

Gamification: Which elements are effective for instructional games?

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Abstract : It is empirically evident that the application of gamification in instructional games has positive impacts on learning. Ahmad and Aziz (2017) revealed the potential of applying the Bloom's Taxonomy as game levels for gamifying instructional games, thus they can be used as a tool for assessment of performance for gauging students' learning progress. Borges et al. (2014) reported that studies on gamification that focus on how gamification can be utilised to boost learning, increase students' motivation and enhance students' skills. Seaborn and Fels (2014) revealed that it improves interactivity through gameful learning experience. Hamari, Koivisto, and Sarsa (2014) discovered that it has positive impacts depending greatly on the context and users in which it is applied. Stott and Neustaedter (2013) indicated that it is significant to promote engagement, but its application in education is particularly sensitive to context. Therefore, identify the right gamification elements for instructional game in order to ensure optimal learning takes place is essential.

INTRODUCTION

Research investigating on the application of gamification has rapidly grown since its emergence in 2005 (Dale, 2014). Therefore, this paper is aimed to evaluate the effectiveness of gamification elements in instructional games that promote learning based on the empirical evidence from prior studies. The research questions for this study are as follow:

1. What gamification elements are use in instructional games?
2. How gamification elements in instructional games promote learning?
3. Are gamification elements used in instructional games effective for learning?

INSTRUCTIONAL GAMES

A game is defined as an activity that occurs in the imaginary world that does not have any effect on the real world, and anything happens in the game

is irrelevant to any contexts outside the game (Garris, Ahlers, & Driskell, 2002). The design of games involve specific game elements. There are no specific game elements that are accepted. Thus, different scholars or researchers suggested different game elements (Garris, Ahlers & Driskell, 2002; Stott & Neustaedter, 2013; Dale, 2014). The game elements from different scholars or researchers are tabulated as follow:

Table 1 : Game Elements by Garris, Ahlers and Driskell (2002), Stott and Neustaedter (2013) and Dale (2014).

Scholars/ Researchers	Game Elements
1. Garris, Ahlers, and Driskell (2002)	<ol style="list-style-type: none"> 1. Fantasy: The game context is not real and does not have any connection with the real context). 2. Rules/goals: There are rules governed a game such as fixed space, duration of time and rules. 3. Sensory stimuli: Another type of reality that is against normal sensations and perception need to be accepted temporarily. 4. Challenge: A game contains activities that are not too easy and not too difficult that is achievable. 5. Mystery: A game stimulates curiosity that is not too easy and too difficult to be solved. 6. Control: A player can regulate, direct, or command something in a game.
2. Stott and Neustaedter (2013)	<ol style="list-style-type: none"> 1. Freedom to fail: provide multiple lives, or allow players to restart at the most recent 'checkpoint'. Making mistakes is part of learning process and they can explore content, involve in decision making and realise the effects of taking the right or wrong decision. 2. Rapid feedback: provide frequent feedback that is crucial in informing learning progress. 3. Progression: provide levels or missions in order to increase their motivation. 4. Storytelling: provide narration or telling stories. It has positive impacts on learning by making learning elements more realistic, thus it can enhance engagement.
3. Dale (2014)	<ol style="list-style-type: none"> 1. Achievements: provide experience points, levels and bonuses 2. Exercises: provide challenges and discoveries 3. Synchronizing with the community: provide leaderboards and collaboration 4. Result transparency: provide experience bars and continuous feedback 5. Time: provide countdown and speed 6. Luck: provide lottery and random achievements

Instructional games are any games that are played for educational purposes. They can be conventional or digital. Digital games are commonly known as computer games. As for computer games, they can be played online or offline. For the purpose of this paper, instructional games are defined as online computer games that are played for educational purposes. The design of instructional games also include the game mechanics that are termed as gamification because the elements are applied in the non-game context in order to make them more game-like (Kapp, 2012). Gamification elements used in the design of instructional games are described in the next part of the paper, Gamification.

The field of instructional games has rapidly been growing and evolving. Consequently, the interest among scholars to investigate the application of instructional games in learning has increased tremendously. Prior studies indicated that they promote learning such as providing enjoyment (Arslan, Moseley, & Cigdemoglu, 2011; Lombardi, 2012; Ang, 2014; Khenissi, Essalmi, & Jemni, 2015), enhancing motivation (Anyaeibu, Ting, & Li, 2012; Eseryel et al. 2013; Schouten et al. 2014), improving the acquisition of skills/ knowledge (Connolly et al. 2012; Nadzrah & Nosratirad, 2013; Scepanoviv, Zaric, & Matijevic, 2015; Santana & Panamericana, 2015) and increasing engagement (Fishman, 2012; Kiili et al. 2012; Nicholson, 2014) and supporting different learning styles (Schaaf, 2012; Bellotti et al. 2013; Soflano, Connolly, & Hainey, 2015). Therefore, it is significance to investigate what makes instructional games effective for learning as with regard to this paper is the gamification elements.

GAMIFICATION

According to Dale (2014), the word “gamification” was included to the Oxford Dictionary’s word of the year shortlist in 2011. The meaning provided by the Oxford Dictionary for it is ‘the application of concepts and techniques from games to other areas of activity’. However, researchers define it in many ways. Kapp (2012) defined it as the application of game-based mechanics, aesthetics and game thinking in engaging people, motivating action, promoting learning, and solving problems. Seaborn and Fels (2014) stated that it is the application of elements and mechanics of games in non-game settings. Caponetto et al. (2014) described it as the use

of game mechanisms in non-gaming environments in order to improve the processes performed and the experience of those involved. Sailer, Hense, Mayr, and Mandl (2017) explain gamification as the process of applying game design elements in non-game contexts in order to make them more game-like.

Gamification permit learning to be more interesting, appealing and eventually, effective (Caponetto et al., 2014). It also has the potential to engage and motivate students in learning (Kapp, 2012). Thus, we define gamification as the application of game elements and mechanics in the design of non-game activities with the purpose of making them to resemble as closely as possible to games.

According to Kapp (2012), there are two types of gamification. They are structural gamification and content gamification. Structural gamification only gamify the structure around the content without changing the content itself. Its purpose is mainly to trigger students in reading the content and engage them in learning. Content gamification is the application of game elements and game thinking in order to change the content to become more game-like. Thus, the content is delivered through context or activities within games. Typical gamification elements as stated by Dale (2014) and gamification elements according to learning objectives as presented by Kapp (2012) is shown in Table 1 and Table 2 respectively.

Table 2: Gamification elements by Dale (2014)

Gamification Element	Objective
1. Points	To reward specific high value behaviours and achievements
2. Achievements	To give positive reinforcement for high value user behaviours
3. Levels	To indicate engagement levels and perform as entries into new challenges
4. Missions	To form a set of behaviours that will lead users to unlock specific rewards
5. Contests (a set of missions)	To provide rewards to those who complete most quickly or effectively
6. Leaderboards	To introduce competition by ranking the achievement of players
7. Notifications	To increase players' engagement when they do a required action
8. Anti-Gaming Mechanics	To determine how frequent to reward a behaviour

Table 3: Gamification elements by Kapp (2012)

	Gamification Element	Type of Gamification	Learning Objective
1	Points , badges	Structural gamification	To encourage students
2	Rewards	Structural gamification	To motivate actions
3	Badges, ranks, rewards	Content gamification Structural gamification	To influence behaviour
4	Points, rewards	Not mentioned	To drive innovation
5	Levels, badges, points	Not mentioned	To develop skills
6	Points, Story, levels	Not mentioned	To acquire knowledge

It is certainly impossible to include all gamification elements in one instructional games. Furthermore, there should be a balance between gamification elements that make instructional games enjoyable and educational elements for achieving the desired learning objectives. Therefore, it is crucial to identify gamification elements that have been used in designing instructional games, examine how they promote learning and whether they are effective in promoting learning.

METHODOLOGY

The search was limited to the papers published from 2013 to 2017. Advanced search was carried out by using two key words: gamification and elements. Papers were selected based on three criteria which were:

1. The papers could be accessed for free.
2. The papers had to be on experimental studies focused on studying the effectiveness of specific gamification elements.
3. The papers were full paper journals.

Selected research papers were analysed in order to identify gamification elements that were used in instructional games, examine how gamification elements in instructional games promote learning, and whether the gamification elements used in instructional games effective for learning.

RESULTS

There were 610 results obtained from the search. However, only six papers were relevant based on the criteria mentioned in the methodology. This is due to many papers only reported on the application of gamification in general. Only six papers focussed on specific gamification elements that affect learning. The analysis of the related papers are tabulated in Table 4 and Table 5:

Table 4: Source, sample and gamification elements studied in the research papers

	Author and Year of Publication	Sample	Gamification Elements
1.	Landers et al. (2017)	339 university students	Leaderboards
2.	Mekler et al. (2017)	273 aged 17 to 68 years old	Points, leaderboards, levels
3.	Nebel et al. (2017)	103 university students at the degree and master levels	Leaderboards
4.	Sailer et al. (2017)	699 with the average age of 22 years old	Badges, leaderboards, Performance graphs
5.	Prestopnik and Tang, (2015)	27 participants aged between 18 to 22 years old	Storytelling, rewards
6.	Ramirez et al. (2013)	9 to 10 years old children	*Rewards

Table 5: Results of the paper analysis

Gamification Element	Source	Learning Impact	Conclusion(s)
1. Badges	Sailer et al. (2017)	Positive	It has an effect on competence need satisfaction and perceived task meaningfulness.
2. Leaderboards	Landers et al. (2017)	Positive	It was motivating in term of players set goals in the games.
	Mekler et al. (2017)	Positive	It increases intrinsic motivation and is effective means in enhancing the quantity of performance.
	Nebel et al. (2017)	Positive	It provided competition though social comparison.
	Sailer et al. (2017)	Positive	It has an effect on competence need satisfaction and perceived task meaningfulness.
3. Levels	Mekler et al. (2017)	Positive	It increases intrinsic motivation and is effective means in enhancing the quantity of performance.
4. Performance graphs	Sailer et al. (2017)	Positive	It has an effect on competence need satisfaction and perceived task meaningfulness.
5. Points	Mekler et al. (2017)	Positive	It increases intrinsic motivation and is effective means in enhancing the quantity of performance.
6. Rewards	Prestopnik and Tang, (2015)	Positive	It made the games enjoyable.
	Ramirez et al. (2013)	Positive	It was engaging and motivating.
7. Storytelling	Prestopnik and Tang, (2015)	Positive	It was attractive and engaging.

DISCUSSION

There were limited studies obtained from the search results from Science Direct for the duration of year 2013 to 2017. The results contain Research on gamification elements is considered relatively new as the idea of gamification was introduced in 2005 and gained its popularity in 2010 (Dale, 2014). Furthermore, the number of research on specific gamification elements is very limited. Four research were very recently published in the year of 2017, and the other two papers were also quite recent as they were published in 2015 and 2013. Since only six papers were obtained, the

analysis is inadequate as it cannot be carried out in depth and only limited to the gamification elements studied in the paper. Thus, other gamification elements may be beneficial for enhancing learning and need to be explored.

There are seven gamification elements identified in the studies namely badges, leaderboards, levels, performance graphs, points, rewards and storytelling. All gamification elements used in the design of instructional games indicate positive outcomes toward learning especially in enhancing motivation, enjoyment, performance and task meaningfulness.

Implications of The Studies on Instructional Game Design

The brief overview of the related studies proves that gamification elements are significantly important not only to promote engagement but also to support learning. It is impossible to include all gamification elements in any instructional game and the elements incorporated cannot match with learning needs for all students. Furthermore this may cause several consequences: a longer time to develop, more cost to be invested and students require a longer loading time to play the games with many features. Therefore, instructional game developers need to decide which gamification elements are suitable to promote optimum engagement and learning for different students' learning needs. The decision may be based on:

a) Types of courses

Courses can be categorised into Science, Technology, Engineering, Mathematics, Health and Languages (Boyle et al., 2016). Other Social Science courses may be grouped under one category.

b) Learning objectives

The Bloom's Taxonomy can be applied as guidance in the game development such as by dividing learning objectives into cognitive levels: Remember, Understand, Apply, Analyse, Evaluate, Create (Munzenmaier & Rubin, 2013)

c) Competency level

Classes are commonly consisted of mixed-ability students in term of cognitive ability and skills. They can be grouped at least in three categories:

good, average and poor. Hence, instructional games should be able to have gamification elements that can cater with these groups of students.

d) Learning style

The development of instructional games should always consider different learning styles of students. For example, Fleming (1995) classifies learning styles into three types: visual (learn by eyes), auditory (learn by ears) and kinaesthetic (learn by touch, hearing, smell, taste and sight). Hence, visual learners may prefer graphical presentations; auditory learners may prefer audios, sounds and music; and kinaesthetic learners may prefer instructional games that provide experience related to real life such as solving puzzles and simulations.

Customization of instructional games can benefit both the game developers and students. Game developers can reduce the gamification elements that can only benefit the target students who will utilise the games. This may lead to reducing the time and cost for developing instructional games. While students can get instructional games with the features they prefer and as the gamification elements are reduced, they will require less time to load the games with less features.

However, there are still limited studies that focus on specific gamification elements for specific purposes. Therefore, it is an urgent need to conduct studies to investigate specific gamification elements for specific purposes. Based on the review of literature, the following gamification elements in Table 6 are considered important to be researched on separately in order to provide more empirical evidence on how each element can impact engagement and learning.

Table 6: Important gamification elements for instructional games

	Gamification Element	When/ How to use	Learning Objective
1	Points	Players are awarded when players achieve desired learning outcomes	To inform learning progress/ achievement
2	Badges	Players are awarded when players achieve specific high value behaviours and achievements	To increase motivation
3	Leaderboards	Players are ranked according to the current achievement	To introduce competition
4	Notifications	Players get notifications when they do a required action	To increase engagement
5	Timers	Players are provided with a timer such as countdown.	To create challenge
6	Levels	Players enter the next level after completing the lower level.	To develop skills
7	Lives	Players can repeat games after they fail to complete it.	To provide freedom to fail
	Storytelling/ Narration	To provide realistic learning elements	To increase engagement
6	Feedback	Players are supplied with feedback after completing a task.	To inform learning progress/ achievement

Research can be conducted through various methods such as qualitative: one-to-one or focus –group interview, classroom or program-session observations, programme documents and audio visual materials; quantitative: true experiments, quasi-experiments, single-subject design, correlational design, or survey design; or mixed methods: combining both qualitative and quantitative that enables researchers to obtain two types of datasets: quantitative and qualitative (Clark & Creswell, 2015). Qualitative data can be analysed manually or by using a computer. Several types of software such as Envivo and Atlas.ti are noticeably useful to help researchers analyse large qualitative data. While quantitative data can be analysed by using the first generation statistical techniques such as Statistical Package for the Social Sciences (SPSS) or the second generation statistical packages which apply Structural Equation Modelling (SEM) such as SEM Amos and Partial Least Square SEM (PLS SEM). Researchers in social sciences have commonly used first-generation techniques, but they has gradually

preferred to use SEM as it is able to overcome the weaknesses of the first generation statistical techniques such as it enables multivariate analysis that statistically analyse multiple variables simultaneously and it can also measure unobservable variables.

CONCLUSION

Since the number of research on specific gamification elements is limited, it is important to investigate specific gamification elements that meet with students' learning needs, are able to engage them in the learning activities and enable learning to take place effectively. It is also crucial to identify which gamification elements reduce the time, cost and effort in designing effective instructional games. It is hoped that more specific studies will be conducted in the future in order to benefit most from the application of gamification elements in the instructional game design.

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