student feel good. The graphic effects have to empower the achievements of the student. If the tasks or missions are not successfully completed, the student will receive punishments.

As soon as the student is solving the tasks his/her achievements will be seen in the progress HUDs (Heads-Up Displays). To complete this idea and maintain students' interest in their ranking in the team there will be a LEADERBOARD naming the five top students. For each task there is a leaderboard, allowing different students to be distinguished with the best results. Rewards and punishments are available through feedback, points and the leaderboard.

Another aspect that we consider important is the AFFINITY group principle (Gee, 2003) which is related with the social aspects of the group. It is important to maintain students' interest in their social group and to generate cooperation among students, as Whitton (2010) suggested.

Sounds and music are not very relevant to undergraduate and graduate students. The scenarios may be very simple but related with the subject matter.

When starting a gamified activity a Tutorial has to be available as well as a Help function.

The aim of our project is to create gamified interactive activities based on students' game preferences. The framework presented is based on the game analyses. The next step is to build a gamified interactive activity for university students based on these findings and then test it.

5. CONCLUSION

"In the last few years, games have converged with natural user interfaces to create an experience for players that more closely mimics real life. (…) For higher education, these game-like environments transform assignments into exciting challenges, reward students for dedication and efficiency, and offer a space for leaders to naturally emerge" (Johnson et al., 2014, p.42).

Knowing what our students are playing in their leisure time gives us information about what they like and it will allow us to propose more exciting, challenging and rewarding activities in class for students. As Burke (2014) states, "gamified solutions must put players' motivations and goals first and make them the primary design objective" (p.21).

Our results show that female students prefer to play casual and puzzle games mostly alone.. Male students also like casual and puzzle games, but they also play strategy and simulation games with others to compete. Students are receptive to using games to learn the content of their courses.

Gamified activities are something that teachers should have in mind to motivate and engage students in learning. In this paper we propose a framework for creating gamified activities. It takes into consideration the context of the course to support interactive activity (storytelling, tasks and feedback), the social aspect (student support and leaderboards) and technical support (tutorial and help functions).

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REFERENCES

Adams, E. & Dormans, J., 2012. *Game Mechanics - Advanced Game Design*, Berkeley, CA: New Riders.

App Annie, 2014. *App Annie Index: 2013 Retrospective – The top trends of 2013*, Available at: http://blog.appannie.com/app-annie-index-retrospective-2013/.

Babbie, E., 1997. *Survey Research Methods*, Belmont, California: Wadsworth.

Burke, B., 2014. *GAMIFY: How Gamification Motivates People to do Extraordinary Things*, EUA: Gartner, Inc.

Connolly, T.M. et al., 2012. A systematic literature review of empirical evidence on computer games and serious games. *Computers & Education*, 59(2), pp.661–686. Available at: http://dx.doi.org/10.1016/j.compedu.2012.03.004 [Accessed February 28, 2013].

Csikszentmihalyi, M., 1992. *Flow: The Classic work on how to achieve happiness*, New York: Harper Perennial.

Gee, J.P., 2007. *Good Video Games + Good Learning: Collected Essays on Video Games, Learning and Literacy*, New York: Peter Lang.

Gee, J.P., 2003. *What Video Games have to teach us about learning and literacy*, EUA: Palgrave Macmillan.

Johnson, L. et al., 2014. *NMC Horizon Report: 2014 Higher Education Edition*, Austin, Texas. Available at: http://www.nmc.org/pdf/2014-nmc-horizon-report-he-EN.pdf [Accessed February 3, 2014].

Kapp, K.M., 2012. *The Gamification of Learning and Instruction: Game-based methods and strategies for training and education*, San Francisco: Pfeiffer.

Klopfer, E., 2008. *Augmented Learning: Research and design of mobile educational games*, Cambridge, Massachusetts: MIT Press.

Manrique, V., 2013. 35 Inspiring Game Examples for Gamification Mechanics. *Epic Win Blog*. Available at: http://www.epicwinblog.net/2013/06/35-inspiring-game-mechanics-examples.html [Accessed December 30, 2013].

Newzoo, 2014. *Newzoo infographics on West-European markets – part II: Germany, France and Spain*, Available at: http://www.newzoo.com/insights/newzoo-infographics-west-european-markets-part-ii-germany-france-spain-2/.

Sherry, J.L. et al., 2006. Video game uses and gratifications as predictors of use and game preference. In P. Vorderer & J. Brryant, eds. *Playing Computer games: Motivations, responses, and consequences*. Mahwah: Erlbaum, pp. 248–262. Available at: http://icagames.comm.msu.edu/vgu&g.pdf.

Squire, K.D., 2011. *Video Games and Learning - Teaching and Participatory Culture in the digital age*, New York: Teachers College, Columbia University.

Whitton, N., 2010. *Learning with Digital Games: A Practical Guide to Engaging Students in Higher Education*, New York: Routledge.

Zimmerman, E., 2008. Gaming literacy: Game Design as a Model for Literacy in the Twenty-First Century. In *The Video Game Theory Reader 2*. New York: Routledge.