Influence of Gamification on Students' Motivation in using E-Learning Applications Based on the Motivational Design Model

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Abstract—**Students' motivation is an important factor in ensuring the success of e-learning implementation. In order to ensure students is motivated to use e-learning, motivational design has been used during the development process of e-learning applications. The use of gamification in learning context can help to increase student motivation. The ARCS+G model of motivational design is used as a guide for the gamification of learning. This study focuses on the influence of gamification on students' motivation in using e-learning applications based on the ARCS+G model. Data from the Instructional Materials Motivation Scale (IMMS) questionnaire, were gathered and analyzed for comparison of two groups (one control and one experimental) in attention, relevance, confidence, and satisfaction categories. Based on the result of analysis, students from the experimental group are more motivated to use e-learning applications compared with the controlled group. This proves that gamification affect students' motivation when used in e-learning applications.**

Index Terms—**Gamification, Motivational Design, ARCS Model, ARCS+G Model.**

I. INTRODUCTION

Gamification is defined as the use of game mechanics in the non-game context to change the behaviour of people [1]. Gamification is the tactics used to contribute motivation principles and engagement based on the gaming concept into ordinary activities. According to Nah et al. [2], one of the techniques can be used to motivate students are by integrating gamification into learning. Gamification of learning is another way to use game dynamics and game mechanics in education. Encourage unmotivated students to become more involved in the process of learning and interacting with other students can be done by adding simple game features in learning. The use of gamification in the learning context can help to increase student motivation [3]. In previous studies, we have proposed the gamification incorporated with the ARCS model of motivational design called ARCS+G model [4]. This model is intended as a guide for applying gamification of learning.

Previous research stated the lack of students' motivation in the use of e-learning applications is one of the reasons why e-learning is not successful or do not achieve the desired goal [5]-[8]. There are many factors that affect motivation in e-learning. Student engagement is the primary mechanism that enables motivational processes to contribute to e-learning and development [9],[10]. Meanwhile, Priego & Peralta [7] states that student engagement is a capital aspect to succeed in any online formative ac-

tivities. According to El-seoud et al. [5], an interactive feature of e-learning is also the factor of increases the motivation of students. Based on above-mentioned facts, it may be concluded that it is worth studying the students' motivation on e-learning applications. Until now, investigations of the influence of gamification on students' motivation in using e-learning applications based on motivational design models have not been carried out widely [11].

Even though a lot of work has been reported on gamification of learning, very little work has been reported on the motivation based on the gamification of learning. The objective of this paper is to access and examine the influence of gamification on students' motivation in using e-learning applications based on the ARCS+G model. Following this objective, two specific Research Questions (RQ) are proposed:

1. Do e-learning applications use in this study produce statistically significant differences between the controlled group, and the experimental group in terms of students' motivation as measured by the overall summative score of the Instructional Materials Motivation Survey (IMMS)?
2. Do e-learning applications use in this study produce statistically significant differences between the controlled group, and the experimental group in terms of students' motivation based on the use of gamification?

II. LITERATURE REVIEW

A. Gamification

The gamification element is derived from the MDA framework, which based on game design theory [12],[13]. There are three components of the MDA Framework, namely: Mechanics is related to games that describe the specific components of the game at the data representation level and algorithms; Dynamics is about the run-time mechanic's behaviour acting on the player inputs and the other outputs over time; and Aesthetics describes the emotional response desired by the player when the player interacts with the game system [14]. Table 1 shows the components of MDA Framework.

B. Motivational Design

Motivation can be defined as the extent to which constant effort is directed towards a goal [15]. Intrinsic motivation can be determined by the individual and externally

TABLE I. THE COMPONENTS OF MDA FRAMEWORK

Game mechanics	Game dynamics	Aesthetics
Points Levels Challenges Virtual Goods Leader-Boards Badges Gifts and Charity	Reward Status Achievement Self-Expression Competition Altruism.	Satisfaction Pleasure Envy Respect Connection.

by sources as conditional variables and environmental factors [16]. Motivational features can sometimes be rewards or fun activities; however, they are not effective unless they participate the learner in the content and instructional goal. According to Malone [17], the teachers can provide extrinsic rewards for achievement or effortful behaviour by introducing fun activities. By creating the enhanced motivation and attribute for some students, better behaviour can be derived from the design of motivation, particularly when motivated designers to focus on the skills development in self-motivation and self-regulation in learners [18].

Motivational design is the process of organizing resources and methods to lead about motivation changes. According to Keller [19], motivational design can be used to enhance motivation to learn, motivation to work, developing of particular motivational attributes and an enhancement of people's motivation skills in self-motivation. The processes and techniques for effective and efficient teaching refers to instructional design in the traditional view. The economy in the use of instructional time, student time, materials and other resources is referred to efficiency. Meanwhile, effectiveness sometimes includes motivation.

C. ARCS+G Model

The ARCS motivational design model is developed by John Keller to explain motivation [20]-[22]. The use of this model is to assess motivational stimuli for learners' motivation and performance. There are four main categories in the ARCS model: attention, relevance, confidence, and satisfaction. The ARCS model has a design that can be customized with a variety of learning conditions, and can be expanded according to the desired requirements.

The primary elements in the interaction of human desire and game play [23] is taken into the ARCS+G model. The gamification elements used in incorporated with the ARCS model are based on the game dynamics such as reward, status, competition, achievement, self-expression, and altruism. In specific, the game dynamics in the ARCS+G model involves the construction of rules that encourage users to explore and learn the properties of learning. The game mechanics are intended to encourage determined emotions in the user through game dynamics that promote the desires and motivations leading to those emotions. In this model, gamification elements added in the categories of confidence and satisfaction based on the ARCS model. The descriptions of the ARCS+G model is shown in the Table 2.

III. METHODOLOGY

A. Design

This study design was the true experimental by using *Posttest design*. A set of questionnaires available for data collection purposes. Questionnaires were used to collect information on the students' motivation related to the study. Questionnaire method was used because of the advantages obtained the required data can be obtained directly from the questionnaire, a short response time and facilitate the respondents to answer.

B. Participant

Population was about the 25 of Form Six students of a school and 24 of them were the respondents. The basis for determining the amount of the sample was based on the *Table for Determining Sample Size* Krejcie and Morgan [24]. They set the minimum total samples should be based on the total population. Based on that table, the minimum number of samples that need to take from 25 populations were 24 respondents. Respondents for the study randomly chosen stratified without taking into account factors like sex and computer knowledge. Students were randomly chosen and divided into two groups, the experimental group and the controlled group. The experimental group has 12 students, and the controlled group has 12 students.

C. Instruments

Instructional Materials Motivation Survey (IMMS) questionnaire was used to measure students' motivational reactions to self-directed instructional materials. IMMS was not intended to measure student's generalized levels of

TABLE II. THE DESCRIPTIONS OF THE ARCS+G MODEL

Categories	Sub-categories	Descriptions
Attention	Perceptual Arousal	- Capturing learner interest.
	Inquiry Arousal	- Stimulating interest using e-learning material.
	Variability	- Maintaining learner attention.
Relevance	Goal Orientation	- Meeting learner needs and know their needs.
	Motive Matching	- Linking e-learning material with learner personal interest.
	Familiarity	- Fixing e-learning material to learner experiences.
Confidence	Learning Requirements	- Building positive expectations for success when using e-learning material.
	Success Opportunities	- Using e-learning material support or enhance the competency of learners.
	Personal Responsibility	- Linking e-learning success to personal effort and ability.
	Reward	- Something of value will be given to people who do activities with the intent to cause the behaviour to occur again.
	Status	- Conditions where to show status or recognition has been achieved.
	Competition	- Enable people to challenge each other to get the high score at some activity.
Satisfaction	Intrinsic reinforcement	- Encouraging and supporting the learner intrinsic enjoyment of the e-learning experience.
	Extrinsic Rewards	- Providing positive reinforcement to the learner success with e-learning.
	Equity	- Convincing the learner to fair treatment.
	Achievement	- Achievement tends to encourage students to seek challenges and setting goals.
	Self-expression	- Self-expression is used to mark him or herself as having a unique personality of those around them.
	Altruism	- Be generous with giving gifts is a strong motivation to develop an ongoing relationship.

motivation toward school learning (i.e. they were not trait- or construct-type measures). The goal of instruments was to find out how motivated students were, or expect to be, by a particular course. There were 36 statements in this questionnaire. Each of the statement has a relationship to the instructional materials studied. This survey uses a Likert-type scale with five possible choices: *(1) Not true, (2) Slightly true, (3) Moderately true, (4) Mostly true, and (5) Very true*. Four factor scores were averaged to construct an overall motivation score. Reliability estimate for motivational scales based on *Cronbach's coefficient alpha* was computed for each of the four factors and the overall score. The *Mann-Whitney U test* used for comparison, the mean of two independent groups (control and experimental).

D. Procedures

According to Keller [21], the excessive motivational tactics in computer-based teaching proved to disrupt the already motivated students. Keller [25] also suggested that motivational strategies not exceedingly time-consuming, work within the delivery system, and be presented in an acceptable way to participants. The student from the controlled group was given a week to use ARCS-based e-learning applications. Meanwhile, the students of the experimental group was given the same time to use the ARCS+G-based e-learning applications. Subsequently, they will be given an IMMS questionnaire to measure the four factors (attention, relevance, confidence, and satisfac-

tion) of the ARCS model as well as an overall motivation score. The data were analysed using Statistical Package for Social Science version 21.0 (SPSS 21.0).

E. Materials

In general, two e-learning applications have been developed. For the controlled group, e-learning applications has been developed based on the ARCS model. While for the experimental group, e-learning applications has been developed based on the ARCS+G model. Both have been used motivational strategies/tactics to stimulate curiosity, illustrate the practical relevance of the content, build confidence, and provide satisfying outcomes. However, for the experimental group, gamification elements have been used to guide the development of motivational characteristics in relation to the beginning, the middle, and the end of e-learning applications. At the beginning of the learning applications, it contains the main page, menu and guidelines; in the middle has been made up of learning content and questions; at the end, it consists of results and feedback. The motivational design for e-learning applications using ARCS+G model was represented in a matrix (Table 3). The first column consists of the list of ARCS+G categories. The second column contains the sub-categories of each ARCS+G categories. The third column shows process questions, the types of strategies/tactics to use will be decided. The fourth column explains the strategies/tactics used in the gamification of learning.

TABLE III.
THE MOTIVATIONAL DESIGN FOR E-LEARNING APPLICATIONS

Categories	Sub-categories	Process questions	Strategies/tactics
Attention	Perceptual Arousal	What can I do to capture the learners' interest?	- Use interesting image - Use animation - Maximize visibility
	Inquiry Arousal	How can I stimulate interest using this e-learning applications?	- Create interactive e-learning applications - The interface should be easy to navigate - Balance aesthetics, usability and visibility
	Variability	How can I maintain the learners' attention?	- Put information first - Use attractive interface - Use up-to-date content
Relevance	Goal Orientation	How can I meet learners' need? Do I know their needs?	- Conduct need assessment - Determine the goal
	Motive Matching	How can I link e-learning applications with learner's personal interest?	- Look at the learners' point of view - Make learners as a partner in the development process
	Familiarity	How can I tie the e-learning applications to the learners' experiences?	- Use subject matter experts - Modify existing e-learning applications
Confidence	Learning Requirements	How can I build positive expectations for success when using e-learning applications?	- Train learners to use e-learning applications - Let learners know what is expected of them
	Success Opportunities	How will using e-learning applications support or enhance the competency of learners?	- Provide situations for learners to experience success with e-learning applications
	Personal Responsibility	How will learners know their success is based on their efforts and abilities?	- Create e-learning applications that enable learners to self-monitor
	Reward	How can learner get rewards?	- learners can claim rewards by using the point
	Status	How can learners know their status?	- Using levels to signify completion of intermediate goals in the e-learning
	Competition	How can learners compete?	- Using leader-board to show the leading scorers of e-learning applications.
Satisfaction	Intrinsic reinforcement	How can use of the e-learning applications be supported and encouraged?	- Provide feedback to show benefits of using e-learning applications
	Extrinsic Rewards	What will provide positive reinforcement to the learners' successes with e-learning applications?	- Give incentives to improve performance
	Equity	How can learners be convinced of fair treatment?	- Standardize scoring measurements for learner tasks and accomplishments.
	Achievement	How to show learner achievement?	- Using badges to reward learners as well as recognize their achievement and accomplishment.
	Self-expression	How learners can show their self-expression?	- Using virtual goods such as clothing, weapons or jewellery.
	Altruism	How can learners be altruism?	- Giving a gift to other learners will pull the learner into the e-learning, and then learners are motivated to send gifts to all learners.

By using this motivational design, the requirements of motivational features for e-learning applications have been determined. The list of motivational strategies/tactics have been used to guide the development of motivational features for e-learning applications. The developed e-learning applications was a web-based, and integrated with Facebook as Facebook's apps. This was so that the e-learning applications can be quickly disseminated to students, and can be monitored easily and effectively.

IV. RESULT & DISCUSSION

A. Research Question 1

Analysis for each category of the ARCS was carried out, and overall scores were calculated. We count Cronbach's coefficient alpha for each factor as an estimate of reliability. The comparison results of the controlled group with the experimental group were shown in the Table 4.

The results from this study shown a statistically significant difference reliability estimates between the experimental and controlled groups in terms of the ARCS categories measured at IMMS. The overall reliability estimates value for the experimental group was .078 more than the controlled group. The experimental group has better reliability estimates in each category of the ARCS (attention, relevance, confidence, and satisfaction) than the controlled group. Therefore, these results have been answered for the Research Question 1. The e-learning applications use in this study produce statistically significant differences between the controlled group, and the experimental group in terms of students' motivation as measured by the overall summative score of the IMMS.

B. Research Question 2

In this study, for comparison, the mean of two independent groups, the *Mann-Whitney U* test was used because the data type was ordinal. Although statistical power of non-parametric test *Mann-Whitney U* was lower than the parametric test t-test, but the *Mann-Whitney U* test was more robust when the assumption for the t-test was not met. Table 5 shows which group can be considered as having higher confidence and satisfaction, overall; namely, the group with the highest mean rank. In this case, the experimental group had the highest confidence and satisfaction.

Table 6 shows the actual significance value of the test. Specifically, the test statistics table provides the test statistic, U statistic, as well as the asymptotic significance (2-tailed) p-value. In the confidence category, the value of Z = -2.558 with the significant level at .011 (refer to line Asymp. Sig. (2-tailed). This result state the p value (.011) <α (.05). Whereas, in the satisfaction category, the value of z = -2.707 with the significant level at .007. This result state the p value (.007) <α (.05). Due to the p value of the confidence and satisfaction in the experimental group was smaller than the alpha (α), it can be concluded that the category of confidence and satisfaction in the experimental group was statistically significantly higher than the control group. This difference was due to the use of gamification elements in the category of confidence and satisfaction based on the ARCS+G model. This proved that gamification influential on the students' motivation when used in e-learning applications. Therefore, the Research Question 2 has been answered that e-learning applications use in this study produce statistically significant differ-

TABLE IV.
RELIABILITY ESTIMATES FOR MOTIVATIONAL SCALES
USING CRONBACH'S COEFFICIENT ALPHA

Category	Control Group (ARCS Model)	Experimental Group (ARCS+G Model)
Attention (A)	.833	.867
Relevance (R)	.784	.847
Confidence (C)	.800	.876
Satisfaction (S)	.801	.895
Total (ARCS)	.883	.961

TABLE V.
RANK

Category	Group	N	Mean Rank	Sum of Ranks
Confidence	Control	12	8.83	106.00
	Experimental	12	16.17	194.00
	Total	24		
Satisfaction	Control	12	8.63	103.50
	Experimental	12	16.38	196.50
	Total	24		

TABLE VI.
TEST STATISTICS

	Confidence	Satisfaction
Mann-Whitney U	28.000	25.500
Wilcoxon W	106.000	103.500
Z	-2.558	-2.707
Asymp. Sig. (2-tailed)	.011	.007
Exact Sig. [2*(1-tailed Sig.)]	.010	.006

ences between the controlled group, and the experimental group in terms of students' motivation based on the use of gamification.

V. CONCLUSION

The purpose of this study was to access and examine the influence of gamification on students' motivation in using e-learning applications based on the ARCS+G model. The advantages of the ARCS model that can be extended and proven successful in the increasing student motivation caused ARCS model was chosen as the basis to be expanded. The expanded model of the ARCS that incorporated with gamification called ARCS+G model enabled the use of the game mechanics element in the motivational design for e-learning applications. The use of these elements in e-learning applications makes learning more interactive and attracts to students. The result shown the influential of gamification on the students' motivation in using ARCS+G-based e-learning applications. There were significant differences in the category of confidence and satisfaction in the comparison of the controlled group, and an experimental group. This because, the gamification elements in the category of confidence and satisfaction successfully engage and attract students in the use of e-learning applications.

However, this study still has its limitation in the population sample, and analysis. This study simply includes Form Six students at a school that have only 24 respondents. Analysis was done on the reliability estimates for motivational scales using *Cronbach's coefficient alpha* and non-parametric test *Mann-Whitney U*. Further research maybe includes a larger population to obtain a sample of respondents more accurate. Analysis will be done by a variety of methods to determine the effect of gamification influence on students' motivation.

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