GLOBAL ACADEMIC RESEARCH INSTITUTE

COLOMBO, SRI LANKA

GARI International Journal of Multidisciplinary Research

ISSN 2659-2193

Volume: 05 | Issue: 01

On 15th June 2019

http://www.research.lk

Author: Anuradha Jayakody, Ruksha Ayeshmanthi de Silva,
Isuri Kaumadie Gamage, Pabasara Damindri Madapatha
Sri Lanka Institute of Information Technology

GARI Publisher | Education | Volume: 05 | Issue: 01
Article ID: IN/GARI/ICEDL/2019/114 | Pages: 01-19 (19)
ISSN 2659-2193 | Edit: GARI Editorial Team
Received: 16.05.2019 | Publish: 15.06.2019

THE EFFECT OF GAMIFICATION ON UNIVERSITY STUDENTS' MOTIVATION AND ENGAGEMENT

[1]Anuradha Jayakody, Ruksha Ayeshmanthi de Silva, Isuri Kaumadie Gamage, Pabasara Damindri Madapatha

Sri Lanka Institute of Information Technology

[1]anuradha.j@sliit.lk

ABSTRACT

Past researches have often determined gamification as an effective, motivating and engaging didactic method for students in universities to rectify the flaws of the traditional methods. Since gamified learning is still an up and coming topic in the Sri Lankan context, especially in Higher Education, this research's aim was to study its effects on motivation and engagement while comparing students' perception and effectiveness in terms of performance between the traditional lecture method and gamification. An experiment was conducted in the Faculty of Business of the Sri Lanka Institute of Information Technology for first year students studying "Principles of Management" using a control group and experimental group. Mixed methods were used to obtain the data which were analysed using descriptive statistics and parametric and non-parametric inferential statistics. Results of a test given to the two groups showed that the experimental group performed better. However, responses to a survey, using questionnaires, showed that the control group had a higher level of perception than the students using the gamified method. Results from the survey, nevertheless, portrays a positive level of perception towards gamification. In regards to motivation, through regression factor scores, the impact of the game elements: Badges, Leaderboards, Challenges, Rewards, Competition, Feedback, Constraints and Emotion showed statistical significance, although the qualitative information through in-depth interviews and observations shows that the overall combination of game elements, including Points and Teamwork are successful in motivating and inducing participation, determining their level of engagement to the learning process, portraying gamification as a successful e-learning tool.

Keywords: E-learning, Engagement, Gamification, Higher Education, Motivation

INTRODUCTION

Today, in the 21st century, performing course tasks well through the Internet or network technology is sought after in education, facilitated by e-learning (Abou El-Seoud, et al., 2014). As an active process of learning, e-learning should be more forward-looking and improve education and while e-learning has improved certain drawbacks of traditional learning (Abou El-Seoud, et al., 2014), educators still proceed to find ways to improve student motivation and engagement in the learning process.

Therefore, the inclusion of game elements have been looked at in a pedagogical view, bringing light to 'Gamification' in education. Games are typically fun and entertaining and it evokes concentration, curiosity and makes individuals lose track of time in trying to progress (Aleksic-Maslac, et al., 2017). Consequently, at present, gamification is gaining ground in e-learning while improving the features of education. Gamification, if properly used in e-learning, can increase satisfaction, engagement, efficiency and effectiveness in students (Urha, et al., 2015).

Gamification, by definition is the inclusion of game elements to a non-game context (Deterding, et al., 2011). This concept is being used not just by educators but in other areas as well, aiming to engage individuals in activities specific to that domain. Education, by its own, is not in a game context and is the process of facilitating the resources for the acquisition of knowledge, skills and information through learning. By gamified learning, students will feel ownership over their learning and gain self-confidence in the game environment, feeling delighted with academic work as well (Bicen & Kocakoyun, 2018).

While the effects of gamification in higher education have been reviewed, a lacuna was identified of studies comparing gamification with the traditional lecture method that is extensively used in universities, specifically in regards to motivation and engagement in the Sri Lankan Higher education context. In view of motivation and engagement, students lack instant delight with typical lectures and as a result, students will lack the motivation to learn and to engage and participate in the learning process (Jayasinghe & Dharmaratne, 2013), therefore gamification is pursued as a solution. In order to determine whether gamification can evade the problems of the lecture method and if the game elements of gamification can influence students' motivation and engagement in learning in the Sri Lankan higher education context, the following questions have to be answered to achieve the proposed objectives:

- How different is the effectiveness of gamified learning and learning through traditional lecture method in terms of student performance?
- How the perceptions of the students vary between gamified learning and learning through the traditional lecture method?
- How to identify which elements of gamification effect the motivation and engagement of students in their learning process?

Hence, the upshots of this research was driven on identifying the significance of feasibility of gamified learning in universities in improving motivation and engagement of students to the learning process, as well as determining if gamified learning is better than learning through the lecture method while assessing the perception and effectiveness in terms of performance of the students towards the two methods. If the efficiency of gamified learning is determined, it can be adopted in future by university educators of Sri Lanka and will contribute to future researchers who can gain insight into studying this area further.

LITERATURE REVIEW

Teaching and learning are two facets of a coin, where good teaching will amount to how well the students learn (Sajjad, 2010). The teacher presents the necessary content and skills which enhances and provides opportunities for the students to learn. In a stereotypical higher education environment, the learning process consist of lectures conducted by lecturers with a large number of students following a teacher centered method. This has been defined as the lecture method (Afurobi, et

al., 2015). This learning method has been used for a long time in universities, where lecturers teach the subject to a large group. It was discovered that this teaching method may not be as useful to students anymore, given that it does not encourage thinking 'out of the box' but cramming information, while not looking at the practical side of the subject (Jayasinghe & Dharmaratne, 2013). Most students in university now can be known as 'digital natives' who are used to receiving information very fast and are integrated to other areas and digital equipment (Prensky, 2011). As one step further, a new concept known as E-learning, i.e. electronic learning, was established.

E-learning is the concept of using electronic means of transferring knowledge in the education process, enabling communication and learning. With its use of technology in the learning practice, students are more receptive, motivated and engaged in it than in traditional lecture methods as students are able to share data and information easily (Abou El-Seoud, et al., 2014). It is a broad area, extended to synchronous and asynchronous-learning, learning management systems, virtual learning environments, blended/hybrid learning, etc.

Additionally, games started to be incorporated into teaching as well, both manually and electronically. Games give its players a desire to reach a certain goal which gives a sense of accomplishment, bringing out good levels of motivation, engagement, behavioral patterns and emotion (Šćepanović, et al., 2015). Therefore, games made a base in e-learning. "Edutainment", coined by joining education and entertainment, became a concept to bring in subject matters with methods of entertainment. which games are. It brought up two new avenues to e-learning: Game learning and gamification (Jayasing Dharmaratne, 2013). Game based lea involves the usage of video games in the learning process whereas gamification is the application of game design elements non- game context. Game based learning and gamification in education are sometimes thought of interchangeably but has a very well-defined difference. It differs by concept, objectives, challenges, character, techniques, benefits, rewards, levels, cost and content (Al-Azawi, et al., 2016).

Gamification is embedding game elements to a non-game context (Deterding, et al., 2011); education in this case. Deterding, et al. (2011) explains game elements as the characteristics of a game. According to Cheong, et al. (2014), there are two perspective to game elements. In one perspective, these elements can be divided into levels of abstraction through design, including game interface design pattern, game design patterns and mechanics, game design principles and heuristics, game models and game design methods as described by Deterding, et al. (2011). The other perspective is the division of game elements into three categories as: Game Components, Mechanics and Dynamics, which are looked at in the view of a pyramid (Table I) as developed by Werbach & Hunter (2012). It presents game elements in three stages. The 1st stage, Components are the specific creations of instances of the mechanics and dynamics. They are the elements that gamify the environment. The mechanics are the processes that drives the action of players forward while dynamics present the aspects of a big picture of gamification.

Table 1: Pyramid of Game Elements (Werbach & Hunter, 2012)

Category	Elements
Dynamics	Emotions, Relationships, Progression, Narrative, Constraints.
Mechanics	Competition, Feedback, Corporation, Challenges, Rewards.
Components	Points, Badges, Leaderboards, Levels, Achievements, Avatars, Teams.

Game components primarily consist of points, level and leaderboards, coined by Werbach & Hunter (2012) as the PBL Triad which are used as the basic of elements when gamifying lessons. However, in the research conducted by Jagušt, et al. (2018), its results suggested that additional game mechanisms beyond leaderboards and points are required to get more positive outcomes, which was also a notion brought up by Laskowski (2015) and Lamprinou & Paraskeva (2015).

There are different tools and systems which could be used to gamify the learning process (Lamprinou & Paraskeva, 2015) (Bicen & Kocakoyun, 2018) (Figueroa-Flores, 2016) such as:

- Socrative
- Class craft
- Class Dojo
- Ribbon Hero and Ribbon Hero 2
- Kahoot

By using either ready-made gamification applications or implementing new gamification designs, studies have aimed to look at how effective gamification is as a teaching method to be able to aid well in the students' learning process.

Students introduced to gamification and game elements perceived it with favourable reactions to it, as it induces social interaction, engagement and feedback (Cheong, et al., 2014) which was the case in many studies (Bicen & Kocakoyun, 2018) (Limniou & Mansfield, 2018) (Hitchens & Tulloch, 2018) (Fotaris, et al., 2016). It was recognized by Hamari, et al. (2014) in reviewing many empirical studies, how motivational affordances (points, badges, leaderboards, rewards, etc.) influence psychological outcomes (motivation, attitude, enjoyment) and behavioural outcomes in gamification, conceptualized in the study as shown in Figure 1. It identified motivational affordances as the independent variables that influence one dependent variable, psychological outcomes which next affects the other dependent variable, behavioural outcomes. Hamari, et al. (2014) presents game elements as the motivational affordances that impact the psychological outcomes such as motivation and engagement which is a product of behavioural outcomes as well considering participation.

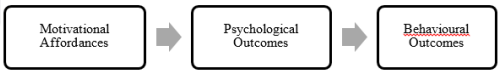


Figure 1: Conceptualization of Gamification (Hamari, et al., 2014)

The perception in the mind of the student can determine how motivated they would be. According to Clark, et al. (2006), motivation stands as a key to accomplishing students' learning and performance goals by devoting their 'mental effort' to the process. It has been often found that students, who were introduced to gamification, had favorable reactions to it, as it induces confidence, engagement and attention (Hamzah, et al., 2015). Additionally, to highlight the influence of motivation, gamification has been looked upon the self-determination theory (SDT), which was applied by Lamprinou & Paraskeva (2015), concluding from the study that students' intrinsic motivation is positively impacted by gamification. In certain investigations, results of the researches showed that students are in fact motivated by gamified lessons, especially when it comes to the sense of achievement, rewards and teamwork and also competition (Cheong, et al., 2014) (Bicen & Kocakoyun, 2018).

The effects of gamification have been identified to have a clear impact on motivation and engagement simultaneously. Links have been drawn to

these two variables, including how an individuals' perception can effect it as well. By qualitatively evaluating the link between these two concepts, Saeed & Zyngier (2012) have concluded that intrinsic and extrinsic motivation can each possess a different relationship with engagement.

Engagement is an aspect that is influenced by gamification which can be behavioural, emotional or cognitive. Considering the engagement of students to gamification in past studies, engagement typically regarded synonymously to participation and involvement according to the past researches. Administrative data such as attendance to class and in activities and observing the class dynamics have been used to evaluate engagement (Aleksic-Maslac, et al., 2017). Alternatively, another aspect looking at active participation and interest towards the lesson as forefront factors of an engaged classroom of student (Fotaris, et al., 2016). However, within this array of studies that have had good reactions to gamification, negative aspects have been cited; gamification has been deemed "childish" and "a futile attempt at encouraging students to a learning style not really needed" in the study by Hitchens & Tulloch (2018). Turan, et al. (2016) found that certain students found gamification making an "unnecessarily competitive environment", "had no benefit to learning" and is "redundant" as it causes demotivation through jealousy. These responses show how different individuals view gamification in different way, leading to further research to understand gamification as an e- learning tool.

The effectiveness of teaching methods can be assessed by gaining the feedback from the learners on how they perceive they have reached the learning outcomes and how motivated or engaged they were by the lessons. Ultimately, a universal measure of the level of knowledge is academic performance, where the results to tests determine how well the lessons have been grasped by the students. Gamified groups of the studies of Strmečki, et al. (2016) and Huang & Hew (2015) have shown higher levels of performance than non-gamified groups. On the contrary, motivation and engagement have had positive outcomes from gamification in two studies, however, the average marks of students in a gamified lesson was less than the students of the non-gamified group (Laskowski & Badurowicz, 2014) (Laskowski, 2015). Plessis (2014) identified that the effectiveness of gamification as an e-learning strategy can be evaluated by assessing the areas of skills and knowledge acquired by students through gamified learning by having students to complete a test.

With this research, in gathering information from secondary sources, the aspects of students' motivation and engagement on gamification were thoroughly examined, while giving a focus towards perception and the effectiveness in terms of performance as well. Gamification within primary education (Halloluwa, et al., 2016) (Ranathunga, et al., 2014) and a study of gamification focusing on gamified and paper-based assessments for English as a second language (ESL) university students (Premarathne, 2017) in Sri Lanka has been studied. While there are a number of studies on motivation and engagement overseas, it is rare in the Sri Lankan Higher Education context. Therefore the significance of this study is to understand the effects of gamification on students' motivation and engagement in higher education as part of their learning process, within the Sri Lankan context. A lacuna of empirical studies comparing traditional lecture method and gamification in education and of mixed methods of research as well (Raed, 2018). As a result, this research attempts to bridge these gaps

identified from reviewing past studies on gamification in education.

CONCEPTUAL FRAMEWORK

The independent variables are the Game elements as identified by Werbach & Hunter (2012) comprising of Components, Mechanics and Dynamics.

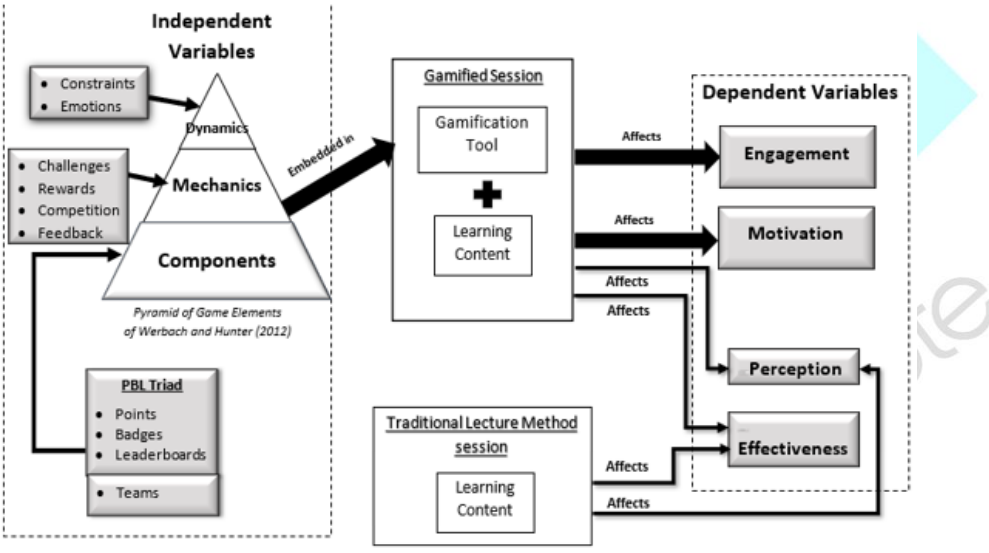
Under Components, "Points" are the numerical accumulations in completing an activity accurately and "Badges" represent achievements visually, while "Leaderboards" rank the players according to their success and "Teams" defined as a group of players working together.

Mechanics include "Challenges" which are the efforts needed to complete activities through constraints. Moreover, "Rewards" are for achievements of the players and "Competition" is the sense of wanting to outdo the other players.

the reactions such curiosity and competitiveness that drive the user experience. The independent variables are the game elements that will affect the dependent variables as seen in the conceptual framework. The independent variables are taken from each level of the pyramid of Game elements by Werbach & Hunter (2012) because the addition of merely the components of the PBL triad has been deemed insufficient (Laskowski, 2015). The game elements are further derived from the motivational affordances identified in the conceptual framework by Hamari, et al. (2014).

Cheong, et al. (2014) has determined the students' perception on individual game element by ranking them individually. Since it has been determined that perception is

Figure 2: Conceptual Framework



Constraints restrict the players, to make achievement tougher and Emotion In addition, feedback is the status received immediately to players through a visual displays. As Dynamic elements, conveys

an influencing factor to motivation and consequently, engagement (Saeed & Zyngier, 2012), the same concept is linked to motivation and engagement on gamification (Fotaris, et al., 2016).

Effectiveness as a variable was researched by Plessis (2014) to determine it in terms of gamification as an e-learning tool. The concept from these studies were drawn for the above conceptual framework, forming the 4 dependent variables.

The effectiveness of both gamified learning and learning through the traditional lecture method can be tested to see if gamification is better than the traditional lecture methods in terms of students' performance in both. The perception of the students on both of these methods are compared to see what the students think is the better method of learning. The impact on the motivation and engagement can be determined by inserting the game elements to the learning contents through a gamification tool.

METHODOLOGY

The research was conducted by getting the participation of undergraduate students from the Sri Lanka Institute of Information Technology. Primary sources and secondary sources (journal articles, books, theses, etc.) of information gathering were used. Mixed methods are found to be more preferred as it is rigorous, has a deeper meaning and present multiple perspectives (McKim, 2017). It was identified by Hamari, et al. (2014) that there a number of studies using quantitative and a substantial amount of qualitative studies but a fewer studies with mixed methods. Raed (2018) proposed future studies to apply mixed methods as well, since it would provide better understanding of the effects of gamification in a "more holistic way"

Experiments have been used in past researches to determine the effects of gamification on students' learning in the past studies reviewed. Therefore an experiment was conducted to see the difference in effectiveness and perception of students regarding gamified learning and learning through the traditional lecture method. A module, 'Principles of Management', conducted for the 1st Year students in the Business faculty of SLIIT was used where 4 topics in this module were covered for the both the experimental group and the control group, with the respective methods specified. The sample for the study was based on convenience sampling. The 1st year students' were selected with the same lecturer teaching the same module. They have been divided into 2 batches by the university itself, of which the two were taken as the two separate groups. Both the batches consisted of 116 registered students each.

The sessions for the control group involved the usual ways in which the lecture is done in the institute. The session for the experimental group was done with the usual proceedings of the university, with the addition of the gamification tool, "Kahoot!", for the lesson. The independent variables are all identified to be existing within 'Kahoot!' according to the study conducted by Bicen & Kocakoyun (2018), except rewards, which were externally given in the form of candy for the 1st, 2nd and 3rd place holders following the practice of Fotaris, et al. (2016). The effectiveness of gamification according to the performance of the students was assessed through a test at the end of the experiment, where both groups received similar questions, under similar circumstances. A survey was simultaneously conducted to determine the perception of both groups and to determine the motivation of the students from the experimental group on the gamified lessons. The instrument used for the research was 5 point Likert scale questionnaires that consists of two parts: one part covered perception and the other covered "Motivation", specifically for the game elements. Both tests and survey were given to the students who attended classes on the last session of the experiments, including the interviews at the end to obtain additional information.

Observation was carried out during the sessions, taking notes of students' behaviour in class using Kahoot.

Table 2: Sample Sizes

Method	Batch	Sample Size (After Eliminations)	Eliminated (Missing data)
Test	Control	76	-
	Experimental	75	-
Survey	Control	75	1
	Experimental	72	2

measure the reliability and internal consistency of the questionnaire to assess the closeness of relationship between the scale items or test data in the instrument as a group.

Table 3: Cronbach's Alpha- Reliability Statistics

Questionnaire Section	Group	Reliability Statistics		Reliability and Internal Consistency
		Cronbach's Alpha	No. of Items	
Part A	Control	0.934	11	Very good
	Experimental	0.917	11	Very good
Part B	Experimental	0.867	11	Good

Table 3 shows that the data gathered from the questionnaire used for both of the two groups of students and each of its divisions have the more than acceptable levels of reliability and internal consistency. Therefore, the rest of the analysis proceeded.

In order to identify the appropriate methods of inferential statistical analysis, the pattern of distribution has to be determined. A test of normality was used to identify normal distribution, in order to decide on the use of either parametric or non-parametric analysis. The Shapiro-Wilk test was used and it showed that the responses for perception were not normally distributed (all responses: $p<0.05$) and effectiveness, through the test for both groups, were normally distributed (control group: $p=.459$, experimental group: $p=.110$). The responses for the part B concerning motivation showed that the data was not normally distributed as well (all elements: $p<0.05$).

Effectiveness- Student Performance

Table 4: Descriptive Statistics- Effectiveness

Batch		N	Mean	Std. Deviation	Std. Error Mean
Marks	Control Group	76	13.133	3.6702	.4210
	Experimental Group	75	15.781	3.4597	.3995

Table 5: Independent Samples T-test Statistics

		Levene's Test for Equality of Variances		T-test for Equality of Means	
		F	Sig.	Sig. (2 tailed)	Mean Difference
Marks	Equal Variances assumed	0.15	0.904	0.000	-2.6484
	Equal Variances not assumed			0.000	-2.6484

Since data from the test had a normal distribution, the independent samples t-test was used for the comparison between the two groups.

The means of the two groups show that the students in the experimental group have scored higher than the control group (Table 4). It can be seen from the Levene's test (Table 5) that there is equal variances being assumed, looking at the level of significance at a 5% error rate ($p=0.904$). Accordingly, the t-test for equality of means shows the t-statistics of -4.562 with 149 degrees of freedom and the corresponding level of significance shows that at an error rate of 5%, there is a significant difference between the control and experimental group of -2.6484.

Perception

The data was collected for 11 responses on perception, with a variable "Overall Perception" being calculated as the mean of each response.

Considering the descriptive statistics of the control group (Table 6), the overall perception of the lecture method is 4.43. The responses with the highest means are: R6 (4.65), R1 (4.64) and R3 (4.63). The mean of the overall perception of the experimental group is 4.16, where the

responses with the highest means being R1 (4.41), R3 (4.24) and R4 (4.23).

Table 6: Mean of Responses- Perception

	Responses	Group	Mean
R1	Fun and engaging	Control	4.64
		Experimental	4.41
R2	Motivated to attend classes	Control	4.41
		Experimental	4.14
R3	Clear & Logical Learning materials	Control	4.63
		Experimental	4.24
R4	Improved understanding of covered topics	Control	4.44
		Experimental	4.23
R5	Effective information transmission	Control	4.37
		Experimental	4.05
R6	Prepares for test	Control	4.37
		Experimental	3.91
R7	Good teacher-student relationship	Control	4.65
		Experimental	4.15
R8	Easy understanding of learning content	Control	4.40
		Experimental	4.01
R9	Improved thinking and problem solving skills	Control	4.29
		Experimental	3.93
R10	Impact on long term memory	Control	4.13
		Experimental	3.82
R11	Satisfaction	Control	4.33
		Experimental	4.01
	Overall Perception	Control	4.43
		Experimental	4.16

the test results, all the activities of the control group have the highest mean ranks and summed ranks than the experimental group (Table 7). In relation to the descending order of the difference in mean ranks between two groups, R7, R6, R3, R8, R9, R5, R11, R10, R2, R1 and R4. R7 shows the largest difference in mean ranks between control and experimental group. The smallest difference in mean ranks between control and experimental group was shown response R4.

When considering U statistics (Table 8), all activities have bigger U values consequently; have smaller difference between the groups. R1 (U=2380.500, z=-1.758, p=0.079) and R4 (U=2424.000, z=-1.463, p=0.144) have no significance difference between control and experimental group as a result of having p > 0.05 values. From this data, it can be concluded that R2, R3, R5, R6, R7, R8, R9, R10, R11 and Overall Perception in the control group were all statistically significantly higher than the experimental group.

Table 7: Mann-Whitney U-test Ranks

	Responses	Group	Mean Ranks	Sum of Ranks
R1	Fun and engaging	Control	80.26	6019.50
		Experimental	69.67	5155.50
R2	Motivated to attend classes	Control	81.99	6149.00
		Experimental	67.92	5026.00
R3	Clear & Logical Learning materials	Control	85.22	6391.50
		Experimental	64.64	4783.50
R4	Improved understanding of covered topics	Control	79.68	5976.00
		Experimental	70.26	5199.00
R5	Effective information transmission	Control	83.91	6293.50
		Experimental	65.97	4881.50
R6	Prepares for test	Control	87.47	6560.50
		Experimental	62.36	4614.50
R7	Good teacher-student relationship	Control	89.41	6705.50
		Experimental	60.40	4469.50
R8	Easy understanding of learning content	Control	84.41	6330.50
		Experimental	65.47	4844.50
R9	Improved thinking and problem solving skills	Control	84.19	6314.50
		Experimental	65.68	4860.50
R10	Impact on long term memory	Control	82.12	6159.00
		Experimental	67.78	5016.00
R11	Satisfaction	Control	82.81	6210.50
		Experimental	67.09	4964.50
	Average Overall Perception	Control	82.87	6215.00
		Experimental	67.03	4960.00

Table 8: Mann-Whitney U-test Statistics

	Responses	Mann-Whitney U	Z	Asymp. Sig. (2 tailed)	r= z/√N
R1	Fun and engaging	2380.500	-1.758	0.079	-0.144
R2	Motivated to attend classes	2251.000	-2.179	0.029	-0.179
R3	Clear & Logical Learning materials	2008.500	-3.307	0.001	-0.271
R4	Improved understanding of covered topics	2424.000	-1.463	0.144	-0.120
R5	Effective information transmission	2106.500	-2.740	0.006	-0.224
R6	Prepares for test	1839.500	-3.827	0.000	-0.314
R7	Good teacher-student relationship	1694.500	-4.612	0.000	-0.378
R8	Easy understanding of learning content	2069.500	-2.881	0.004	-0.236
R9	Improved thinking and problem solving skills	2085.500	-2.791	0.005	-0.229
R10	Impact on long term memory	2241.000	-2.162	0.031	-0.177
R11	Satisfaction	2189.500	-2.384	0.017	-0.195
	Average Overall Perception	2185.000	-2.451	0.014	-0.201

Motivation

Exploratory Factor Analysis can identify the underlying variables or the factors that lie within many independent variables that can influence the dependent variable (Gaur & Gaur, 2009). Firstly prior to conducting the factor analysis, the Kaiser-Meyer-Olkin test and Bartlett's test

was done to assess if conducting factor analysis to this data is suitable. According to the Table 9, it shows the KMO value is 0.856 and the approximate of Chi-square is 272.609 with 45 degrees of freedom which is significant at 5% level of significance ($p<0.05$), which shows that the data in this study is suitable for factor analysis.

Table 7: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.856
Bartlett's Test of Sphericity	Approx. Chi-Square	272.609
	df	45
	Sig.	.000

Principle component matrix was used as the extraction method and the rotation method used was Varimax, which is the most frequently used. The communalities show the total amount of variances that can be explained by the extracted factors as seen in Table 10.

Table 8: Communalities

	Communalities		% of total variance explained by extracted factors
	Initial	Extraction	
Points	1.000	.514	51.4
Badges	1.000	.583	58.3
Leaderboards	1.000	.536	53.6
Teamwork	1.000	.582	58.2
Challenges	1.000	.539	53.9
Rewards	1.000	.651	65.1
Competition	1.000	.706	70.6
Feedback	1.000	.609	60.9
Constraints	1.000	.562	56.2
Emotion	1.000	.504	50.4

As seen in Table 11 below, the initial eigenvalues explains the total variances explained by all the variables. The factors with eigenvalues higher than one after extraction are considered. Accordingly, the cumulative percentage shows that 57.8% of the variance can be explained by Scree plot (Figure 3) where its slope changes from steep to shallow after the second component.

Table 9: Total Variances Explained

	Initial Eigenvalues/ Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumu. %	Total	% of Variance	Cumu. %
1	4.572	45.721	45.721	4.335	43.349	43.349
2	1.212	12.122	57.843	1.449	14.494	57.843
3	.882	8.821	66.664			
4	.771	7.708	74.372			
5	.610	6.103	80.475			
6	.556	5.563	86.038			
7	.452	4.523	90.561			
8	.372	3.719	94.280			
9	.342	3.421	97.701			
10	.230	2.299	100.000			

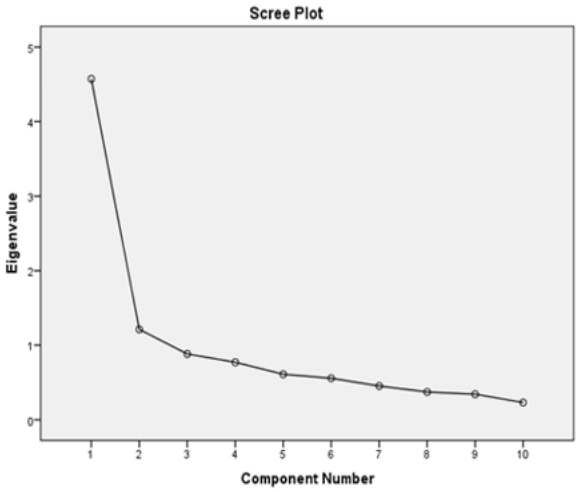


Figure 3: Scree Plot

The component matrix (Table 12) shows the component loadings prior to rotation, whereas Rotated Factor Matrix shows the rotated loadings. The component loadings are essentially the correlation coefficient between the variable and the factor. A good factor solution reflects high loadings on one factor and low on all other factors in the rotated factor matrix, where less than 0.40 of a loading is dropped off (Gaur & Gaur, 2009). Therefore, considering the rotated factor loading, Factor 1 consists of the elements "Badges", "Leaderboards", "Challenges", "Rewards", "Competition", "Feedback", "Constraints" and "Emotion" and Factor 2 consists of "Points" and "Teamwork".

Table 10: Component Matrix (Including Rotated)

	Components Matrix		Rotated Components Matrix	
	Components		Components	
	1	2	1	2
Points	.276	.661		.711
Badges	.739	-.191	.763	
Leaderboards	.726		.674	.287
Teamwork	.255	.719		.761
Challenges	.720	-.144	.732	
Rewards	.798	-.120	.801	
Competition	.838		.823	.166
Feedback	.761	.170	.689	.366
Constraints	.652	-.369	.727	-.183
Emotion	.704		.654	.275

Through factor analysis, the factor scores can be used as the independent variables to assess the impact to the dependent variable (Gaur & Gaur, 2009). Therefore, the factor scores for Factor 1 (RFS1) and Factor 2 (RFS2) were applied to regression analysis.

Table 11: Regression Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.629	.395	.378	.692

The model summary explains the overall model fit of the variables. The R square being 0.395 can be interpreted as 39.5% of the variance in motivation can be explained by both factor scores. It indicates the existence of a relationship of the model with Motivation.

Table 12: Regression- ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	21.597	2	10.799	22.570	.000
	Residual	33.014	69	.478		
	Total	54.611	71			

Looking at the ANOVA table, the first figure of concern would be the level of significance. Table 14 shows the regression model is a right fit for the data to determine the impact to Motivation at a 5% error rate ($p<0.05$).

Table 13: Regression- Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	4.139	.082		50.772	.000		
	RFS1	.537	.082	.612	6.537	.000	1.000	1.000
	RFS2	.127	.082	.145	1.553	.125	1.000	1.000

As seen from Table 15, from the unstandardized coefficients, the regression equation can be given as:

Equation (1):

Motivation=4.139+0.537(RFS1) + 0.127(RFS2)

However, Factor 2 with the factor loadings of "Points" and "Teamwork" can be seen as a statistically insignificant predictor ($p>0.05$). This reflects that Factor 1 has a statistically significant impact on Motivation ($p<0.05$).

Table 14: Mean and Correlation Coefficients

Elements	Mean	Correlation	Sig.(2-tailed)
Points	4.11	0.177	.138
Badges	4.10	0.513	.000
Leaderboards	4.18	0.546	.000
Teamwork	4.10	0.051	.671
Challenges	4.00	0.549	.000
Rewards	4.11	0.540	.000
Competition	4.03	0.574	.000
Feedback	4.14	0.456	.000
Constraints	3.93	0.471	.000
Emotion	4.24	0.613	.000
Motivation	4.18		

Table 16 shows the means and the non-parametric correlation statistics, Spearman rank-order correlation coefficient. When subjected to ranking the elements by means, Emotion, Leaderboard and Feedback were highly rated.

Subsequently, when the correlation coefficient is looked at, it demonstrates that "Emotion" has the highest r value that indicates 0.613 and $p<0.05$, which shows a statistically significant, moderately positive correlation with Motivation. In second is "Competition" which has a similar relationship with Motivation ($r=.574$, $p<0.05$), whereas thirdly "Challenges" and Motivation have a similar relationship ($r=.549$, $p<0.05$). On the contrary, "Points" ($r=0.177$) and "Teamwork" ($r=0.051$) indicates a weak relationship with Motivation compared to other elements. Since the significance level of "Points" and "Teamwork" are less than 0.05, there is no statistically significant relationship either.

Qualitative Analysis

Engagement

The engagement has been determined by observing the behaviour of students during the gamification session (Fotaris, et al., 2016), however it was seldom used in other qualitative and mixed methods. Therefore, observation was used.

On the first day of the sessions, with the introduction of the Kahoot application, the students found it confusing as it was a new method used. Once the initial confusion on how to use it was expelled, the following characteristics were observed:

- Concentration and teamwork displayed when the question appears, characterized by discussions among team members to accommodate to the time constraint.
- The active discussions among all the students in the class increased the noise level in the classroom, especially by teams that had finished answering well within the time constraint and the students at the back end of the classroom. The class was the noisiest when the answers were given and the leaderboards were displayed.
- Body language shows the students to be relaxed and happy, demonstrated by smiles and laughter, especially at the moments of the display of answers and the leaderboard and cheers and applause during the presentation of the rewards to the winning teams.
- Certain students seemed confused and visibly upset when their team names were not on the leaderboard (leaderboard shows only the top 5).
- Students seemed frustrated during times of technical difficulties, since their progress and overall performance is negatively impacted.
- Students seemed agitated when the number of questions reached to 20 and the time given to answer was long.

Overall, the classroom displayed a care free environment with active participation by students. These characteristics were displayed during all the Kahoot session done, however, at the last session, additionally, these characteristics were observed:

●Certain students portrayed negative facial expressions seeing that the Kahoot session was being set up.

●There was active participation but the level of enthusiasm since the last sessions were noticeably reduced and much calmer.

●The end of the session was much calmer, with visible relief and obligatory applause during the presentation of the rewards.

Semi- structured in-depth Interviews

In-depth interviews were carried out to determine any new insight to how the students were motivated and engaged. Figure 4 depicts the positive and negative responses out of a total of 12 students:

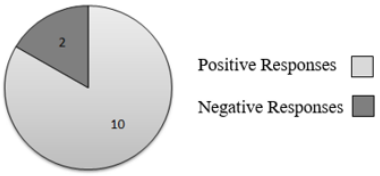


Figure 4: No. of Positive and Negative Responses

Table 17 reports the findings through the responses regarding each game element.

Table 15: Responses and Findings- Game Elements

Game Element	Findings
Points	• The most common response to this element was "good" (n=9). • The two students who found gamification negative and one overall positive student's reaction was "We didn't know how the points were given to the answer". They found that the point system was not transparent enough, including how the bonus points for the time limit worked.
Badges	• Most students, even those who were not in the top 3, portrayed it positively with responses such as "It was nice to see the winners". • However, some students implied that it did not impact their overall view (n=1). The response was "It was okay but does it have any impact?"
Leaderboards	• The responses were mostly positive, where students noted that receiving the leaderboard at the end of each question was "very good", since it was a "simple and uncomplicated way" to know their progress and also "motivational" since it pushes the students to being on top. • The problematic notion regarding this element was that it did not show all the players and only the top 5: "Leaderboards should include all the teams than just the top players to know where we stand".

	simple". Some students did not recognize the constraints as impactful.
Competition	• "Good" and "effective" were the responses from most students. Most students explained how elements like the leaderboards, rewards and the time constraint made the gamified session engaging through competition. • The students that had an overall negative view of gamification stated that competition "doesn't help them remember the subject matter" and is "unnecessary".
Feedback	• A majority of students' responses were "good", "we enjoyed it and it was fun" and "refreshing". • Some students found the feedback for answers were too slow, with one student stating that "the problem was that we have to wait for other teams to finish for us to if we are right". • Another student's concern was that it they didn't get the correct answer clearly stating that it "would be better if the correct answers were given for the students' devices apart from the screen" than the graphical view shown in Kahoot.
Emotion	• The highlighted words were "fun", "enjoyed", and "excited", "hyped" and "happy" • The two students simply had blank expressions stating that they "didn't feel anything" and "felt frustrated because valuable time was spent for this".
Teamwork	• This was deemed "effective working with own friends" and that "makes it easier to answer correctly and quickly" and "more fun". • Most opinions were positive except 2 students who critiqued it as an opportunity for "free riding" and "unfair to the students with knowledge".
Challenges	• Some students found this element positive because "challenges makes it more competitive". • The way in which students identified challenges were different between certain students. Certain students found the time constraint as a challenge while others found teamwork as challenge. • Although a minority, certain students did not find any challenge within the gamified session.
Reward	• "Good" was the immediate response from the students with the follow up of being "effective. One student elaborated it saying "it is engaging because you need to win and take that prize". • The negative responses to this element was that "it felt like bribery" and that it was "too simple for the time and effort" taken for the gamified session. One student stated that "it would be better if something with more depth was given" than candy.
Constraints	• Most students found the constraints "effective", recognizing the time constraint to answer while others found it to be "too

Although for the majority of the students found gamification to be enjoyable, all students expressed that their progress was affected by the drops in the internet connectivity:

- "We answered being in 1st Place but the last grade came as 3rd"
- "We could not enter the answers for few questions as connection was lost".

Overall, 8 students preferred gamified learning, 2 students did not like gamification method and 2 students preferred a balance between gamification and a traditional method.

The following responses reflect the negative statements (n=2) towards gamification when they were inquired if the gamified sessions were motivational, engaging, stimulated their curiosity and if the sessions were of value:

"It seemed like a childish effort"

"It seems unnecessary for learning the subject"

"Playing it during lessons felt like a waste of time" On the contrary, the positive responses of the students (n=10) were as follows:

"It was fun and engaging"

"I has a really good new experience"

"It was better than writing notes"

"By understanding the question and getting to know the answer, it's tracing the mind, so it will be easy to learn."

"It made the lessons easy to learn"

"It was a perfect experience"

"I wish it were implemented for other modules"

"Would like to experience more sessions like this"

"In normal classroom & lectures, we just listen to what the lecturers are saying, going through the tutes but this was more engaging and now we remember the theory because of the game discussing and doing it. So it goes in to our mind more when we do something like that";

DISCUSSION

In order to determine the difference in effectiveness in terms of test performance between the two groups, the statistics from the independent samples t-test shows a statistically significant difference with a mean difference of 2.65 which indicates that the students in the experimental group, have scored higher than the control group. Considering experiments between gamified and non-gamified groups, these results had similar patterns in past studies, deriving results showing the gamified groups' performance as statistically significantly better (Huang & Hew, 2015) (Strmečki, et al., 2016). This answers the question that seeks to determine the effectiveness of the two methods in terms of performance, showing that the gamification is effective than the traditional lecture method in terms of students' grades.

From the eleven responses to identify the level of perception, the top response for the traditional lecture method was "Promotes good teacher-student relationship". The experimental groups' top response was "fun and engaging". In the view of the results from the inferential statistics, it was uncovered that there is a statistically significant difference between the perceptions of the two groups, where the perception of the control group was higher than of the experimental group. The responses that had the most statistically significant differences were "Good teacher-student relationship", "prepares for test" and "clear and logical learning materials". This result is different from the conclusion derived by Limniou & Mansfield (2018), where the items used to determine what the students think of their learning experience was higher for the gamification approach. Certain studies have exposed students to both the traditional or non-gamified approach without dividing into groups and reported

that the students prefer the gamified approach than the non-gamified approach (Cheong, et al., 2014) (Fotaris, et al., 2016). This disparity could be explained taking into account that the control group have not been exposed to gamification and are perceiving the lecture method through different dimensions, including teaching characteristics competencies, which is a testament to the effectiveness of the lecturer (Pavlina, et al., 2011). Further, "fun and engagement" and "improved understanding of covered topics" has a statistically insignificant smallest difference. The second research question is answered; the control group has a higher perception on traditional lecture method than the gamified group. Despite a higher perception level of the control group, the experimental groups' perception towards gamification is still positive with a mean of 4.16 out of 5 in the Likert scale. This is confirmation that this study has found that students like and have a good perception of this method as identified by many past studies (Cheong, et al., 2014) (Fotaris, et al., 2016) (Hitchens & Tulloch, 2018) (Bicen & Kocakoyun, 2018)

Since the perception of the experimental group does not statistically reflect negativity for gamification, its effect can be further scrutinized to determine the motivation and engagement of the students in the experimental group as per the third research question by assessing the impact of the elements to motivation and engagement. From the descriptive statistics, the elements were subjected to mean ranking. Emotion, Leaderboard and Feedback were highly rated by the students. Additionally, exploratory factor analysis presented a two factor solution which allows the factor scores of these components to be analysed by regression. Accordingly, it was determined that the two factors attribute to a 39.5% variance in motivation. Factor scores of Factor 2 consisting of "Badges", "Leaderboards", "Challenges", "Rewards", "Competition", "Feedback", "Constraints" and "Emotion" had a statistically significant impact to motivation, while the other factor with "Points" and "Teamwork" did not. The correlation analysis found that "Points" and "Teamwork" do not have a statistically significant relationship with overall motivation as well, whereas "Emotion", "Competition" and "Challenges" were closely but moderately correlated to motivation.

The variables of motivation and engagement were further examined by gaining more insight from the students, directly from them and through observation. In terms of engagement, their behaviour to certain elements poses as confirmation to their responses:

Most students liked teamwork and this was clear where many students were helping each other by iterating answers and having discussions with their teammates.

Receiving the leaderboards was deemed effective and the feedback was thought to be fun and enjoyable by the students. The behaviour after the questions had been answered and the feedback was given was observed to be as the students explained, with the students cheering for correct answers. The disappointment of certain students on the representation of only the top teams as stated in the interviews were observed during the sessions, noticing the looks of confusion.

Emotions were visible by the dynamics of the classroom, displaying an enjoyable and carefree environment, as explained by the students as fun, hyped and happy. This was the element with the most positively and statistically significant relationship to overall motivation as well, reflecting how the emotions from gamification can intensify their motivation and engagement to the learning process.

While many students enjoyed the Kahoot sessions, which was reflected in their

responses to the interviews and survey, the loss of internet connectivity played a huge role as a point of disappointment. Performance decreased with the network problems as "Points" are highly influenced by time. Reduction in points impact the other elements as well. This problem has been identified previously in studies that have used Kahoot, as a point of negativity in students despite an overall positive outlook (Bicen & Kocakoyun, 2018). This could be a reason affecting students' perception in the experimental group, also noted by their negative facial reactions, with several teams speaking out about it in class. Regardless, participation to the lessons were very well observed, seen through their keenness and the insight given through interviews. Another aspect seen through observations was that students were much calmer and disposed than the initial session. This could be attributed to the concept of the novelty effect wearing off as pointed out by Hamari, et al. (2014) despite it being only 3 sessions. However, it can be pointed out that although "Points" and "Teamwork" were statistically insignificant to motivation, the combination of all game elements presented in the conceptual framework of this research, altogether poses an impact to overall motivation and engagement of the students in the gamified group by analysing the behaviour and responses.

CONCLUSION

This research has obtained the answers to all the research questions that aimed to study the effects of gamification on motivation and engagement and the differences between learning through traditional lecture method and the gamification method in the higher education context of Sri Lanka. While the control group had a higher level of perception about the lecture method, by test performance, the gamified group performed well. Therefore, the positive effects of gamification can be established with the additional determination of a positive impact game elements have on the motivation and engagement of the students that learned through gamification. Additionally, this research shows that determining gamification as an effective e-learning tool is not just by the influence of the specific game elements but by the efficiency of the technology used and the overall experience and dynamics of a gamified environments.

While this study has determined the effects of game elements, future researchers should focus on identifying different preferences of game elements for an effective gamification tool that can significantly improve the drawbacks of traditional methods and for the better acceptance of gamification within the higher education context. Further, focus can be given to analyse the impact of gamification on motivation and engagement, in this same context and in the long run to understand its success as an effective e-learning tool.

REFERENCES

Abou El-Seoud, M. S. et al., 2014. E-Learning and Students' Motivation: A Research Study on the Effect of E-Learning on Higher Education. International Journal of Emerging Technologies in Learning, 9(4), pp. 20-26.

Afurobi, A., Izuagba, A., Obiefuna, C. & Ifegbo, P., 2015. Effects of the Use of Lecture Method and Wordle on the Performance of Students Taught Curriculum Studies 1: EDU222. Journal of Education and Practice, 6(18), pp. 142-149.

Al-Azawi, R., Al-Faliti, F. & Al-Blushi, M., 2016. Educational Gamification Vs. Game Based Learning: Comparative Study. International Journal of Innovation, Management and Technology, 7(4), pp. 132-136.

Aleksic-Maslac, K., Sinkovic, B. & Vranesic, P., 2017. Influence of gamification on student

engagement. International Journal of Education and Learning Systems, 2(1), pp. 76-Huang, B. & Hew, K. F., 2015. Do points, badges and leaderboard increase learning and activity: A quasi-experiment on the effects of gamification. Hangzhou, The Asia-Pacific Society for Computers in Education. 82.

Bicen, H. & Kocakoyun, S., 2018. Perceptions of Students for Gamification Approach: Kahoot as a Case Study. International Journal of Emerging Technologies, 13(2), pp. 72-93.

Cheong, C., Filippou, J. & Cheong, F., 2014. Towards the Gamification of Learning: Investigating Student Perceptions of Game Elements. Journal of Information Systems Educatio, 25(3), pp. 233-244.

Clark, R. E., Howard, K. & Early, S., 2006. Motivational Challenges Experienced in Highly Complex Learning Environments. Oxford: Elsevier Science Ltd..

Deterding, S., Dixon, D., Khaled, R. & Nacke, L., 2011. From Game Design Elements to Gamefulness: Defining "Gamification". Tampere, ACM Press.

Figueroa-Flores, J. F., 2016. Gamification and Game-Based Learning: Two Strategies for the 21st Century Learner. World Journal of Educational Research , 3(2), pp. 507-522.

Fotaris, P., Mastoras, T., Leinfellner, R. & Rosunally, Y., 2016. Climbing Up the Leaderboard: An Empirical Study of Applying Gamification Techniques to a Computer Programming Class. The Electronic Journal of e-Learning, 14(2), pp. 94-110.

Gaur, A. S. & Gaur, S. S., 2009. Statistical Methods for Practice and Research. 2nd ed. Plessis, I. D., 2014. The Effectiveness of Gamification as an E-Learning Strategy. International Journal of Management and Premarathne, P. B. T. K., 2017. A study on incorporating gamification into ESL classroom via Kahoot!. Kelaniya, University of Kelaniya.

Prensky, M., 2011. Digital Natives, Digital Immigrants. On the Horizon, 9(5), pp. 1-6. Applied Science, 3(7), pp. 24-26. New Delhi: Raed, A. S., 2018. The effect of gamification on motivation and engagement. The International Journal of Information and Learning Technology , 35(1), pp. 56-79. SAGE Publications.

Halloluwa, T., Vyas, D. & Hakim, U., 2016. Gamification for development: a case of collaborative learning in Sri Lankan primary schools. Personal and Ubiquitous Computing, 22(1), pp. 391-407.

Hamari, J., Koivisto, J. & Sarsa, H., 2014. Does Gamification Work?- A Literature Review of Empirical Studies on Gamification. Waikoloa, IEEE.

Hamzah, W. M. A. F. W. et al., 2015. Influence of Gamification on Students'Motivation in using E-Learning Applications Based on the Motivational Design Model. International Journal of Emerging Technologies in Learning, 10(2), pp. 30-33.

Hitchens, M. & Tulloch, R., 2018. A gamification design for the classroom. Interactive Technology and Smart Education, 15(1), pp. 28-45.

Jagušt, T., Botički, I. & So, H.-J., 2018. Examining competitive, collaborative and adaptive gamification in young learners' math learning. Computers and Education, 125(1), pp. 444-457.

Jayasinghe, U. & Dharmaratne, A., 2013. Game Based Learning vs. Gamification From the Higher Education Students' Perspective. Kuta, IEEE.

Lamprinou, D. & Paraskeva, F., 2015. Gamification Design Framework Based on SDT for Student Motivation. Thessaloniki, IEEE.

Laskowski, M., 2015. Implementing gamification techniques into university study path –a case study. Tallinn, IEEE.

Laskowski, M. & Badurowicz, M., 2014. Gamification in Higher Education: A Case Study. Portoroz, ToKnowPress.

Limniou, M. & Mansfield, R., 2018. Traditional learning approach versus gamification: an example from psychology. Valencia, Editorial Universitat Politècnica de València.

McKim, C. A., 2017. The Value of Mixed Methods Research: A Mixed Methods Study. Journal of Mixed Methods Research, 11(2), pp. 202-222.

Pavlina, K., Zorica, M. B. & Pongrac, A., 2011. Student perception of teaching quality in higher education. Istanbul, Elsevier Ltd..

Ranathunga, R. et al., 2014. A Gamified Learning Tool for Sri Lankan Primary Schools. Malabe, Sri Lanka Institute of Information Technology.

Saeed, S. & Zyngier, D., 2012. How Motivation Influences Student Engagement: A

Qualitative Case Study. Journal of Education and Learning, 1(2), pp. 252-267.

Sajjad, S., 2010. Effective Teaching Methods at Higher Education Level. Pakistan Journal of Special Education, 11(1), pp. 29-43.

Šćepanović, S., Žarić , N. & Matijevi, T., 2015. Gamification In Higher Education Learning – State Of The Art, Challenges And Opportunities. Belgrade, eLearning Industry.

Strmečki, D., Bernik, A. & Radoše, D., 2016. Gamification in E-Learning: Introducing Gamified Design Elements into E-Learning Systems. Journal of Computer Sciences, 11(11), pp. 1108-1117.

Turan, Z., Avinc, Z., Kara, K. & Gok, Y., 2016. Gamification and Education: Achievements,. International Journal of Emerging Technologies in Learning, 11(7), pp. 64-69.

Urha, M., Vukovic, G., Jereb, E. & Pint, R., 2015. The model for introduction of gamification into e-learning in higher education. Greece, Elsevier Ltd..

Werbach, K. & Hunter, K., 2012. For the win: How game thinking can revolutionize your business. 1st ed. Philadelphia: Wharton Digital Press.