Towards the Gamification of Learning: Investigating Student Perceptions of Game Elements

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ABSTRACT

Games offer people engaging and motivating experiences. The process of recreating this type of experience in systems that are not typically considered games is called "gamification." Improving engagement and motivation in a learning environment is desired by many educators as traditional approaches do not seem to be as engaging as they once were with students. Hence, gamification may be a useful tool to improve the learning environment. As a precursor to the development of a game-like learning system, we survey 51 undergraduate IT students to obtain their perceptions on game elements, which are the building blocks of what makes a game identifiable as such. All game elements that were presented to the respondents were highly rated. It was found that undergraduate students have a positive perception of systems that use game elements and are interested in its use for learning. Overall, students favored social interaction, engagement, feedback, and increased learning, which suggests that gamification is particularly suited to learning approaches such as social constructivism. We suggest that future work should include the development of a prototype for a game-like educational system that helps to provide useful feedback for students about their learning progress.

Keywords: Student perceptions, Computer assisted education, Student expectations, Pedagogy

1. INTRODUCTION

Due to the ubiquity of games and the uptake in playing games, researchers have investigated the application of games to domains other than pure entertainment for quite some time. Gamification is a recent trend that involves the incorporation of game elements into non-game applications or domains. That is, the use of elements from games to "gamify" things such as systems or activities. This emerging concept has been applied in domains such as marketing for some time, and is being increasingly applied to learning (Landers and Callan, 2011; Lee and Hammer, 2011; Muntean, 2011).

One objective of gamifying learning is to stimulate the same motivation and engagement that gamers have towards games in learners toward education. By increasing learner motivation and engagement, it is envisaged that learning will improve. Gamification, however, is not a simple process and can be quite complicated to implement correctly. It is not simply a matter of adding common game elements, such as points, badges, and leader boards, to existing processes or systems. Such a surface approach of gamifying existing systems translates to superficial benefits, if any. This approach has vilified gamification and has led it to be derisively termed "pointsification" (the simple addition of points to processes or systems) (Robertson, 2010).

Three important aspects of proper implementation of gamification are: (1) to understand the target audience (i.e., the "players"), (2) determine what these players should do (e.g., the objective of the activity/system), and (3) use the appropriate game elements to motivate the players to act (Aparicio et al., 2012; Werbach and Hunter, 2012). In the case of learning, students are the "players" in the system and, thus, to be able to successfully gamify learning for improved motivation and engagement, it is necessary to understand students and their perspectives on this matter.

The work reported herein forms part of a larger study in which students' perspectives on game elements were obtained and analysed, and the results were used to design, develop, trial, and evaluate a gamified multiple choice quiz software tool, named Quick Quiz. However, in this paper, we focus our discussion on students' perspectives of game elements and gamification. Specifically, we investigate a group of undergraduate students studying business information technology to obtain details about their game experience, their expectations of gamification in education, and the gaming design elements they believe will make learning more enjoyable. We analyse their responses and

based on our findings we provide some recommendations for gamifying learning activities.

2. BACKGROUND

In this section, we provide background material necessary to appreciate the context of our work. Specifically, we discuss: (1) gamification, games and learning and (2) game elements. We also discuss other gamification-related work that has been carried out to contextualise our own work for the reader.

2.1 Gamification, Games, and Learning

Gamification is a practice that is currently receiving increasing interest (Deterding, Sicart, et al., 2011). The concept makes use of elements from games, which are well-known for motivating and engaging players for lengthy periods, and apply them to non-game contexts in order to re-create the same level of motivation and engagement for other purposes (Deterding, 2012). Gamification is particularly useful for encouraging desirable behaviours. Examples of gamification include applications such as: (1) *LinkedIn*, which uses progress bars to encourage users to complete their profiles, (2) *EpicWin*, in which users get points for completing items from their to-do lists, and (3) *Fitocracy*, in which users get points for exercising.

One potential use of gamification is its application to learning, particularly when there is a lack of motivation and engagement from students. The application of games to better motivate and engagement learners is not new as "serious games," games for serious purposes, have been used in domains such as: the military, business, and education (Deterding, Dixon, et al., 2011). However, the use of serious games in education is quite different to the use of gamification in education. Serious games refer to full-fledged games, such as complete virtual environments with avatars, as opposed to gamification, which refers to the use of game elements, such as progress bars, points, etc. to achieve a non-game outcome. On the other hand, the gamification of learning incorporates game elements into the learning process for increased motivation and engagement with the ultimate goal of improving learning outcomes.

The application of gamification in learning is becoming increasingly important as learners no longer seem to be as engaged with traditional teaching approaches as they once were. A number of studies have found game-based learning to be more interesting for learners (Kapp, 2012b). The gamification of learning has also been found to assist students to develop problem-solving and higher order thinking skills (Kapp, 2012b).

2.2 Game elements

"Game elements" can be defined as "elements that are characteristic to games" (Deterding, Dixon, et al., 2011). These game elements, however, can be complex as they are not just visual elements such as progress bars. Although a detailed investigation is outside the scope of our work, we discuss some existing literature on what game elements are and explain what we mean when we refer to game elements in this work.

Game elements can be classified on various levels of abstraction. Some examples of concrete elements are those that are typically seen in games, such as badges and leader boards, while more abstract examples are time constraints and styles of games. Table 1 shows a particular classification of game elements based on a review of the literature.

Level	Description	Example
Game interface design patterns	Common, successful interaction design components and design solutions for a known problem in a context, including prototypical implementations.	Badge, leader board, level
Game design patterns and mechanics	Commonly reoccurring parts of the design of a game that concern gameplay.	Time constraint, limited resources, turns
Game design principles and heuristics	Evaluative guidelines to approach a design problem or analyse a given design solution.	Enduring play, clear goals, variety of game styles
Game models	Conceptual models of the components of games or game experience.	Mechanics, Dynamics and Aesthetics; challenge, fantasy, curiosity; game design atoms; Core Elements of the Gameplay Experience
Game design methods	Game design-specific practices and processes.	Play testing, play centric design, value conscious game design

Table 1. Levels of game design elements (reproduced from Deterding et al., 2011)

An alternative perspective is the division of game elements into three categories: dynamics, mechanics, and components. Similarly to the previous classification, these categories are also divided based on levels of abstraction. Table 2 presents a description and examples of these categories. Each of the mechanics provides a way to implement one or more dynamics in a game and, similarly, components are tied to one or more of these higher-level elements.

Category	Description	Example
Dynamics	High-level aspects of game that have to be considered and managed, but not directly implemented into games.	Constraints, emotions, narrative, progression, relationships
Mechanics	Processes that engage players by moving actions forward.	Challenges, competition, cooperation, feedback, rewards
Components	Specific forms of mechanics or dynamics.	Achievements, avatars, badges, levels, points, teams

Table 2. Categories of game elements (based on Werbach and Hunter, 2012)

Given these two perspectives on game elements, the commonality is that they are classified or categorised based on levels of abstractions (Table 1 presents from concrete to abstract, while Table 2 presents from abstract to concrete).

Gamification is not simply about the use of game elements, it also contains aspects of game design, game techniques, and game thinking, which are all important. The player's experience is not solely affected by the game elements, but rather by the interaction of all of these aspects and how well they meld into the objectives of the gamified activity or system. This "melding" is achieved through the appropriate use of the aforementioned game design, game techniques, and game thinking. However, as our work is a preliminary attempt to understand learners' perspectives on this matter, we limit the boundary of our research to the most concrete of game elements, that is, those categorised as "game interface design patterns" in Table 1 or "components" in Table 2.

2.3 Related work

Despite the proliferation of research undertaken in the area of gamification of learning, little guidance is available for implementing gamified learning activities. Little information is available on the relative importance of the various game elements from students' perspectives especially for selecting the most appropriate ones in various educational contexts. What is frequently reported in the literature is that the most popular low-level game elements implemented in gamified systems are: points, badges and leader boards (PBL) (Huotari and Hamari, 2012) as these elements represent both the reward and competitive aspects of the system. As far as we know, no attempt has been made to investigate students' preferences of these game elements in the context of gamification of learning.

Concrete or physical game elements are considered as surface characteristics and limiting the design of gamification systems to these elements may not only fail to engage students but might even damage existing engagement (Deterding, 2012). According to Kapp (2012a), four effective game elements are: (1) freedom to fail (encouraging students to take experiment and take risks in order to learn), (2) interest curve (flow and sequence of events over time to maintain engagement), (3) storytelling (students learn better when the facts are embedded in a story) and (4) feedback (frequent and targeted feedback). Other high-level elements include: progression (scaffolded instruction), collaboration and competition (Stott and Neustaedter, 2013).

Although these high-level elements are no doubt important to the success of a gamified learning activity, the concrete game elements are also required as the high-level elements depend on the lower-level elements. That is, the high-level elements (which are important but more abstract) are realised through the implementation of the lower-level elements (which are more concrete) with which users interact. Thus, before embarking on the design of a gamified learning activity, it is useful to know how students perceive the low-level elements and their preferences for these elements. The high-level elements are more suited for integration in the pedagogy rather than the physical implementation of the activity.

3. METHOD

The main aim of the study is to understand undergraduate students' perception of game elements in order to inform the development of gamified learning systems or activities. Undergraduate students were targeted as they are the largest game-playing demography in tertiary education (Brand et al., 2009). Our research was undertaken as a precursor to the development of a gamified system for learning. As students are important stakeholders in this system, it is important to obtain their perception on the matter.

In the following sub-sections, we describe the paper-based survey questionnaire we employed, the participants, and our data collection process. The data collected was analysed both qualitatively and quantitatively.

3.1 Questionnaire Survey

The survey instrument contained two sections. In the first section, participants were required to answer questions about their demographic details and game playing experience. The majority of questions in this section were multiple choice questions and participants were to simply select the best answer (with a number of questions allowing for multiple options to be selected). Where appropriate, participants were able to select an "other" option in which they could elaborate upon unlisted options. Participants were also given the opportunity to select "none" as an option for questions.

The questions in the second section of the questionnaire were about participants' attitudes towards gamification and their opinion on how useful particular game elements (such as points, leader boards, progress bars, etc.) could be in making non-game systems enjoyable in the context of learning environments. The questions related to attitude towards gamification were multiple choice questions with an "other" option to add unlisted options. Participants were required to answer questions about the game elements by selecting their usefulness on an 11-point Likert scale (1 – 10, and "N/A") and were also able to provide justification for each of their selection.

At the end of the questionnaire, participants were given the opportunity of elaborating or clarifying any of their answers and to provide any additional comments.

3.2 Participants

Undergraduate IT students were targeted as the research team believed that undergraduate IT students are more likely to play games than postgraduate students. They are also most likely to have a better understanding of games, their various concepts and elements. Participants were sought from four undergraduate IT courses from the same program. The courses from which participants were recruited included: two first year courses, an introductory database course and a programming course, and two second year courses, a business/web development course and a programming course.

3.3 Data Collection

From the four IT candidate courses, students were informed of the research project and participated on a voluntary basis. Of the 179 students, 55 survey questionnaire responses were obtained (30.72% response rate). Of those, only 51 were usable as 4 were incomplete.

The demographic details of the participants are presented in Table 3. Although the sample is small, it captures the demography that we are interested in: undergraduate IT students aged between 18 – 21 years old and studying full-time.

Characteristics	Sample	
	Count	%
Gender		
Male	40	78.43
Female	11	21.57
Age Group		
18 – 21	41	80.39
22 – 28	7	13.73
29 – 48	3	5.88
49 – 65	0	0.00
> 65	0	0.00
Mode of Study		
Full-time	49	96.08
Part-time	2	3.92
Student Type		
Domestic	42	82.35
International	9	17.65

Table 3. Demographics of surveyed students

3.4 Findings

The questionnaire responses were analysed along the dimensions of gaming experience, expectations of gamification in learning, and usefulness of game elements. The analysis considered participants' multiple choice answer selections, Likert scale selections, and any justifications or comments participants may have provided.

3.4.1 Gaming experience: The gaming experience of students was investigated to ensure that they were well acquainted with games and their elements. The analysis of this dimension confirms typical beliefs about undergraduate (IT) students being avid gamers.

From the analysis of the responses, it was found that 100% of participants have played computer games previously. Of the students surveyed, 74.50% played computer games at least once per week with 35.29% playing every day (refer to Figure 1). The most common types of games played are: multi-player (17.71%), shooter (16.57%), adventure (14.28%), and strategy (12.57%) games (refer to Figure 2). Students' most common reasons for playing computer games included: playing with others (29.90%), to relieve boredom (29.90%), and as a source of mental challenge (20.62%) (refer to Figure 3).

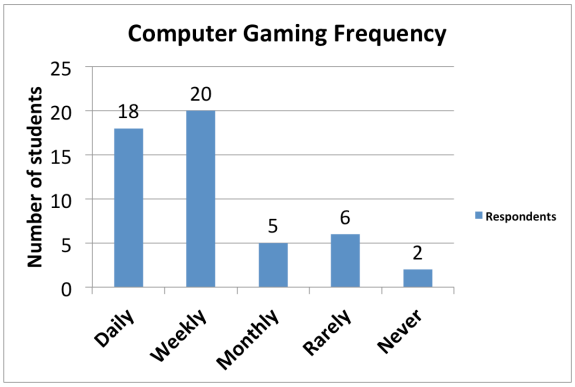

Figure 1. Computer gaming frequency

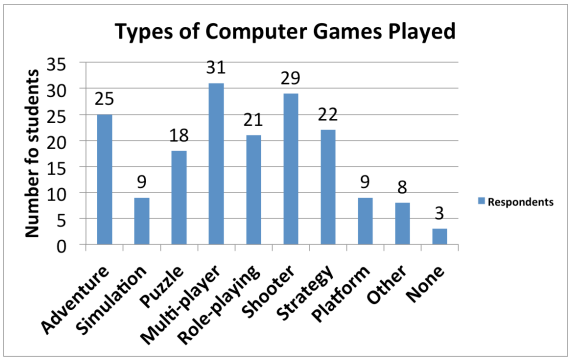

Figure 2. Types of computer games played

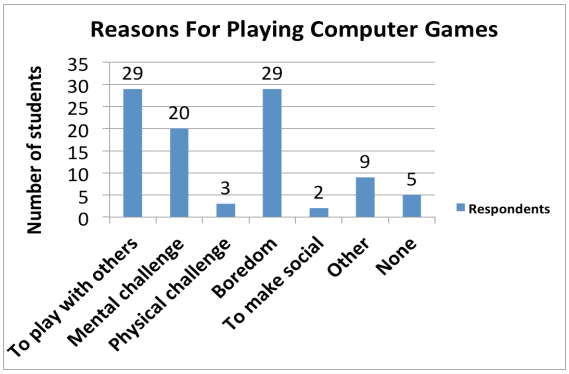

Figure 3. Reasons for playing computer games

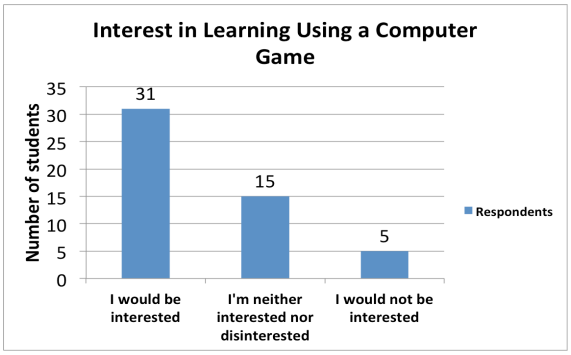

Figure 4. Interest in learning using a computer game

Nearly half the students surveyed (49.00%) have played some sort of educational game. Analysis of respondents' comments showed that the majority of educational games they have played were related to learning mathematics and typing. A significant amount of students were in favour of using a computer game for learning (60.78%), while 29.41% were indifferent, and 9.80% were not interested (refer to Figure 4).

From these results, it is evident that undergraduate students are experienced with games, desire social interaction within games, and are open to the use of games in learning. The desire for social interaction with others through games is apparent as participants favour multi-player games (i.e., games that have a strong social element) and their strongest motivation for playing games is a combination of playing with others and boredom relief.

3.4.2 Expectations of gamification in learning: The majority of students (80.39%) have not heard of the term "gamification" previously. However, when asked about how they felt about gamification in education, after being given a minimalist explanation of the term ("the addition of game elements to systems or activities that do not normally have any game-like features"), 31.37% of respondents stated they found it to be an exciting idea, 21.57% stated they would be comfortable with it, and 5.88% would be anxious about it (refer to Figure 5). The remaining respondents selected the "none of the above" option, which is possibly due to a lack of familiarity with gamification and hence a reluctance to select any of those options.

Those who know of gamification have mainly read about it on the Internet (including gaming sites). One student heard of it at work, *"I work for a digital marketing company and learnt about it there as a marketing strategy,"* and two students encountered the term in their final years of secondary school, *"studied it in IT in Year 11"* and *"[know of if] through Year 12 media studies. I studied issues the media creates in society. Gamification was one issue."*

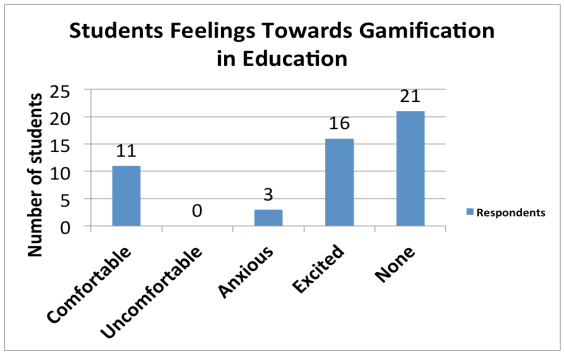

Figure 5. Student feelings towards gamification in education

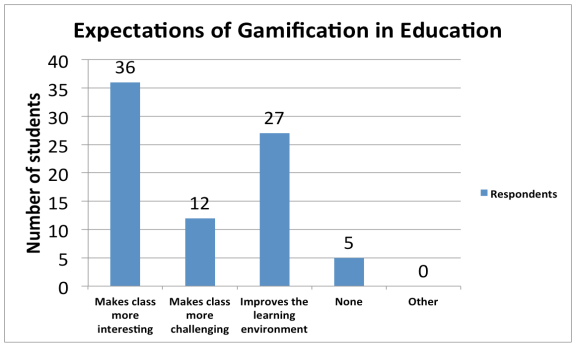

Figure 6. Expectations of gamification in education

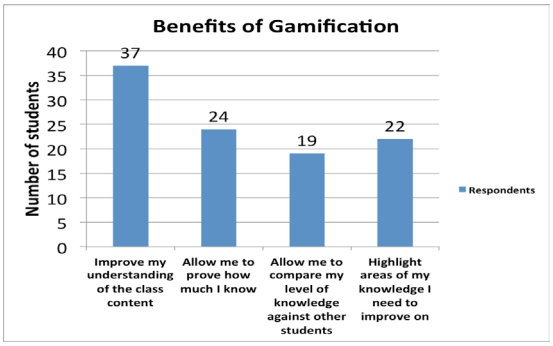

Figure 7. Benefits of gamification

The majority of students (93.75%) have positive expectations of gamification in education (refer to Figure 6). Many believe its use in education will make classes more interesting and improve the learning environment. One student stated that with gamification in education, *"people may actually show up to class,"* while another believed that gamification would increase participation in class, *"if there are other benefits [to attending class] then there are more incentives to participate."* The first comment is related to the disturbing trend of dropping student attendance in classes while the second is related to better motivating and engaging students not only to attend classes, but to also participate in class interactions.

Students felt positively about the use of gamification in education; 31.37% were excited about it. The most common expectation of gamification is that it will increase student interest in class (45.00%), followed by improvements to the

learning environment (33.75%). The most commonly anticipated benefits (Figure 7) were an improvement in their understanding of course content (36.27%) and determining their own knowledge (23.53%).

3.4.3 Usefulness of game elements – quantitative analysis: In the "game elements" section of the questionnaire, students were given 6 common game elements and were asked to rate the usefulness of each element (on an 11-point Likert scale; 1 – 10 and "N/A") based on the potential of the game element to make a gamified system more enjoyable. Students were also asked to provide justification for each of their ratings.

As we wanted to obtain students' general thoughts about these game elements, we did not present them in the context of a particular game. Instead, students were provided with short descriptions and answered the question without any pre-conceived notions. From the ratings, descriptive statistics about the game element ratings were calculated, and are presented in Table 4.

Game Elements	Min.	Mean	Median	Mode	Max.	Std. Dev.
Points	1	8.23	9	10	10	2.13
Leader boards	1	7.89	8	10	10	2.28
Profile	1	8.11	8	10	10	2.13
Teams	1	8.83	10	10	10	1.78
Progress Bars	5	8.63	9	10	10	1.37
Badges	1	7.91	8	10	10	2.04

Table 4. Descriptive statistics of game element usefulness

The overall result shows that the sample of students who were surveyed thought positively of the usefulness of all the game elements in making a system more enjoyable. In fact, given the mode of 10 for all of the game elements, the maximum of 10 for all the elements, and the high mean and median values, it seems that participants believe that all the game elements are useful.

There is quite a bit of variation in the ratings of the game elements. The elements with the least variability (in order of least to most) are: progress bars, teams, and achievement badges. Interestingly, progress bars received the highest minimum rating (5) compared to all other elements (they all received a minimum rating of 1). It would appear that progress bars would be one of, if not the most, useful game element to increase enjoyment in the use of a system as it has the highest minimum value, the second highest mean, the (equal) second highest median, the (equal) highest mode and the least variability in the set of responses.

After having analysed the data collected on game elements from a descriptive statistical point of view, we next describe the detailed quantitative analysis performed in order to establish the existence of any preferences for these game elements, and more particularly those analyses performed to determine statistically significant preferences. We further explored the data collected in order to gain deeper insights on what students perceive as useful game elements in the context of gamification of learning and hence determine their preferences for a gamified system. We determined student preferences based on the various groups that were identified in the data collected, namely: (1) considering all surveyed students as a single group, (2) segregating students into those who play games regularly and those who do not, (3) segregating students into groups according to the reasons they play games, and (4) segregating students into groups according to the type of games they play.

An initial exploration of the dataset grouping all students in a single group using confidence intervals of the means of the six game elements we are interested in (points, leader boards, profiles, teams, progress bars and badges) is shown in Figure 8. There seem to be varying degrees of preferences with teams, progress bars and points emerging at the top of the list.

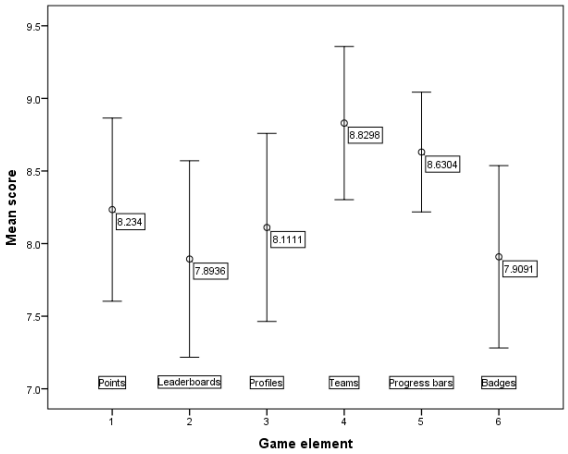

Figure 8. Confidence interval of the means of game elements for all students

Further exploration of the dataset showed that the scores attributed to the six game elements are not normally distributed as determined by the Shapiro-Wilks W test ($p<0.001$). The p-value of the "Based on Median" statistic of the Levene's test of homogeneity ($p=0.229$) is not significant and hence the variances of the scores of the six elements can be considered as similar. Given the non-normality and homogeneity of the dataset, non-parametric tests for comparing multiple groups are more appropriate to compare the mean scores of the game elements.

We used the Kruskal-Wallis test to determine the preferences of the game elements, the output of which is shown in Table 5. Although the output again confirms the preference of teams, progress bars and points, these rankings are actually not significant ($p=0.118$). This means that in the context of gamification, for the IT undergraduate students as a whole, it does not really matter which game elements are used to promote learning behaviours.

Game element	N Mean rank
Points	47 138.46
Leaderboards	47 126.10
Profiles	47 134.34
Teams	47 163.39
Progress bars	47 145.74
Badges	47 121.19
Chi-square	8.782
df	5
Asymp. Sig.	0.18

Table 5: Mean ranks of game elements for all students

In our next analysis, we investigated student preferences for two different groups of students, namely those who play games regularly and those who do not. The dataset was split into regular players and non-regular players based on the frequency students stated they played games. Students who played on a daily or weekly basis were considered as regular players and the rest as non-regular players. Confidence intervals for the mean scores for regular players are shown in Figure 9 while those for non-regular players can be seen in Figure 10.

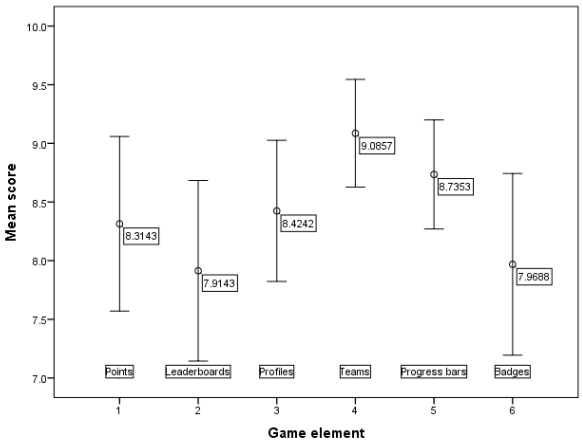

Figure 9. Confidence interval of the means of game elements for regular players

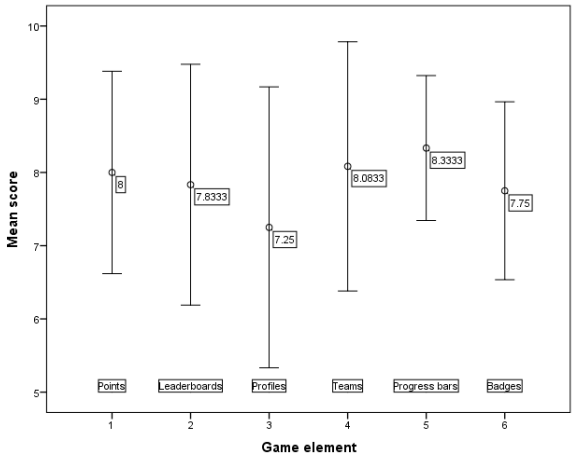

Figure 10. Confidence interval of the means of game elements for non-regular players

Regular players seem to favour teams, progress bars and profiles while non-regular players favour progress bars, team and points. Again, as the dataset exhibited non-normality (Shapiro-Wilks W test, $p<0.001$ for regular players and non-regular players) and homogeneity (Levene's test, $p=0.112$ for regular players and $p=0.559$ for non-regular players) we used the Kruskal-Wallis test to evaluate game element preferences.

The Kruskal-Wallis tests (shown in Table 6) were not significant for both the regular players ($p=0.144$) and the non-regular players ($p=0.945$), meaning that both groups have no statistically significant preferences for game elements when it comes to the gamification of learning. Again, this means that in the context of gamification, it does not really matter which game elements are used to promote learning behaviours since both regular and non-regular game players have no specific preferences.

Game element	Do not play regularly N Rank	Play regularly N Rank
Points	12 37.42	35 101.59
Leaderboards	12 36.46	35 90.29
Profiles	12 34.04	33 100.62
Teams	12 40.17	35 123.11
Progress bars	12 38.54	34 108.19
Badges	12 32.38	32 90.20
Chi-square	1.204	8.232
df	5	5
Asymp. Sig.	0.945	0.144

Table 6. Mean ranks of game elements for regular and non-regular players

We next investigated students' preferences according to the reasons they played games. We could speculate that those who play with others are interested in the social aspect of the system and would favour team work, while those who play for the mental challenge would like time constraints and challenging questions and those who play to relieve boredom would like to attend classes rather than staying at home and find learning interesting.

Using the previously described statistical techniques, we investigated the preferences of students who stated that they reasons they play games were: (1) to play with others, (2) for the mental challenge, (3) for the physical challenge, (4) to relieve boredom, and (5) for social reasons. The results of the Kruskal-Wallis tests are shown in Table 7. No statistically significant preferences were detected in these five categories of students/players.

Game element	Play with others	Mental challenge	Physical challenge	Boredom	Social reasons
	N Rank	N Rank	N Rank	N Rank	N Rank
Points	29 86.06	20 70.03	3 9.17	29 85.90	2 7.00
Leaderboards	29 75.34	20 51.58	3 9.17	29 73.98	2 4.00
Profiles	29 89.66	20 55.18	3 9.00	29 86.88	2 5.25
Teams	29 106.10	20 73.63	3 9.17	29 105.29	2 7.50
Progress bars	29 96.43	20 62.18	3 11.00	29 95.21	2 9.00
Badges	29 71.41	20 50.43	3 9.50	29 79.74	2 6.25
Chi-square	10.381	8.449	0.330	7.156	2.478
df	5	5	5	5	5
Asymp. Sig.	0.065	0.133	0.133	0.209	0.780

Table 7. Mean ranks of game elements according to reasons for playing

We finally investigated students' preferences according to the types of games played. Again, we could speculate that students who like to play adventure games have the tendency to explore all options of the game, students who like to play multiplayer games are interested in the social aspect, while students who like to play shooter games like high intensity games under time constraints and strategists are interested in determining how to beat the game. We investigated the preferences of students who played various types of games such as: (1) adventure, (2) simulation, (3) puzzle, (4) multiplayer, (5) role-playing, (6) shooter, (7) strategy, and (8) platform. Again, the results of the Kruskal-Wallis shown in Table 8 do not support any evidence of statistically significant preferences in these eight groups of students.

Thus, the statistical analyses performed in this study suggest that the undergraduate student cohort has no particular preferences for low-level game elements as far as implementing them in a gamified system. All the game elements surveyed are equally appealing to these students. However, whether a gamified system based on these elements would be successful or not is another matter as the success of such as system would not be solely dependent of these elements.

3.4.4 Usefulness of game elements – qualitative analysis: In the following sub-sections, we discuss the participants' justification and comments about each of the game elements.

Point system: The point system was described to students simply as the accumulation of points for things done in a game. Comments about the use of points in gamifying a system indicated that students most commonly thought of it as a competitive aspect, e.g., *"without score then no competition. It will be boring."* Others thought of it as a feedback mechanism about their performance, *"it is always good to see how well you do, and competition is also good," "keep track of performance," "keep track of progress."* One student also suggested that it could be used *"to determine your place on the social hierarchy."*

Some students associated the point system with the context of learning, *"Vital. It's the proof a student can show about their knowledge."* Conversely, another student did not believe that scoring many points meant that one learnt a lot, *"getting a high point may not necessary [sic] mean you may score well on the subject grade [sic]."*

Leader boards: The leader board was described as the ranking of players in the game. A leader board builds upon the point system, and, naturally, the students' comments reflected that. In regard to the leader board, participants commented on competition, e.g. *"compete [with] each other," "strive to be the best," "find your competitors," "see how good you are compared to others."*

One student pointed out, *"your [sic] not here to compete, your [sic] here to learn."* This is the same student who mentioned that scoring points is not necessarily indicative of learning. Other students felt that those who did not perform well may not enjoy such game elements, *"lower*

Game element	Adventure	Simulation	Puzzle	Multiplayer	Role playing	Shooter	Strategy	Platform
	N Rank	N Rank	N Rank	N Rank	N Rank	N Rank	N Rank	N Rank
Points	9 27.00	18 60.72	31 90.53	21 66.67	29 83.50	22 66.25	9 22.94	8 23.13
Leaderboards	9 24.44	18 47.42	31 80.37	21 49.10	29 76.48	22 63.02	9 22.06	8 21.19
Profiles	9 27.94	18 49.22	31 96.32	21 64.62	29 88.74	22 66.68	9 25.61	8 22.19
Teams	9 34.05	18 65.03	31 112.29	21 75.17	29 100.98	22 82.84	9 38.78	8 29.31
Progress bars	9 25.50	18 57.50	31 99.84	21 66.90	29 99.50	22 70.07	9 34.50	8 26.75
Badges	9 26.06	18 47.11	31 81.65	21 58.55	29 75.79	22 50.14	9 21.11	8 24.44
Chi-square	2.552	5.875	8.406	6.612	7.561	9.413	10.649	2.139
df	5	5	5	5	5	5	5	5
Asymp. Sig.	0.769	0.319	0.135	0.251	0.182	0.094	0.059	0.830

Table 8: Mean ranks of game elements according to types of games played

performing individuals wouldn't really like it," although, some believed that the leader board would better motivate those individuals, *"could be a double-edged sword but if you have scoring, you have a leader board. [It] creates competition and they [lower performing individuals] will do better."*

Player profile: The description of the player profile provided to students also included the tracking of playing statistics. More students stated they would find it useful as feedback for their own benefit: *"only for my own analysis," "interesting for each player to know their stats," "keep track of yourself,"* and *"helps give players feedback of their progress."* One student believed it could be used for social display and recognition, *"this is awesome, can show off your profile"* while two students related it back to learning, *"see where we are according to knowledge"* and *"important that each student has their profile to show others/teachers. Always good to look at total stats and look back for historical analysis."*

Teams: Teams were described as the ability to play the game together with others (including human and/or computer players). Comments for this game element re-asserted the fact that students are social beings. They did not like playing alone, *"sometime play by self [sic] is boring"* and *"obviously, playing alone is boring,"* were keen on team work, *"it's enjoyable playing in teams, preferably with human players," "team work is good, goes without saying"* and *"improves cooperation,"* and even related it to real life, *"team work, communication, collaboration are critical life skills."*

Progress bars: Progress bars were described as the use of graphics to indicate levels of completion. They relate to the extent of work completed (or to be completed) to accomplish a task. Students were in favour of it, *"graphics are far better than text. More interesting and player engaging"* and *"easier to see."* Some thought it may be both motivational and interesting, *"visual aids motivates [sic] the user and makes [sic] it more interesting,"* and others related it to goal achievement, *"closeness to goal"* and *"levelling up!"*

Achievement badges: Achievement badges were described as badges awarded as recognition for accomplishments in a game. Students generally thought badges would better motivate players: *"Great idea, makes you want to keep playing until all are achieved"* and *"adds another source of motivation."* One student admitted that although he/she was not particularly fond of it, it might be useful for motivating more advanced players, *"Probably personal taste, [I] don't love it particularly but it gives the advanced students things to work at."*

4. DISCUSSION AND RECOMMENDATIONS

The analysis of the findings is discussed and student perceptions about the various game elements are elaborated upon in this section. Furthermore, we provide some recommendations about how these game elements can be applied in gamified systems or activities for education.

4.1 Discussion

The responses to the game experience section of the survey showed that the sample of participants was appropriate as they all had computer game experience. The responses also confirmed the view that the majority of undergraduate IT male students play computer games regularly.

Although only 49.00% of participants have previously played educational games, 60.78% of participants would be interested in learning using a game (only 9.80% would be against it; refer to Figure 4). This is supported by a recent survey that found that 55% of people would be interested to work for an organisation that increased productivity through the use of games (Saatchi & Saatchi, 2011). In our results, the interest in gamification is higher and this may be because the sample was predominantly composed of a demography known to be keenly interested in games. The responses also revealed that participants were particularly in favour of social interactions in games as "multi-player" was the type of game most commonly played. Additionally, the primary reasons given for playing games is "to play with others" (29.90%) and boredom relief (29.90%). This further indicates students' preference for social interaction and also an interest in being better engaged.

The majority of participants are interested in learning using a computer game, however, in regard to gamification, few have heard of the term. Subsequent questions in that part of the questionnaire further queried their potential attitude towards gamification (e.g., feelings towards gamification in education and expectations of gamification in education). As students have not yet experienced gamification in their learning activities, it seems that they do not fully understand what gamification is. Thus, from the comments participants provided (some believed the research was to result in the development of massively online multiplayer game for education and were very excited about it), it would seem that participants equated gamification with using games in education. To that end, their responses reveal that most participants were comfortable or excited about the use of games or gamification in education, and that they expect it to make classes more interesting and improve the learning environment.

Although there is a distinct difference in definition between gamification and games, this is important from the perspective of the designer, who creates a system with game elements (and not a full-fledged game), but not from the perspective of a user, who uses the gamified system and may experience it as a proper game (Deterding, Dixon, et al., 2011). From the perspective of an undergraduate student (i.e., a user), the distinction is neither apparent nor important as long as the gamified system creates an environment in which the learning process is interesting. That is, in practice, whether games or game-like systems are used to create interesting and motivating learning activities is unimportant. What is of importance is the impact the activities have on the learners: they motivate and engage students to learn.

The analysis of responses regarding the expectation of gamification in learning revealed that, in addition to being in favour of it (31.37% of participants were excited about it), students expect that gamification will increase their interest (45.00%) and improve their understanding. That is, they

expect the approach to be better engaging, and this will lead to improved learning.

The game elements chosen in the questionnaire (point system, leader boards, player profile, teams, progress bars, and achievement badges) can be classified as "game design interface patterns" (Deterding, Dixon, et al., 2011) or game "components" (Werbach and Hunter, 2012). These were chosen as they are concrete, generic and common enough that they transcend games and gamification. That is, whether they are used in games or in gamification, their purposes typically remain the same. Thus, even if the participants were unclear about the distinction between games and gamification, their answers to these questions are valid.

All game elements were highly rated by students. Our quantitative analysis did not reveal any statistically significant preferences for particular game elements, different preferences between regular and non-regular players, or different preferences due to reasons for playing games. Perhaps the lack of difference between regular and non-regular players is the most interesting finding as it may mean that, in terms of game elements, gamification implementers do not have to cater for the these two groups of players. That is, as there are no discernible differences between the two groups' preferences, designers can create a single implementation that should be, in theory, as effective for both groups.

Students had a tendency to favour teams, progress bars and points although these preferences were not statistically significant. The interest in progress bars may indicate a certain preference for obtaining feedback while the *"teams"* element reinforces the desire for social interaction.

From the game elements listed in the questionnaire, a number of them were related to feedback. These include: point system, leader boards, progress bars, and achievement badges. However, participants perceived the type of feedback provided by each element to be different.

Participants generally viewed the point system as an indicator of self-performance with some relation to competition. Leader boards were seen as both competition and as a mechanism for comparison of performance with others and not just as a ranking mechanism. That is, participants thought of leader boards as a way to determine how much better others were compared to themselves and also as a way to identify whom their *"competitors"* are. Although progress bars were seen as mechanisms to provide feedback, they, along with achievement badges, were believed to provide some degree of motivation. In particular, progress bars were seen to be motivational and increase interest through visual displays of current progress. Progress bars were linked with goal achievement and reaching the next level (*"levelling up"*). Thus, progress bars are related to goal (or task) completion. Achievement badges were perceived to provide a different type of motivation. Unlike progress bars, they did not motivate the completion of tasks; rather, they motivated task mastery. This is evident in comments such as: *"makes you want to keep playing until all are achieved"* and *"gives the advanced students things to work at."* The interest in progress bars may indicate a preference for detailed feedback about progression through learning content or understanding.

The questionnaire responses confirmed typical views about the expectation of games for learning, however, they also revealed a number of insights which can be used to inform the development of gamified systems or activities for learning.

4.2 Limitations

This study had two limitations that were identified. Firstly, the number of responses that formed the usable dataset was somewhat low (that being 51). A higher number of responses may have provided a greater view of the perceptions of game elements amongst a wider range of students. However, as mentioned in Section 2.3, the sample was still representative of the population of students that we were targeting.

Secondly, there was an attempt made to triangulate the results from the study using the game element ratings and comments by the respondent; however this could have been further explored. The survey instrument allowed for students to enter their own comments, however, only a small amount of respondents elected to provide extra comments. This is in part due to the first limitation of the limited dataset of potential comments. The comments that were provided were used in section 3.4 to aid in the analysis of the game elements.

4.3 Recommendations

Given that students are interested in interacting with others through games, boredom relief, and feedback, gamification may be well suited for learning approaches that include such elements. In particularly, gamification appears particularly apt for social constructivism in which students interact with others actively to construct learning artefacts.

Gamified systems and/or activities should also have a strong focus on feedback, which is effective for motivation (Werbach and Hunter, 2012). Different types of feedback should be provided, but feedback about progression seems to be most desirable by students. The progress bar is obviously most suited to display progression. It should clearly indicate what the learner has currently completed and what remains to be completed.

Other game elements can also be used to provide feedback and motivation. For example, if a point system is designed such that points are awarded for something that is relevant to the learner, it provides feedback about the learner's performance and provides meaningful gamification (Nicholson, 2012). In the context of learning, a point system could award points for correctly completing tasks. A leader board based on these points can then be used to provide students feedback about how they compare to others as an indication of their relative performance. This combination of a point system and leader board can also provide motivation for students. To motivate mastery of tasks, achievement badges can also be used. They may also motivate learners to complete additional or "bonus" material/activities to increase competency.

Game elements such as leader boards and achievement badges should be publicly viewable to all users as they are status symbols or represent the achievement of individual users. One particular issue with this public display of achievement is that some users may feel uneasy about it or even embarrassed if they have not performed well. Two

approaches to address this is to either give users the option for their ranking and badges to be publicly viewable or to allow users to use an anonymous display name that does not identify them to others (i.e., not their real name or student number).

An initial implementation should follow the recommendations of this paper and continue to evolve the features based on feedback received from students and instructors. To provide a guiding method to the implementation, it is recommended that a Design Thinking approach be followed. Design Thinking encourages the use of prototyping to continually evolve a product based on feedback from relevant stakeholders (IDEO, 2012). Designers may also wish to consider the Hook model (Eyal and Hoover, 2013) when designing their system. The Hook model outlines a design methodology for creating habit-forming products. To do so, the product must encourage users to go through the following four phases in a continual cycle: (1) being triggered to perform an action, (2) enabling the user to perform an action, (3) being given variable rewards and (4) having the user invest (intellectually, not financially) in the product in a way that will encourage them to go through the cycle again (Eyal and Hoover, 2013). Different aspects of gamification may be suited to different phases, hence why a prototyping approach is recommended.

Finally, given the continually evolving nature of games and the use of gamification in an educational setting being relatively new, it may be useful to revisit this study in a number of years and compare the findings. A longitudinal study may shed more light on which game elements have a greater positive impact on student learning than others. This would be particularly true if students have at that point been exposed to some form of gamification already, as their responses would perhaps be more informed. Students with exposure to gamified learning systems may also be more prepared to answer the question of how they feel about gamification, as 41.18% of students did not do so in this study.

5. CONCLUSION

The aim of this work was to understand students' perception of gamification and game elements in order to develop gamified systems for learning. The investigation involved surveying students in the first and second year of an undergraduate business IT program. The questionnaire employed enquired about students' gaming experience, their expectation of gamification in education, and their views on the usefulness of particular game elements to increase enjoyment in the use of a gamified system.

The survey confirms the typical belief that undergraduate students are experienced with games (100% of students surveyed have played computer games) and that they engage frequently in the activity (74.50% played computer games at least once per week with 35.29% playing every day).

The results revealed that students' perception of gamification is positive. Although 80.39% of surveyed students have not heard of the term previously, 31.37% found it to be an exciting idea and 21.57% said they would be comfortable with it. Only 5.88% of students said they would feel anxious about it and no student said they would be uncomfortable with it. However, 41.18% of students did not believe any of those options matched their feelings towards, possibly due to a lack of familiarity and uncertainty about what gamification is. Most students have not heard of gamification and tend to equate it with games. This also reinforces the fact that to the user (i.e., students in this case), whether games or gamification is used is not important. What is of greater importance is the ability to engage students in game-like systems that motivate them to carry out their learning activities.

Students also believe elements such as point systems, leader boards, player profiles, teams, progress bars, and achievement badges to be useful in creating enjoyment for a game. Overall, students seem to favour the following from a gamified learning system: social interaction, engagement, feedback, and increased learning. These seem to suggest that gamification is particularly suited to learning approaches such as social constructivism and that gamified systems or activities should have a strong focus on feedback.

As the data collected in this study showed that there are no general preferences for using any of the game elements presented to the students, the next step is to firstly investigate if there are preferences according to player types. In the gaming literature, eight player types have been proposed, namely griefer, networker, politician, friend, opportunist, scientist, planner and hacker (Bartle, 2004). However, these player types are of limited use in the context of education and alternative player types have been proposed, namely: socialiser, free spirits, achievers, philanthropists, networkers, exploiters, consumers and self-seeker (Marczewski, 2012). A tool will be created to profile students in terms of player types and then investigate any relationship between player types and specific game elements.

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7. REFERENCES

Aparicio, A. F., Vela, F. L. G., Sánchez, J. L. G., & Montes, J. L. I. (2012). Analysis and Application of Gamification. *Proceedings of the 13th International Conference on Interacción Persona-Ordenador*.

Bartle, R. A. (2004). *Designing Virtual Worlds*: New Riders.

Brand, J. E., Borchard, J., & Holmes, K. (2009). *IA9: Interactive Australia 2009*. Gold Coast, Queensland, Australia: Bond University.

Deterding, S. (2012). Gamification: Designing for Motivation. *Interactions*, 19(4), 14-17.

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). From Game Design Elements to Gamefulness: Defining Gamification. *15th MindTrek Conference*, Tampere, Finland.

Deterding, S., Sicart, M., Nacke, L., O'Hara, K., & Dixon, D. (2011). Gamification: Using Game-Design Elements in Non-Gaming Contexts. *The Annual Conference Extended Abstracts on Human Factors in Computing Systems*.

Eyal, N. & Hoover, R. (2013). *Hooked: A Guide to Building Habit-Forming Products*: Createspace Independent Pub.

Huotari, K.. & Hamari, J. (2012). Defining Gamification: A Service Marketing Perspective. *The 16th International Academic MindTrek Conference*, Tampere, Finland.

IDEO. (2012). Design Thinking for Educators. Retrieved July 15, 2013, from http://designthinkingforeducators.com/

Kapp, K. M. (2012a). Games, Gamification, and the Quest for Learner Engagement. *T+D*, 66(6), 64-68.

Kapp, K. M. (2012b). *The Gamification of Learning and Instruction: Game-Based Methods and Strategies for Training and Education*. San Francisco: Pfeiffer.

Landers, R. N. & Callan, R. C. (2011). Casual Social Games as Serious Games: The Psychology of Gamification in Undergraduate Education and Employee Training. In M. Ma, A. Oikonomou, & L. C. Jain (Eds.), *Serious Games and Edutainment Applications* (399-423): Springer-Verlag.

Lee, J. J. & Hammer, J. (2011). Gamification in Education: What, How, Why Bother? *Academic Exchange Quarterly*, 15(2), 146.

Marczewski, A. (2012). *Gamification: A Simple Introduction*: Andrzej Marczewski.

Muntean, C. I. (2011). Raising Engagement in E-Learning through Gamification. *The 6th International Conference on Virtual Learning*, Babeş-Bolyai University of Cluj-Napoca, Romania.

Nicholson, S. (2012). A User-Centered Theoretical Framework for Meaningful Gamification. *The Games+Learning+Society 8.0*, Madison, WI, USA.

Robertson, M. (2010). Can't play, won't play *Hide&Seek: Inventing new kinds of play* (Vol. 2013).

Saatchi & Saatchi. (2011). Engagement Unleashed: Gamification for Business, Brands, and Loyalty. Retrieved February 11, 2013, from http://www.slideshare.net/Saatchi S/gamification-study

Stott, A. & Neustaedter, C. (2013). *Analysis of Gamification in Education*, *Technical Report 2013-0422-01*, Connections Lab, Simon Fraser University, Surrey, BC, Canada, April.

Werbach, K. & Hunter, D. (2012). *For the Win*. Philadelphia: Wharton Digital Press.

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