

From Games Played by Secondary Students to a Gamification Framework

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Abstract: Playing video games is attractive for most students. Most of them have mobile devices and play mobile games anywhere and anytime. In this paper we report the most played digital games by Portuguese students from grades 10 to 12. A survey was conducted in Portugal (n=697) in 2013. The diversity of games played is huge, and there are differences in gender preferences and game habits. We analyzed the students' preferred games according to Gee's (2003) learning principles and to game elements. Based on this data we propose a gamification framework to create gamified activities for Secondary School students.

Introduction

“For today’s students to succeed in a world of tomorrow that hasn’t yet been created, we need more than luck; we need mechanisms for students to identify their skills and passions, refine them, and channel them into productive future selves” (Squire, 2011, p. 62). Nowadays, the industry of video games is more profitable than films, this is a business where billions of dollars are involved. Many people from all around the world play for many hours per week in those virtual worlds.

“The truth is this: in today’s society, computer and video games are fulfilling genuine human needs that the real world is currently unable to satisfy. Games are providing rewards that reality is not. They are teaching and inspiring and engaging us in ways that reality is not. They are bringing us together in ways that reality is not.” (McGonigal, 2011, p. 4)

Students enjoy interacting in social networks, interactive activities, playing games, sending SMS or MMS to their friends and receiving immediate feedback (Yong & Gates, 2014). For these reasons they have been known as the net generation (Tapscott, 2009), digital natives (Prensky, 2001, 2009), thumb generation (Rheingold, 2002), homo zappiens (Veen & Vrakking, 2006), among other names. However, there is a contrast between games and most school activities, which are less challenging than games or less interactive than their social network. In a project proposed in 2011 - "From Games to Mobile-Learning Interactive Activities"-, we stressed that, although most Portuguese students have a laptop, bought through special price conditions from 2007 to 2012, they consider it too heavy to bring to the classroom (Moura & Carvalho, 2008). They prefer to use mobile devices such as mobile phones, MP3/MP4 players, PSP, or Nintendo DS (Cortal & Carvalho, 2011; Moura & Carvalho, 2008; Trotter, 2009). They need challenging computer interactive activities to learn using their mobile devices, in the same way as they play games (Douch, Attewell, & Dawson, 2010; Gee, 2007; Prensky, 2006; Sin, Talib, Norishah, Ishak, & Baki, 2014; Squire, 2008; Williamson, 2009; Yong & Gates, 2014).

A game establishes routines, rules and actions that the player needs to learn in order to succeed (Gee, 2007). Game activities are characterized by spaces to be explored, learning from both success and failure, feedback that players can use to adjust their own understanding, and multiple possible outcomes (Klopfer, 2008). Games enable players to practice problem-solving and decision-making skills, to multi-task by dealing with many different “inputs” and “outputs” all at once, to collaborate by teaming up with other players, to take risks and experience failure in a safe environment, and overall, to develop the skills suited to 21st century life and work (Douch et al., 2010; Trespalacios, Chamberlin, & Gallagher, 2011; Williamson, 2009). Players learn to manipulate and control highly complex environments and systems (Prensky, 2006). Moreover, Gee (2003) recognizes that “good video games incorporate good learning principles” (p.114) and this idea was one of the focus of our project.

For Jane McGonigal (2011) games can be used to change society. She was one of the first game designers to develop games with the purpose of changing habits and not only for entertainment. The concept of gamification implies the use of game characteristics to non-game contexts. According to Karl Kapp (2012) “gamification is using game-based mechanics, aesthetics and game thinking to engage people, motivate action, promote learning and solve problems” (p.10). Gamification Mechanics (Manrique, 2013) will help us to understand what exists in the most played games that we can use to develop gamified activities. In this paper, we propose a framework for gamified learning activities for mobile devices based on students’ mobile game preferences.

Research

The project under development has several research questions. The first one is the following: Which mobile games do our students prefer to play? The first aim of our project was to identify the most played mobile games by students and what they like in those games. The objective for the first step was to characterize students’ digital game preferences in mobile devices. These games were classified under Gee’s (2003) 36 learning principles and under gamification mechanics (Manrique, 2013).

A survey (Babbie, 1997) was carried out. A questionnaire was developed with four dimensions: 1) Student characterization, 2) Mobile game habits (games played in each mobile device and time spent in gaming), 3) Game preferences (the most played game, reasons to play that game, the impact of certain 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 game what kind of characteristics it would have. The questionnaire was reviewed by experts. The language used in the questionnaire was adapted for each learning cycle of the intended audience, from K12 and university students.

After receiving permission from the Ministry of Education, we sent an email to schools and teachers to allow students to reply to the questionnaire. The data collection instrument was available online, in Google Drive forms. Four versions were available: 2nd cycle (K5-K6), 3rd cycle (K7-K9), Secondary Education (K10-K12) and University Students. In this paper our focus will be on the Secondary Education students, from grade 10 to 12 (15 to 18 years old).

From 14th May to 30th October 2013 we received 697 responses from secondary students, of whom 614 are players (Table 1).

Subjects	Respondents (f)			Players (f)			
	Gender	M	F	Total	M	F	Total
Grades							
10		228	131	359	216	98	314
11		100	67	167	95	56	151
12		104	67	171	98	51	149
Total		432	265	697	409	205	614

Table 1: Respondents and gamers

Results

Mobile devices used to play games

The students were asked to indicate the game they played most often in mobile devices. In average the Portuguese students use three devices to play. The most used device is the laptop computer (79,2%), followed by the

cellphone (49,0%) and in third place the smartphone (38,9%). As regards gender differences, female students use the tablet as the third device (39,5%). The Nintendo 3DS is the device least used by students.

Figure 1: Mobile devices used to play by gender.

Tablets, smartphones and cellphones are used to play casual games. Casual games are simple and quick to play and specialize in providing high rewards for a short investment of time. In the case of PSP and laptop we are mostly talking about hard core games, games that require a lot of investment to attain the promised rewards. The time variable is crucial here in comprehending the gender differences.

Time spent in playing games per week

Playing games is in fact a “boy domain” (Lucas & Sherry, 2004), boys play much longer than girls, and the average time played per males is 8.9 hours and females play an average of 3 hours per week (see Carvalho & Araújo, 2014). This result is similar to other findings like those of Wang (2011) with Norwegian teenagers, where the average time for girls is up to one hour and for boys is between 5 and 10 hours per week. In Simons, Bernaards, & Slinger's (2012) report about “the Netherlands, 95% of adolescent boys and 81% of adolescent girls play video games; boys an average of 9.8 hours a week and girls 3.9 hours a week” (p.2).

The games they play most often

The five most played games by secondary students are presented in Table 2.

Ranking	Female	Male
1 st	<i>Pou</i> (Zakeh)	League of legends (LoL; Riot Games)
2 nd	<i>Subway Surfers</i> (Kiloo Games & Sybo Games)	Pro Evolution Soccer (PES; Konami)
3 rd	Candy Crush (King.com)	<i>Counter Strike</i> (CS; Valve Software)
4 th	<i>The Sims</i> (Electronic Arts)	Football Manager (FM; SEGA)
5 th	<i>Grand Theft Auto</i> (Rockstar Games)	<i>Grand Theft Auto</i> (Rockstar Games) <i>FIFA</i> (EA Sports)

Table 2: Top five of the most played games by gender.

Looking to Table 2 it is possible to identify that males play games about sport, fighting and war. These preferences have also been identified in the research conducted by Terlecki et al. (2010). Girls play mainly casual games; these do not take long to play, and are only played in short sessions.

As regards gender preferences there are some big differences. Male gamers prefer violent games not even recommended for their age group (GTA and CS), sport games, particularly soccer games (PES, FIFA and FM) and battle arena (LoL). The games preferred by male gamers are all hard core games, requiring a lot of effort, occupying plenty of hours in their lives and highly competitive.

Female gamers prefer simulation games that manage people or animal life (The Sims or Pou), and racing games (Subway Surfers). They like to win coins to buy things for their character (Subway Surfers and Pou). Candy Crush, a match-three puzzle game, was the one with most downloads worldwide in 2013 (App Annie, 2014). These games allow social interaction: it is possible to share special items and connect people on Facebook or by SMS/email (Android and iOS) or ask for help. This interest in being connected with others is particularly relevant to females, as reported by Terlecki et al. (2010). Females consider playing as a way of interaction with others. These games are single player.

Girls at Secondary School play Grand Theft Auto, a violent game that is unusual for girls. The reasons mentioned are the actions they live through during the game: killings, evading police, stealing and driving cars.

They consider the story fun and the game is entertaining. But this game is played because it was fashionable at the time of the data collection, so we may consider it to be a temporary preference, also for males.

The games Pro Evolution Soccer, FIFA and Football Manager are sport type of games about football that is a typical boy's activity (Blakemore, Berenbaum, & Liben, 2008; Cherney & London, 2006; Sin et al., 2014; Terlecki et al., 2010; Williams, Consalvo, Caplan, & Yee, 2009). Most of the other games are about war and fighting like Counter Strike (CS) and League of Legends (LoL). These games are played in multiplayer mode; they are violent games (LoL) and extremely violent in real environments [CS], with long and intense playing sessions. The competition is very intense.

Males focus on the thematic of the game and on its competitiveness. In the male world's fantasy they are invincible. More important for females are the actions performed and the opportunity to test ideas and attitudes they cannot perform in real life. Fun is also an attraction.

There are also big similarities between the games played by girls and boys. All games, except GTA, have the following gameplay characteristics. The most played games are short and quick to play. Players have to resolve situations or tasks in a short time. There are also battles in LoL that need more time, but the majority are short-time tasks.

They are highly repetitive, like a drill to master. The tasks that the player needs to accomplish are similar as the game develops, so they are repetitive but of increasing difficulty. The player has to do the tasks to become a master, as represented by XP points. As games are quick and repetitive, rewards are massive, keeping pleasure high. Every action achieved gives points to the player; for example, the character in Subway Surfers collects coins along the run and points with the distance covered. Achieving points and badges are an important characteristic in these games, and they engage and are pleasant to the player. For instance in CS every killing of the enemy gives points to the player that he can use to buy some equipment. These pieces of equipment are like badges, because boys are thrilled by guns with better functions.

In those games search for social acceptance through Leaderboards is very important among friends. To be among the higher places in the game is similar to being a popular person.

Except for GTA, there is no storyline in these games. When available the story is secondary, mostly irrelevant to the meaning of play. For instance Candy Crush Saga has levels organized by episodes, where the player is shown some event that the character has experienced and he needs to acquire a type of candy. At the end of the episode after a number of levels achieved, a candy is given to solve the situation shown in the beginning. But while the levels are being accomplished nothing is mentioned about the story. In the sport games there is no story at all. In LoL the story is the introduction to the game and contextualizes the player in the goals he has to accomplish.

GTA is the game that has big differences compared with the other games. In GTA the player by his actions will know the evolution of the story. The story is essential to the game. The player has to accomplish missions to go further in the levels of the story. He has to have control of all the crime in the city, being the boss of the criminal world. The player will succeed by going up in the hierarchy of criminal world. The rewards are based on payments made after successful missions, and with these payments equipment, like a car or weapons, can be bought for other missions. For all these reasons, this game is different from all others.

Playing games to learn in school

Students were asked about their interest in learning school subjects with games. Most of them were receptive to this idea (Table 3).

Game types	Male	Female
Action	72.1%	53.1%
Adventure	50.6%	70.1%
Sport	57.1%	27.7%
Strategy	53.4%	72.3%

Table 3: Type of games they would like to play for learning school subjects.

Asked about the type of game they would like to play for learning school subjects, male students suggest action, sport and strategy games (as they are used to playing) and females prefer strategy, adventure and action games. A strategy game is a type of game that does not belong to their list of most played games, but they recognized its importance for learning. Awareness is also gained of what the act of leisure, and the act of learning, are about. They recognized that strategic approaches will facilitate learning more. Sport games are relevant for male students but not so popular with female students.

There is also a difference in gender preferences related to playing games alone or with others online. Girls prefer to play alone and boys prefer to play with others online.

Identification of learning principles and game mechanics in students' preferred games

After analyzing the games we identify several learning principles (Gee, 2003), grouped according to some gamification mechanics (Manrique, 2013) more frequently found in this study. Table 4 resumes our findings.

<i>Gamification mechanics</i>	<i>Learning principles</i>
Avatar	7. Committed Learning Principle 8. Identity Principle 9. Self-Knowledge Principle
World	6. Psychosocial Moratorium Principle 10. Amplification of Input Principle 17. Situated Meaning Principle
Quest	12. Practice Principle 13. Ongoing Learning Principle 14. Regime of Competence Principle 24. Incremental Principle 29. Transfer Principle
Feedback (rewards/punishment)	11. Achievement Principle 22. Intuitive Knowledge Principle
Social	35. Affinity Group Principle 36. Insider Principle

Table 4: Gamification mechanics and learning principles identified in the games played by Portuguese secondary students.

In the center of all games there is an Avatar (character) that is either controlled by the player or else needs something from the player. In this relationship between avatar and player we can find learning principles 7., 8. and 9. The player has to feel a commitment to the avatar (7.), he has to accomplish something and the avatar depends on him. The player customizes this avatar and makes choices in the game built on the identity he has designed in his mind (8.). The player also understands his capabilities and limitations in helping the avatar to accomplish the quests and chooses the equipment the player can make best use of (9.).

Also in the center is the World (context/thematic of the game). As we said before males like football and war/violent games and females like to take care of persons or animals. Despite their differences in the thematic they have something in common: the need to do something they cannot do in real life (Pou and Sims: to take care, GTA; to drive, kill, be a criminal, LoL and CS: to fight for a cause and be fearless, PES, FM and FIFA: to play in or manage a famous football team). For these reasons, it is important to build a world with realistic features. There are some learning principles that we can relate to the World, such as 6., 10., and 17. In this World the player takes risks and there are no real consequences (6.). Also it is possible to do things in an easier way (10.), like playing a football match in 12 minutes instead of the 90 minutes of real life. These are characteristics of game design that make the interaction between player, avatar and world more engaging. In these Worlds we can find signs (words, action, objects, symbols) that have a contextualized meaning for the player (17.), as with the word “sims” that has meaning only to Sims players and not to other people.

Another important component of these games is the Quest, tasks or mission that the player must help the avatar to accomplish – with this we can associate learning principles 12., 13., 14., 24. and 29. As we said before, the tasks are highly repetitive (12.), have a drill to master (13) and the player feels in each level that he/she can make it

by trying and practising (14.), that losing has no negative effect, and that all he needs is to try again and not make the same mistakes. The game develops in a progressive way where previous findings have to adapt to a new complexity (24.), like the different maps or partners in CS or the different boards on Candy Crush. Every time a new situation is presented in the game the player is able to practice and adapt what is known to the new findings (29.).

From the quest the player receives a Feedback, can be positive (a reward) or negative (punishment); this is related to learning principles 11. and 22. With this feedback (positive or negative) the player feels an intrinsic reward (11.). If he completes the task and earns points or coins he will feel like a winner but if he loses, the player has to strive harder because he knows that he can do it (see 14.). These points or coins received by practice will put the player on a leaderboard or allow him to buy equipment in the game that can give him prestige within his affinity group (22.).

Finally to social interaction, where learning principles 35. and 36. play a role. All the games allow sharing points, rewards, helping other players, etc. These features are a way of building new relationships with others (35.). An experienced player can help new players in the chat, becoming a "master" to the novice players (36.)

Gamification framework for secondary students

We conceive a conceptual framework for gamification of secondary students activities (Figure 2) based on Gee's (2003) learning principles, Manrique's (2013) gamification mechanics and Schell's (2008) game design theory, together with data collected by us.

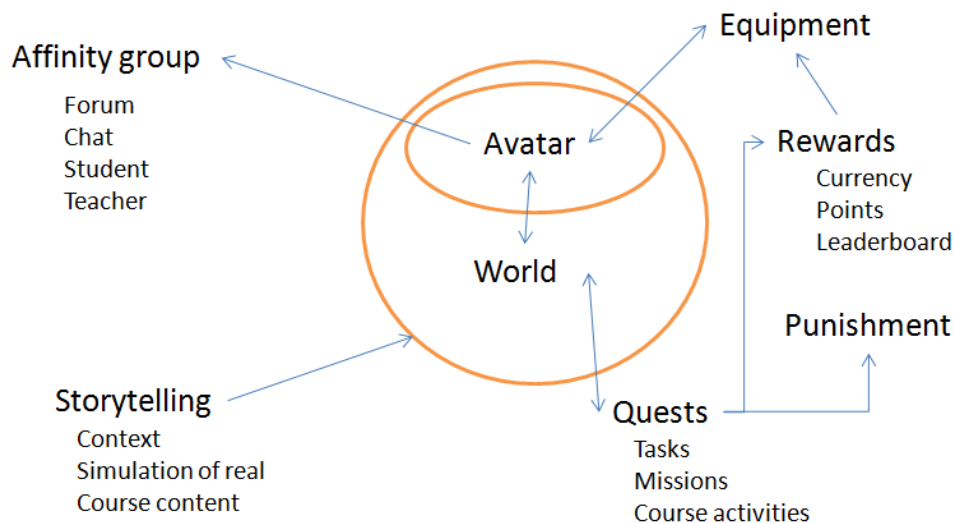


Figure 2 - Gamification framework for secondary students activities.

In the center of our conceptual framework we place the magic circle, the World where players are to be transported (e.g. football field, arenas, train tracks, etc.), in which they assume an Avatar identity (e.g. football players, warriors, runners, etc.). This serves as the introduction to the game, where all activities must occur, but should not interfere with playing activities, serving only as backdrop. The Context introduces the player to the aim of the gamified activity. It is important to create a Context where the player can do things or be someone.

This World is directed by the Game Mechanics, which are made up of 3 components: objects (like balls, guns, candies, skates, football players, etc.), connected with the story but dependent only on the game actions and rules; actions, which correspond to what players can do in the game (the verbs of action: fighting, running, connecting); and rules, defining limits and obstacles to play (tasks, missions or quests). The Quests guide the player to the actions in the game to complete tasks or missions to help the avatar to accomplish something he needs. The Feedback is made in the form of Rewards and Punishments (constituted by such attributes as points, coins, leaderboards and achievements). Rewards in the form of points or coins can be used in exchange for new Equipment. This can turn into an intrinsic motivation to play, because there are some objects to which the player's Affinity Group gives particular importance, and the equipment can help the player to progress in the game.

Finally, it is important to build an Affinity Group where accomplishments may be shared and help offered between players. This Affinity Group can be used like a tool, where a teacher can present challenges that guide students to specific learning goals or set work to be done as a team in a cooperative way.

To gamify an activity it is necessary to create a physical or digital (World) space, where the student (Avatar) can interact with. It is important to give meaning to what the student has to do in, so the context have to be related to Course content (Storytelling). The tasks given to the students can be similar to course activities (Quests). The feedback can be given by teacher but also by colleagues (Affinity Group), it can be a comment, a badge or even a grade (Rewards) or something to help to improve or retry the task (Punishment). Related to the Course content can be developed a list of objects (Equipment) that have the power to help the students to improve their skills or it can work like collecting items that have meaning to the group (Affinity Group). Also it is important to create a way of improve interactions between all students and teachers of the class, where it is possible to ask for help or share some findings or achievements (Affinity Group).

Conclusion

Based on the games most played by secondary students we identify some gamification mechanics (Manrique, 2013) and learning principles (Gee, 2003) to conceive a framework to develop gamified activities.

It is important to create a world where an avatar can interact. The context based in Course content establishes the background for engaging the player and the learning goal. Themes that correspond to gender stereotyped preferences should be avoided, as reported by authors like Cherney & London (2006), Sin et al. (2014), Terlecki et al. (2010). Themes have to be related to the course content. In this world the player has to accomplish goals or to complete quests (Course activities). They have to solve several tasks. The feedback guides the player and he/she receives rewards or punishments. Rewards allow the player to acquire new equipment (content related) which can confer prestige in the Affinity Group or help the avatar to achieve better results. The management of an Affinity Group can be a tool for teachers to achieve some learning goals, by orienting the group's aims or by challenging them to achieve certain results.

This framework is important for our future work, to develop gamified activities for secondary students using their mobile devices.

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