

# THE ROLE OF GAMIFICATION AND GAME-BASED LEARNING IN ACHIEVEMENT OF COURSE OUTCOMES (COS) WITHIN VIRTUAL ENVIRONMENTS OF TEACHING LEARNING

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**Abstract:** Gamification is the application of game-based elements to non-game system of teaching learning. Within education this can be incorporated and which can help in enhancement of skills of learners. This paper reviews the use of some of this specifically designed software used in classroom for teaching learning. The opportunities to use these game-based mechanisms assessment of learning have remained under-examined and under-exploited. Thus, this paper identifies how these game-based mechanisms can improve assessment while increasing efficiency and providing new opportunities for educators. the potential efficacy of the gamification of education has been demonstrated in this paper. The aim of this study was to explore the influence of applying gamification techniques to increase student engagement in learning and achievement of COs.

The study was conducted on the control group of students with 120 undergraduate students from Second Year class of Under Graduate courses. The students in two of the classes were assigned to be the treatment group whereas the students in the others were the control group. Stu051dents in the treatment group attended a course designed for gamification, while students in the control group attended a regular course. The results showed that in the treatment group, student engagement in learning was significantly better than that of the students in the control group. This paper provide empirical support for gamification of education and conclude that students clearly valued the engagement of gamified learning activities which leads to Achievement of course outcomes (COs).

**Keywords** Gamification, game-based learning, Course outcomes (COs), virtual environments.

## I. INTRODUCTION TO THE STUDY

Throughout human history, the designated intermediaries of scientific knowledge have been the persons who espouse perceived truths that are deemed, by mankind, to be foundational, empirical, concrete, rigid, fundamental and immutable across all fields of science and technology. Consequently, at the turn of the twentieth century, Sir Albert Einstein was bestowed the honour of being one of the most important intermediaries of mankind's scientific knowledge, as his purely conceptual works of General Relativity, Special Relativity, and Quantum Mechanics caused a fundamental change in mankind's overall perception of the physical nature of the material universe.

In essence, Einstein's ability to think outside of the box, whilst still staying true to the foundations of the scientific method, enabled him to develop theoretical works, or scientific works, that were very comprehensive and well thought out, or that were testable or verifiable through use of physical experiments and observations; and this encouraged many in the scientific community, to embark on a journey to test, validate and examine, the compatibility, rigidity, consistency, accuracy, and coherency of the concepts and models that were developed by Einstein.

Student engagement refers to the degree of a student's active involvement, the degree of attention, interest, and passion that students show when they take part in the learning process (Reeve, 2012; Trowler, 2010). Student engagement is one of most important factors associated with improved learning, and much of the research to date has indicated the importance of student engagement leading to a positive impact on learning outcomes (e.g. Carini, Kuh, & Klein, 2006; Klem & Connell, 2004; McMahon & Portelli, 2004). The more students are engaged in learning, the more they will learn and progress in their learning.

Thus, how to promote student engagement is a significant challenge for educators.

In order to fulfill the requirement of more studies on gamification in education, the present study was designed as a case study, in order to explore the influence of applying gamification techniques to increase student engagement in learning. Specifically, we designed gamified learning activities with a combination of online and offline learning activities, and then investigated a group of undergraduate students studying on a general education course. Previously, there have been studies which examined the individual differences in terms of motivational goal orientation (Gonida, Voulala, & Kiosseoglou, 2009; Poondej, Koul, & Sujivorakul, 2013), computer self-efficacy (Busch, 1995; Cassidy & Eachus, 2002), Therefore, these factors, which can influence student engagement, were considered covariance variables in the analysis.

## 2. GAMIFICATION OF EDUCATION

E-learning is defined as information and communication technologies used to support students to improve their learning (Higher Education Funding Council of England, 2005).

Table 1

Author	Work done by the author
Normark and Cetindamar (2005)	e-learning as the ability of system to electronically transfer, manage, support, and supervise learning and learning materials
(Zamfiroiu & Sboru, 2014).	E-learning platforms and web-based applications are very popular, allowing users to access information directly via internet, E-learning enables learning from anywhere and at any time
Urh and Jereb (2014)	statistically important differences between the elements of time regarding learning and average grade
Hu & Hui (2012)	advantages of e-learning, such: geographical reach, learner control (in terms of flexibility and convenience), and cost effectiveness in course delivery and management, educational institutions and professional organizations are embracing e-learning by implementing an expanding array of technology

	enabled platforms (Hu & Hui, 2012).
Singh and Hardaker (2014),	The highlights on barriers and obstacles in using e-learning.

## 2.1. GAME MECHANICS, GAME DYNAMICS AND GAMIFICATION

Table 2

Author	Work done by the author
Maroney (2001)	games can be defined as “a form of play with goals and structure.” Entertaining games provide engaging activities, and it would appear that far from waning, interest in games for leisure is still growing
Hamari & Koivisto, (2013)	Computer-supported gamified services such as Nike+, Zombies, Run!, Fitocracy, and Runkeeper all aim at structuring, supporting and motivating the exercise activities (Hamari & Koivisto, 2013)
Schonfeld (2010)	Well-known game mechanics elements are (Bunchball, 2010): points, levels, badges, achievements, virtual goods, leader boards, and virtual gifts. Some game dynamics elements are: rewards, status, competition, selfexpression
(Deterding, 2011).	Gamification can be defined as the “use of game design elements to motivate user behavior in non-game contexts”
According to (Dominguez et al., 2013),	gamification represents incorporating game elements into a non-gaming software application to increase user experience and engagement.
Pedreira, Garcia, Brisaboa, & Piattini, (2015) Hugos, (2012).	Gamification has been applied in many different domains in the recent years. In an attempt to improve the results of employees in the development of their daily tasks and work
Gartner, Inc. (2011).	predicts that more than 50% of organizations will gamify innovation processes by 2015, as gamification provides accelerated feedback, clear goals and challenging tasks.
According to Biro (2014),	gamification has some common elements with the behaviourist learning theory, like superiority of positive reinforcements, small step-by-step tasks, immediate feedback, and progressive challenges
(Sua & Cheng, 2013).	Educational gamification proposes the use of game-like rule systems, player experiences and cultural roles to shape learners’ behavior

## 3 METHODOLOGY OF THE STUDY

### 3.1. OBJECTIVES OF STUDY

- To study the changing learning patter of learners from non-game-based learning to game-based learning.
- To identifies how these game-based mechanisms can improve assessment and provide new opportunities for educators
- To understand the engagement of gamified learning activities which leads to Achievement of course outcomes (COs).

### 3.2 SCOPE OF STUDY

- Meaningful learning and follows the principles of digital game-based learning models to design as a multimedia material, which allow learners to enjoy learning.
- Finding out the differences in learning outcomes with distinct instructional strategies.
- Students with convergent styles highly regarded the well-designed curriculum in meaningful learning.
- development of a game as the learning approach to establish the gamification mobile learning system and enhance the learning achievement.
- Finding out differences in unit level learning outcomes with distinct instructional strategies.

### 3.3. SAMPLE (PARTICIPANTS) STUDY:

The semi experimental control group was designed with 40 undergraduate students from Second Year Bachelor of Management studies Program in a college affiliated to University of Mumbai located at Mumbai. The students from other Classes were assigned to be the treatment group wherein the undergraduate students from Second Year Bachelor of Management studies Program were selected to be the samples. Students in the treatment group (N = 80, Males = 50 %; Females = 50 %) attended a course designed for the gamified learning activity, while students in the control group (N = 40, Males = 50 %; Females = 50 %) attended a regular course. Both the treatment group and the control group had the same subject matter and materials. The only thing that differed was the treatment group’s learning activities which were created from gamification concepts to achieve the course objective.

### 3.4 MEASUREMENT AND DATA COLLECTION PROCEDURE

For the purpose of the study, a questionnaire was given to students in both the treatment group and the control group.

### 3.5. EXPERIMENTAL DESIGN

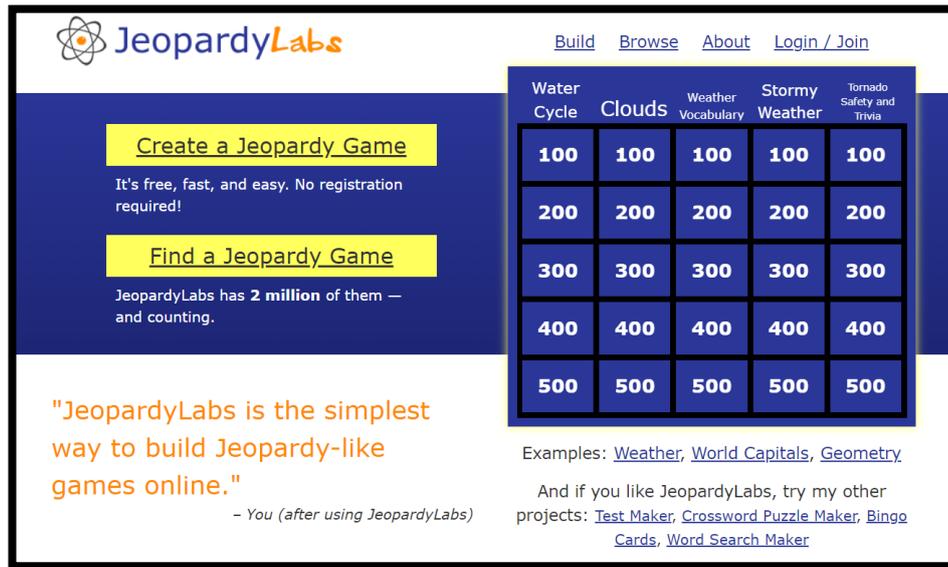
In this study, an experiment was carried out in which ‘Business Research Methods’ course was gamified, and student engagement was compared between a gamified group (treatment group) and non-gamified group (control group). The course is an undergraduate course that covers the principles, concepts, and practices of Research , including the critical thinking skills necessary to navigate, evaluate and use the information resources available today.

Within the learning activities of the treatment group, there was implementation of a points system, division of small clusters, the level of questions differed at every step they move , all common elements of gamification mechanics.

We used Edmodo an educational technology company offering a communication, collaboration, and coaching platform (www.edmodo.com), which is a free online learning management system. This system allowed students to check their course activities,

points, levels, achievement and rewards. Edmodo acted as a link between the class and the educator. Students were examined by the link on Edmodo which was connecting the class through this platform to Jeopardy Labs – (jeopardylabs.com) refer figure:01.

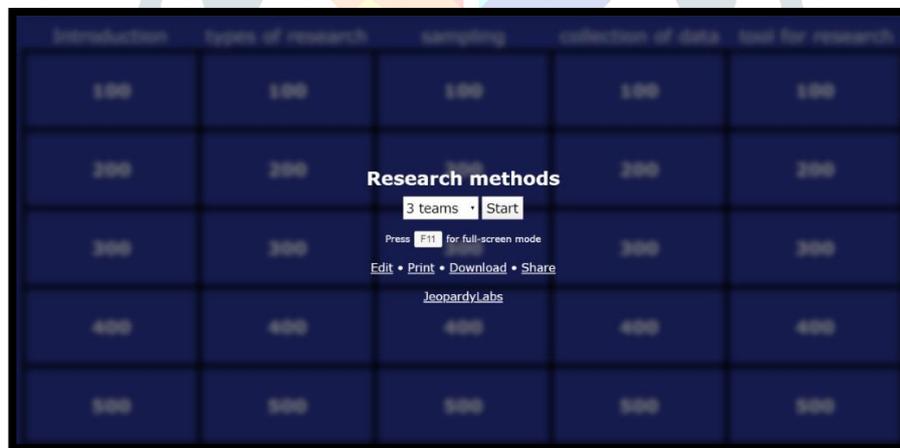
(Figure:01- Screen capture showing Cover Page of Jeopardy Labs a gamification platform)



We set up an activity as an objective that students had to complete. Students earned experience points after they completed the quiz. Within each section, the link was shared (<https://jeopardylabs.com/play/research-methods146>) refer Figure :02 and 03 The game was developed to identify the following

- Students conceptual understanding about the topic
- Assessment of students understanding
- Achievement of Course Outcome (Students will get the basic knowledge of relative terms used in Research)
- Creating the breathing environment in class
- Development of Collaborative learning environment
- Making learners collaborate and learn through peer learning

(Figure:02- Screen capture showing Cover Page of Jeopardy Labs a gamification platform, A game on Research Methods )



(Figure:03- Screen capture showing Cover Page of Jeopardy Labs a gamification platform, A game on Research Methods)

Introduction	types of research	sampling	collection of data	tool for research
100	100	100	100	100
200	200	200	200	200
300	300	300	300	300
400	400	400	400	400
500	500	500	500	500
Team 1		Team 2	Team 3	
0		0	0	

Screen Capture shows the Cover Page of Jeopardy Labs a gamification platform, A game on Research Methods. Classified and based on Unit 1 of Business Research Methods course of Second Year Undergraduate Programs Bachelors of Management Studies, the module comprises of five major topics Introduction to Research Methods, Types of Research, Sampling, Collection of Data and Tool for Research. This entire game is based on these five topics, where the students have to bid the amount mentioned on the screen from any one of the categories of the topic, students were divided into 3 groups in the class, these groups are individual team names as Team 1, Team 2 and Team 3, it depends upon the strength of the class and decision of the instructor. Students will get a question based on the topic and the level of the amount they have bid. Students have to discuss among themselves and at the end they will answer the questions, if they win and answer the correct question they win the reward points which have bid, which acts as a motivation to them, the team which loses the point will have a deduction of the same amount from their total points. In order to move up a level, students had to earn the required amount of points, which they could see on the online system.

In addition, we also included achievement rewards, which are badge icons displayed publicly on the online system on Edmodo for the winning team. Students can see which achievement rewards they have earned and what is required to receive additional rewards.

#### 4. STATISTICAL DATA ANALYSIS

Due to the characteristic differences between participants in the control group and treatment group, We considered *motivational goal orientation (mastery goal, performance-approach goal, and performance-avoidance goal), computer self-efficacy, and perception of meaningfulness in the classroom learning environment* to be potential covariate variables, then matched cases based on these baseline variables.

A One-Way ANCOVA was conducted to determine a statistically-significant difference between students in the treatment group and students in the control group, based on their engagement in learning. The covariates of *motivational goal orientation (mastery goal, performance-approach goal, and performance-avoidance goal), computer self-efficacy, and perception of meaningfulness in classroom learning environment* were controlled in this analysis.

Results also showed that those variables (computer self-efficacy, meaningfulness, mastery goal, performance-approach goal, and performance-avoidance goal) were positively associated with engagement in learning. In addition, both the observed and adjusted means (shown in Table 3) indicated that students in the treatment group had a higher engagement in learning than students in the control group. Descriptive statistics and ANCOVA results for students' engagement in learning by the type of group, and controlling for motivational goal orientation (mastery goal, performance-approach goal, and performance-avoidance goal), computer's self-efficacy, and perception of meaningfulness in classroom learning environment.

**Table 3**

Type of group	Students' engagement in learning				
	Observed Mean	Adjusted Mean	SD	n	
Control	3.41	3.46	.40	40	
Treatment	3.76	3.75	.41	80	
Total	3.58	3.60	.44	120	
Source	SS	df	MS	F	Partial Eta Squared
Computer self-efficacy	1.029	1	1.029	8.745**	.016
Meaningfulness	6.288	1	6.288	53.419***	.090
Mastery goal	9.497	1	9.497	80.687***	.130
Performance-approach goal	1.452	1	1.452	12.339***	.022
Performance-avoidance goal	.815	1	.815	6.927**	.013
Type of group	11.398	1	11.398	96.840***	.152
Error	63.442	539	.118		

Note. Homogeneity of regression tested and not significant for each of the covariate by dependent variable interactions.

\*\* p < .01; \*\*\* p < .001

#### 5. DISCUSSION ON THE STUDY

- The aim of this study was to evaluate the learning engagement of gamified learning activities. These activities targeted the learning on an "information literacy skills" course that is a core course in a general education program.
- We designed gamified learning activities with a combination of online and offline learning activities.
- The points system, levels, achievement badges, and leader boards, which are gamification elements, were used in these learning activities.
- We found that there was a significant difference in effects on learning engagement between the two groups of students, after controlling the individual difference factors (*motivational goal orientation, computer self-efficacy, and perception of meaningfulness in the classroom learning environment*).
- Students in the treatment group had a higher engagement in learning than students in the control group. These results implied that a gamified learning activity generates higher levels of engagement in learning.

- The points and levels systems, in which points are generally awarded for the completion of tasks and then accumulated, were used in the gamified learning activities of the treatment group.
- In this study, we used digital achievement badges, one of the game mechanics, as symbols or indicators of the accomplishment of various achievements in the learning task. Also, we used them to serve as student goals, so that students would need to be committed to pursuing them, and would think of badge achievement as obtaining a reward. Gamification studies have found that achievement badges can be used to affect students' behavior and as a promising method to increase user engagement.
- Moreover, in the gamification context, points and badges are considered as types of formative feedback to students in two ways. The first way is that they provide students with their competency level. The second way is that they allow students to reflect on how much effort, motivation, or engagement they should invest into their learning. From a theoretical perspective, feedback will have a positive effect on learning when it is related to the process of learning and it can be done through both cognitive processes and affective processes. Thus, the effect of providing instant feedback is likely to be a key mediator between the use of game mechanics (points and levels systems, and digital achievement badges) and increased student engagement.

## 6. CONCLUSION AND SUGGESTION

Gamification of education is an educational approach to which game mechanics are applied. The main objective is to motivate students to participate and engage in learning. This study contributes to education literature by demonstrating the influence of applying gamification techniques to increase student engagement in learning. Our study indicates that gamified learning activities increase student engagement in learning.

However, the study contains some limitations. Firstly, since self-reported methodologies were used in this study to collect information from students, the results may not reflect the full truth of their manner because of the possibility of response distortions. Secondly, due to the limitation of budgets for learning management software, we used the free online learning management system which did not provide all of the gamification functions, such as Jeopardy Labs. This presents a valuable opportunity for future studies to be conducted. Future work should examine the other dependent variables that might result from implementation of gamified learning activities, especially the perception of gamification elements and learning outcomes.

