Gamification of the Games Course

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Abstract

Our objectives are to determine if gamification could improve the motivation of students to do coursework and how this could be implemented for one of the University of Cape Town's (UCT) courses. Our subjects were 90 anonymous university and college students from Cape Town who took part as participants in two surveys.

Our main outcome measures were the average type of gamer among the subjects and the level of motivation they would possess for each example of education-appropriate gamification. We found that the average type of gamer is a Mastermind-Conqueror-Seeker – a player who takes pleasure from strategizing and solving puzzles, beating the competition and discovering interesting things. These gamers also do not like fear, pressure or working with people. The quizzes and lone challenges received 57.8% and 53.3% of the participants' votes, respectively. The levels of motivation for badges, progress bars, storyline, visual and leaderboards averaged to between "very motivated" and "moderately motivated" except the rewarding of stars and the social forum.

We have determined which gamification techniques have the potential for being effective in an educational setting. A story-line, reward system and a potential technical implementation have been devised and proposed.

Introduction

One of the most common reasons for poor academic performance in university students is the lack of time management due to distractions. With many students living with a new-found freedom it is not surprising that they find parties, movies and videogames far more entertaining than coursework.

Recently, however, a new form of engagement has been developed: Gamification, the use of game design elements in non-game contexts (1). It combines the work at hand with reward-based design aspects of games to create a product that is enjoyable and motivating as well as productive and efficient. Gamification has been applied in social contexts (Foursquare), in businesses and in competitions to motivate participation (2).

We aim to research gamification and its applications to determine if it could improve the work ethic of students and, if so, how it could be implemented for one of the University of Cape Town's courses.

Scope

If the education system is examined critically, a number of game-like attributes can be discovered (3). For example in a university setting, one starts small as a novice (first year) student with minimal knowledge of the coursework for the coming year. As one progresses, one goes on quests (lectures) to learn skills (coursework) and is then tested on this through various exciting missions and duels (tests and assignments) that will determine if one reaches the final battle (exams) in order to level up (pass the year) or, if one loses the level, the game is over (failure). The end goal of this game is to gain sufficient knowledge in a field of choice in order to graduate with a degree (badge of honour – final prize at the very end of the game). Unfortunately, it is quite a badly designed game, with little motivation but to achieve and beat one's own best, which, of course, is not everyone's main objective.

A game needs to be motivating, addictive and encouraging with very short-term goals so that one can fail and try again until one succeeds. In university, if one fails a single test, it is possible to fail the entire course. This puts immense pressure on students, again decreasing motivation. (4)

This is why gamification could, potentially, have a positive effect on universities and primary and secondary education as well. By improving the design of the "university game", learning could be transformed into a fun experience that could motivate all types of students, not just the self-motivating achievers.

As Jane McGonigal, an expert in the games design industry, said, "The average young person today in a country with a strong gamer culture will have spent 10 000 hours playing online games by the age of 21". If we capture the essence of fun in games that draws these young people in to spend over a year of their lives in a virtual world of fun, we could harness it in order to promote anything we want (5).

Method

The implementation of the gamified course would take place through Sakai (Vula) of UCT, an online education focused application of Sakai. The course chosen for the proposal is the games design course offered by UCT for second year Computer Science students. This group would be a good test-case as they would have past experience in

gaming and would therefore be familiar with these motivational features, allowing the students to more simply acclimate to the new learning environment. A counter argument, however, could be that these students would be immune to the gamification incentives as they have been overexposed in their past gaming experience.

Extensive online research was done to establish which attributes of games are usually used in the gamification industry and which would be most effective in education. It was decided that two surveys would be undertaken: a survey to determine gamer personality types and a survey to determine reaction toward proposed gamification.

The "gamer personality test" BrainHex Survey

When creating a traditional computer game the target gamer personality types are essential in the design. As gamification is based on this type of game design, it has also been incorporated into the creation of gamified products (6). The most prevalent gamer personality test is the Bartle test which has four categories: achiever, socialiser, explorer and killer (7). The Bartle Model has a few flaws, namely that the player types are said to be mutually exclusive and that the model is not empirically based and therefore cannot be validated (8). We used the "Brainhex" model survey which extends the Bartle model to incorporate four more categories: seeker, survivor, daredevil and mastermind, while replacing "killer" with conqueror (9) (see Appendix A). It also incorporates certain "exceptions" – specific game attributes that the gamer does/does not like as part of their game play like fear or pressure (see Appendix B). The BrainHex model accepts that gamer types are not mutually exclusive. The scores for each class were summed to find the most common class for students in Cape Town.

Our Survey

A survey was drawn up using the online survey creator, SurveyMonkey, distributed through Facebook and answered by 90 university and college students in Cape Town. This target group was selected for the following reasons: this is the age group of students for which the implementation would be designed, they have been in a traditional course and can therefore compare their courses to the proposed scenario and it gives a more general result, which is applicable to more than just the Computer Science faculty. This survey incorporated the BrainHex survey as well as a proposed scenario for the students to visualise the full scope of the proposed implementation.

Gamification design

Any good gamification design should have three basic properties. It should have a special **meaning** for the user, the ability to inspire the user to **master** the topic being gamified and it should be **autonomous,** to make the user feel free (10). It should focus on meaningful accomplishments, a sense of discovery, social/bonding

interactions and incorporate visually pleasing elements (11).

For users to have a personal connection to the gamified program, they must feel that the program has a purpose for them specifically, i.e. the end goal must be one the users wish to achieve. The users must be able to clearly see and track the progress toward the long and short term goals, especially the final goal. This way they can identify with each step and will see the progress made toward the goal they wish to achieve. This gives the program meaning.

To motivate the users to work toward these goals, gamification implements an accomplishment based reward system. Points, stars and badges are often "given" to users for completing important tasks. Progress bars allow the users to keep track of their points and their proximity to the next big achievement, either rising to a new level or wining a badge, etc. The prospect of winning a badge inspires users to work toward goals themselves as the badges act as a self-affirmation symbol as well as allowing users to identify with a group that works toward the same goals (12). Leaderboards allow the user to view their achievements compared to those of others in the same community – also creating a sense of belonging to a similar minded group and competition among them.

The design of the reward system must be done carefully in order to maximize user enjoyment. The progression from one level/badge/star to the next cannot be easy. In essence, it must be an interesting challenge that is just out of comfortable reach. The challenge must also vary in complexity as the difficulty level changes (10). If a user is faced with the same challenge, just at a higher difficulty level he/she might soon lose interest, but if it incorporates a new, unexpected twist, the intrinsic pleasure people get from solving new puzzles will be kept alive. This leads to the addictive nature of games and therefore prompts users to master whatever information they need to play.

The program must incorporate a simple, yet well thought-out story with a matching copy to excite and intrigue the users. This will draw together the reward system and the goals to create a fun and exciting atmosphere. The age-old stories that allow gamers to "save the world!" can also apply to gamified programs and will give the users a sense of purpose outside of the overall meaning the program has for them.

Lastly, gaming is a free pass-time. If one wants to emulate the design and effectiveness of games, one must give the users the freedom to roam and do as they please. In gamification, the designer's main objective is to manipulate the users. By doing this and giving each activity an external reward, the internal reward the user feels is devalued (10). Gamers may enjoy the external rewards they receive when they succeed in a game, but it is also the internal joy of succeeding at something challenging that makes a gamer want to carry on to achieve more (10). If the gamified program drowns out the internal accomplishment users

feel, users that play for this feeling might lose interest. This would negate the positive effects gamification should have. Also, if users feel that they are being manipulated, they may notice that their freedom within the program is a façade. This feeling of being controlled could remove the pleasure from their gaming experience and might cause their usage to decrease. Within gamification one must remember to give the user the freedom of choice.

Results

The survey received 90 responses. Of this figure, 38.9% were female, while 61.1% were male. BrainHex survey found that the top 3 classes were Mastermind, Conqueror and Seeker. This means that the main gamer type found is a person who enjoys working on challenging problems and puzzles, working hard to beat all competitors and loves discovering things. Of the 90 participants, 54 have a BrainHex exception. The top 3 categories were: no fear, no mercy and no pressure. This indicates that of the 60% of participants with exceptions, the majority enjoy being in control, dislike being afraid or under pressure and do not enjoy playing with other people. (13)

Questions from the BrainHex survey pertaining to the participants and their gaming habits (14):

Question Number	Questions	Answers
1	Year of birth	Participant entered their year of birth
2	Geographical Territory:	• North America • Southern or Central America • Western Europe or UK • South Asia (incl. China, India and Japan) • Africa • Middle East • Australasia • Other(please specify)
3	I typically play computer or videogames:	• Every day • Every week • Occasionally • Rarely • Never
4	I would consider myself:	• Hardcore gamer • Something between a Hardcore and a Casual gamer • Casual gamer • I have no idea!
5	I work in:	• A non-videogames related industry (or I don't work/am a student) • Video game development • Videogame publishing • Videogame retail • Videogame press • Videogames in some other context (e.g. research)

6	I prefer the following way of playing games:	• Single player alone • Single player with other people helping or pad-pressing • Multi-player, in the same room • Multiplayer, over the internet • Team play or Clan play over the internet • Virtual worlds or MMORPGs
7	My attitude to videogame stories is:	• Stories are very important to my enjoyment of videogames • Stories can help me enjoy a videogame • Stories are not important to me in videogames • I prefer videogames without stories • I don't play videogames
8	Name three games that exemplify what you enjoy about games:	Participant could enter any 3 games
9	I live with, and/or like living with:	• A cat or cats • A dog or dogs • Both cats and dogs • Neither
10	Optional: If you know your Myers-Briggs Type, please select it here:	Participant chose from a list of Myers-Briggs Personality Types

Questions from the BrainHex survey following the instructions to rate each videogame experience listed and then choose from "I love it!", "I like it.", "It's okay.", "I dislike it." and "I hate it":

Question Number	Question
11	"Exploring to see what you can find."
12	"Frantically escaping from a terrifying foe."
13	"Working out how to crack a challenge puzzle."
14	"The struggle to defeat a difficult boss."
15	"Playing in a group, online or in the same room."
16	"Responding quickly to an exciting situation."
17	"Picking up every single collectible in an area."
18	"Looking around just to enjoy the scenery."
19	"Being in control at high speed."
20	"Devising a promising strategy when deciding what to try next"
21	"Feeling relief when you escape to safe area."
22	"Taking on a strong opponent when playing against a human player in a versus match."
23	"Talking with other players, online or in the same room."
24	"Finding what you need to complete a collection."
25	"Hanging from a high ledge."
26	"Wondering what's behind a locked door."
27	"Feeling scared, terrified or disturbed."
28	"Working out what to do on your own."
29	"Completing a punishing challenge after failing many times."

| 30 | "Co-operating with strangers." |
| 31 | "Getting 100% (completing *everything* in a game)." |

Question from the BrainHex survey asking participants to read the seven statements and rate them in order of preference (1 being most preferred and 7 being least preferred):

Question Number	Statement
32	A moment of jaw-dropping wonder or beauty.
33	An experience of primeval terror that blows your mind.
34	A moment of breathtaking speed or vertigo.
35	The moment when the solution to a difficult puzzle clicks in your mind.
36	A moment of hard-fought victory.
37	A moment when you feel an intense sense of unity with another player.
38	A moment of completeness that you have strived for.

Questions from our survey pertaining to BrainHex results:

Questions and possible answers	BrainHex score	Number of participants
3. Please fill out the BrainHex questionnaire and fill in the points you got for each of the following classes (if negative enter zero):		Total: 90
Seeker	11.44	90
Survivor	6.86	90
Daredevil	9.24	90
Mastermind	**14.21**	90
Conqueror	12.53	90
Socialiser	7.81	90
Achiever	10.48	90
4. If you had one or more "BrainHex exceptions" what were they?		Total: 54
No commitment	/	5
No mercy	/	12
No punishment	/	4
No problems	/	7
No pressure	/	11
No fear	/	25
No wonder	/	0

The assessment tasks gave valuable feedback. 57.8% of participants liked the quizzes and 53.3% liked lone challenges while only 23.3% liked group challenges (participants could select more than one option). This ties in with our BrainHex results that the participants prefer to play alone than in groups. Crosswords were very unpopular with 15.6% of people choosing this option. This

is again shown in the badge question, where only 12.2% of participants voted for a "social interaction" badge, while "mastery of knowledge" received 76.6%, "investigative prowess" received 56.7% and "speed" 31.1%.

Questions from survey:

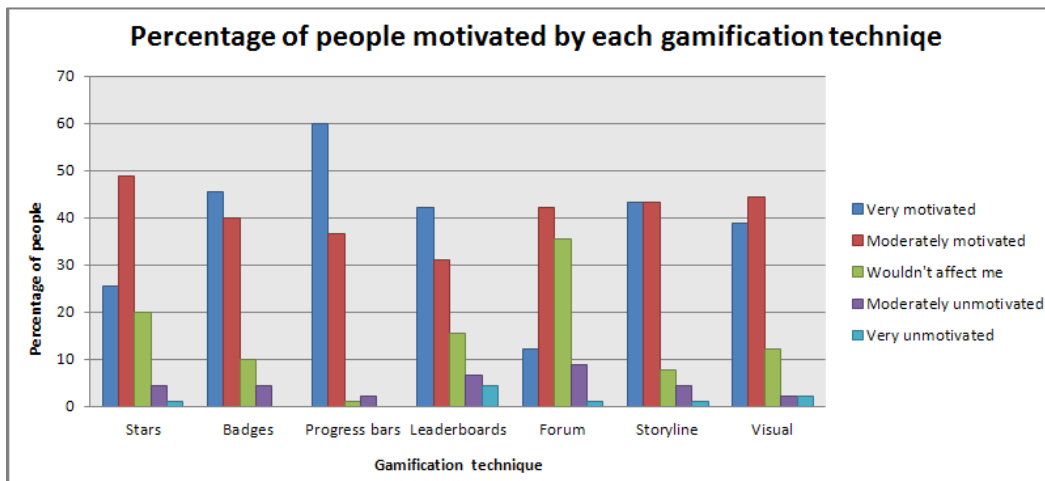| Questions and possible answers	Percentage
1. What is your gender?	
male	**61.1**
female	38.9
2. Which faculty are you in?	
Science	**41.1**
Commerce	15.6
Engineering and the Built Environment	14.4
Health Science	3.3
Law	1.1
Humanities	24.4
5. In what form would you like the timed, online assessments to appear?	
Quizzes	**57.8**
Crosswords	15.6
Lone challenges	53.3
Group challenges	23.3
Other	2.2
6. What sections of great performance should the badges be awarded for?	
Mastery of knowledge	**76.7**
Speed	31.1
Social interaction	12.2
Investigative prowess	56.7
Other	0

The final question was about the motivation each given gamification technique would give the student. This produced valuable information. See the table outlining the average rating of motivation from 1 being "Very motivated" to 5 being "Very unmotivated.

Final question in survey:

7. How motivated would you be by each form of game design below (as mentioned in the scenario)?	Average rating (1-5)	Standard deviation from mean
Stars	2.07	0.86
Badges	1.73	0.82
Progress bars	**1.46**	0.64
Leaderboards	2	1.12
Forum	2.44	0.86
Storyline	1.77	0.86
Visual	1.84	0.87

Also, see the graph below of the participants' percentage votes for each gamification technique. Clearly, the progress bars are most popular, while the forum is the least. Interestingly, the participants were more motivated by the progress bars to the next badge, than the badge itself.

Graphical representation of the answers for question 7:

Percentage of people motivated by each gamification techniqe

Implementation: Proposal for the games course

Goals

Short-term: The students would now have compulsory short, timed, assessments in the form of quizzes, lone challenges and group challenges. The quizzes would be made up by the tutors. There would be a simple entry program where the tutors could enter a question, the answer, the section and the difficulty level. These would be stored in an online database and the quizzes would be built by randomly selecting 30 of these questions to be done in an allocated amount of time. There should be 2/3 quizzes available every week. The student would have to do the first to unlock the second, and so-forth, like unlocking levels in "Angry Birds"

The lone and group challenges would take part on alternating weeks. They would be designed to test the students' coding and problem solving skills.

While these assessments are compulsory, they are available to do at whatever time the student feels like it. This will raise the autonomy of the gamification design, allowing students to feel freer and make the program feel more like a game.

Longer-term: The classic assignments and tests games design students would receive would remain the same. These would be marked the conventional way, but the student would gain points for knowledge, skill and speed for the work done.

Long-term: The long-term goal of finishing the course with the required knowledge and more would be emphasized in class as well as throughout the game.

Rewards

Often players are given badges in games to measure their level of achievement, and progress bars to indicate how close they are to the next level. Our results showed that students seemed more motivated by progress bars than the badge that the progress was made towards. However, because both received a high motivation rate, we would suggest implementing both badges and progress bars.

The progress would measure an experience contribution to a main level, as opposed to smaller attribute levels (knowledge, speed, skill). This is because these things would be hard to improve upon, and rather unnecessary to encourage- since we are only concerned with involving them enthusiastically in the course material.

The rewards would be as follows: for doing an online assessment and getting 80%, a student would get one star for the quiz. For 90% he/she would get two stars and for 100% three stars. A student can try each quiz three times in order to get the three stars. If a student gets 90% for an assessment, he/she would get one clue in the quest for finding the hard drive thief (see storyline below). Accomplishing the assessments with 90% or above and the tests and assignments with above 80% would earn the students points for knowledge. Submitting the assessments and assignments within a specified "short" period of time (dependent on difficulty), would give the students points for speed. Getting 70% or above on a group assessment would earn all members of the group points for social interaction. All these points would add up and can be tracked in the progress bar that would always be visible on the screen. This would track the progress to the nearest badge. The badges would be set to "Novice" by default and would range all the way up to "Game Master".

The top 20 students in the week's assessments according to speed and percentage would be listed on the leaderboard. Their badge rank would be displayed as well. This allows students that previously did not do well to feature while still showing that others might have worked harder previously.

Once the class has grown accustomed to the design of the course and have proven themselves, another activity could be implemented where students that show merit can unlock the ability to enter their own question for past

quizzes that students have yet to get three stars for. If this were to be adopted, it would render the past quizzes self-sufficient after a short time.

A method to bridge the virtual program with the real world would be to reward the top 10 students overall at the end of each term by inviting them to an informal dinner at a popular, family restaurant.

The Story
Storyline: The student would be told that he/she is a detective. A hard drive with an incredibly dangerous virus on it was stolen from the senior lecturer's computer lab in the Computer Science building at UCT. It is suspected that the perpetrator was one of the students. The detective has been hired to go undercover as a student and figure out the mystery before this virus gets into the wrong hands. Throughout the game the detective would gain clues by scoring 90% or higher in the weekly assessments. In the last week of the semester everyone is given the final clue after completing the final assessment. This will compile the clues and will bring about an interesting twist – potentially the culprit is a faculty member or a tutor. The final challenge would be to find the perpetrator in person and the student to do this first would receive a prize.

Copy: A detective's desk picture would be used, somewhat like this (15):

Here the files and books would be links to the different activities available in the gamified course. The books on the left would be where you could access uploaded course-work. The crime report in the middle could be where the current and past assessments are stored. The suspect files would be a collection of the clues acquired. The leaderboards and social statistics would be in the shelf on the left. For the student to get to his/her profile they would click the police hat. If a new quiz/lecture slide is uploaded or a person rises in the leaderboard, the appropriate item would light up like the crime report in this picture.

Personalised
Every student/detective would have their own profile. This would extend the profile the student already has on Vula, by listing the achievements as well as the badge level. This would also aid in the community and social aspect as if someone is struggling, they can find a student's profile and email them.

Another aspect that could be incorporated into the reward and personalised categories would be the ability to gain options to personalize your profile as rewards. For example, if you reach level 5, you can change the colour of your font in the chat room. If you reach level 10, you have a silver crown next to your name in the chat room and if you reach "Game Master" you will get a golden crown.

Practical implementation
The gamified course (as specified above) should be implemented in a separate, interactive website alongside Vula on the same servers. It would be loaded into an iframe embedded in the Vula tab dedicated to the games course. There would be two main database designs: one which stores the question data and the other which stores the students' data. This database would be hosted on the Vula server and accessed by the gamified website.

Conclusion

The gamification techniques which were found to be the most potentially effective in an educational setting were: stars, badges, progress bars, leaderboards, a storyline and a visual. Each of these appeals to the mastermind-conqueror-seeker gamers, which were the highest scoring personality types we found in the 90 Cape Town students that took the surveys.

A proposal was devised along with a potential technical implementation, to combine the gamification techniques into a fun, interactive learning environment on Vula.

By interacting with a visual and a surrounding story-line (appealing to seekers), students would immerse themselves in the imaginary world while taking part in assessment tasks and being rewarded with stars and badges (appealing to masterminds). Progress bars would motivate the student to complete the necessary tasks to receive the newest badge. Leaderboards would display the results of the top students publicly (appealing to conquerors).

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Appendices

Appendix A
BrainHex Classes and their respective meanings:

BrainHex Class	Meaning
Seeker	**Likes:** finding strange and wonderful or familiar things. **Behaviour:** often shows curiosity, sustained interest, and a love of stimulating the senses.
Survivor	**Likes:** escaping from scary threats, pulse-pounding risks. **Behaviour:** rides on the edge of your fear –loves to be terrified and then feel safe again.
Daredevil	**Likes:** negotiating dizzying platforms or rushing at high speed while still in control. **Behaviour:** focused on thrill seeking, excitement and risk taking.
Mastermind	**Likes:** solving puzzles and devising strategies. **Behaviour:** focused around making the most efficient decisions.
Conqueror	**Likes:** defeating impossibly difficult foes, struggling until eventually achieving victory, and beating other players. **Behaviour:** forceful – channels anger in order to achieve victory.
Socialiser	**Likes:** hanging around with trusted people, and helping people. **Behaviour:** tends to be trusting, and gets angry at those who abuse trust.
Achiever	**Likes:** collecting and doing anything possible, **Behaviour**: works obsessively towards completing tasks and collections, and the intense reward of overcoming impossibly distant goals.

(9)

Appendix B
BrainHex Exceptions and their respective meanings:

Exception	Meaning	Opposite to this class
No Commitment	Dislikes being asked to complete everything, preferring to pick and choose which tasks to attempt, or simply messing around with a game.	Achiever
No Mercy	Rarely cares about hurting other players' feelings. Alternatively, may simply not enjoy playing with others.	Socialiser
No Punishment	Dislikes struggling to overcome seemingly impossible challenges, and repeating the same task.	Conqueror
No Problems	Dislikes having to solve puzzles or find solutions without clear instructions.	Mastermind
No Pressure	Dislikes being asked to perform under pressure, preferring to take time so to make the right decision.	Daredevil
No Fear	Dislikes feeling afraid, preferring to feel safe or in control.	Survivor
No Wonder	Dislikes having to search for things, preferring clearly defined tasks.	Seeker

(13)