Gamification Elements in Quizizz Applications: Evaluating the Impact on Intrinsic and Extrinsic Student’s Motivation

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Abstract: In recent year, gamification has begun to invade in the educational setting. It is to train students to create an intellectual challenge, identifiable methods, and interactivity resulting from the playing. This paper will discuss further on the level of motivation of the students, specifically on intrinsic and extrinsic motivation once after applying the gamification in their learning process. Followed by which gamification elements that significantly influences the inherent student motivation when using Quizizz application. This study used non-experimental as a research design. Participating students include 63 students from Building Engineering in Kolej Kemahiran Tinggi Mara (KKTM) Sri Gading, Batu Pahat who took the course of Mathematical Engineering. The findings showed that students’ intrinsic and extrinsic motivation was at a moderate level after applying the gamification approach. While then the results of inference test using multiple regression analysis indicate that only 44 per cent of the variance in the students’ intrinsic motivation can be predicted from the gamification elements and 63 per cent of the variance in the students’ extrinsic motivation. The findings also revealed that the gamification elements used in the Quizizz application are significant in the relationship with students’ extrinsic motivation from points, level of difficulty, and avatar construct. In contrast, gamification elements also significant in the relationship with students’ intrinsic motivation from points construct. Thus, this paper will able to help instructors in creating and creatively use the gamification as one of the methods in their teaching styles, other than enhancing the students’ extrinsic and intrinsic motivation. Finally, the results and implications are discussed further for a better motivational design of gamification.

Keywords: Gamification elements, Quizizz application, intrinsic motivation, extrinsic motivation.

1. Introduction
The rapid growth of information and communication technologies (ICT) has dramatically affected various sectors worldwide. The sophistication of ICT has also created many forms of technology that can help in everyday life, such as smartphone, tablet or computer. Later, technology gaming was introduced as an activity that carried out by interacting players who obligated to a set of regulations to achieve their objectives [1]. Within recent years, the establishment of gamification becomes trending in many of services as the user engagement support [2-3]. Its concept frequently applied to various designs for teaching and learning purposes [4]. Hence, this trending has also begun to invade in the educational setting.
In the educational context, teaching and learning can be enhanced through the technology-based learning method to increase the student interest and focus in class. Thus, games become the most popular technology-based learning method among students [5]. This method allowed not only the students to interact, experience, and discover their surroundings, but also could enhance the student motivational strength [6]. Indeed, the student learning method must be diversity in which parallel with the 21st-century education for the sake of improving student understanding in learning and enhance their motivational level optimally. However, the gamification approach in teaching and learning frequently been related to motivational factors [7-12].

In teaching and learning, the motivational factor is crucial in addressing various types of learning, including traditional learning, distance learning, and online learning. Imperatively, gamification in education is an approach of online learning among students that has continuously increased these days [4]. Educational gamification usually engages with human motivational behaviour. According to [2], gamification has identified as a new concept in fostering the student’s motivation. It is being associated with game mechanics when involving in students learning outcomes. Generally, motivation distinguished through intrinsically and extrinsically. [33] argues that both intrinsic and extrinsic motivation should be considered in designing the gamification. This can ensure that all of the standard criteria needed in education for a game to be a motivational game.

2 Gamification approach
Games are created based on mechanics, but gamification is created based on elements. According to [13], gamification used game-based mechanics, aesthetics, and thinking which engaging human, motivating action, learning encouragement, and problems solving. The purpose is to train students to create an intellectual challenge, identifiable methods, and interactivity resulting from the playing. To achieve effective learning outcomes from gamification, it mainly relies on four components, namely the game, element, design, and non-game context (table 1). Nevertheless, [9] summarize that gamification is develop based on strategy deployed from the gamification element of mechanics, dynamics, and motives. Thus, gamification mechanics are used been recognized and gives a practical solution in a way that appeals to a particular group [14].

| Table 1. Gamification Components. |
|-----------------------------------|
| Component | Description |
|-----------|-------------|
| Game      | A system where players produce measurable results [15]. Rule-based games that form free and exploratory activity [16]. |
| Element   | Allowed us to distinguish gamification from other games [17]. |
| Design    | Technology-based game design [17]. |
| Non-game Context | The use of game-like concepts in solving problems by engaging learning environment and motivate the learners [4]. |
The difference between each of the gamification is through the elements [17]. In gamification element, there are several types of mechanics such as searching, level of difficulty, badge, points, leaderboard, reward, story, avatar, and progress bar, which it can either used separately or with a combination [18]. In order to test the effectiveness of gamification usage toward the students’ intrinsic motivation, this study has chosen the Quizizz application as the platform in identifying students’ learning motivation through this approach. The Quizizz application is an educational application using the concepts of the learning-based game designed in the form of online games for teaching and learning in class [19]. These are the five elements of mechanics focused on the Quizizz application; including points, level of difficulty, reward, and avatar.

The main idea of gamification is to capitalize on the potential motivation in games by transferring the game design element to a non-gaming environment. It offers an opportunity in experiencing the rules, roles, and emotions to develop a new framework of understanding of their activities structure [20]. Gamification could motivate the student to participate profoundly and change their self-concept into learners [21]. Furthermore, motivation is one of the most critical factors that can influence the success of gamification [11]. Thus, the knowledge of human motivation must be address before gamification development.

2.1 Intrinsic Motivation
Intrinsic motivation is when doing something that inherently enjoyable or exciting [7]. In gamification, identifying the intrinsical motivation factors of the system is imperative to determine which gamification mechanics to be used [9]. It is related to the concept of self-determination, which frequently used in examining the students’ learning motivation [4]. While in the teaching and learning styles, students are engaged in the activities that could give them more satisfaction and not due to the result of buying [7]. Besides, it is also a process of initiating, guiding, and maintaining goal-oriented behaviours among the students [22]. Intrinsic motivation is much necessary for the development of gamification because it is something that makes the students tend to do what they want and for their benefit.

2.2 Extrinsic Motivation
Extrinsic motivation refers to behaviours driven by external rewards such as money, fame, grades, and praise. It comes when there are some types of recognition or rewards provided in completing the activities that motivate the students to achieve their aims. As [7], extrinsic motivation refers to doing something derived from a different outcome, such as monetary incentives or social pressure. It is related to the concept of expectancy to measure motivation in students when applying the gamification approach [8][7].

Games have proved to be a useful tool in student learning styles, but would it be influencing the students’ motivation intrinsically or extrinsically? This paper will investigate further on students’ motivation after using the gamification application in their learning process. Also, we will focus on the four mechanics of gamification element that inherent in student motivation, especially after using the Quizizz application.

3 Methods
A quantitative approach through a survey used in collecting the data to evaluate the level of intrinsic motivation of Diploma students in Building Engineering at Kolej Kemahiran Tinggi MARA (KKTM) Sri Gading, Batu Pahat after applying gamification in their learning process. The focus sample is selected
using a random sampling method from the population generalized. A total of 63 respondents were selected from the Mathematics Engineering course to answer the questionnaire. The Quizizz application is used to test the student's feedback after using the gamification method in their learning process. Then, the study constructed 35 items to measure demographics, level of intrinsic and extrinsic motivation, and gamification elements. The first part of demographics consists of two items that are gender and semester, which gives the information on the participant’s background. The other parts consist of items constructed to determine the level of intrinsic and extrinsic motivation, and gamification elements used in influencing the student's motivation. Each of the items in part two and three are measured using a 5 point Likert Scale of the level of agreement. The experts assessed the reliability of the instrument being tested through a pilot study by using a similar characteristic of the samples with acceptable consistency of $\alpha > 0.6$ and validity. The data were analyzed using descriptive and inferential statistics, intercorrelation, and multiple regressions.

### 4 Findings and discussion

Descriptive and inferential statistics analysis using the mean, standard deviation and multiple regressions were performed to identify the level of students’ intrinsic and extrinsic motivation after using the gamification approach in their learning process. There are eight items from the survey measuring the students’ intrinsic and extrinsic motivation each.

![Respondent Demographics Percentage of Gender and Semester (n=63)](image)

In total, there are 63 students have participated in the survey. Majority of the 50.80 per cent are female students, and the remainder is male students. Then, large portions of 71.40 per cent are students in the third semester, 14.30 per cent in the second semester, and another 14.30 per cent are students in other semester (figure 1). From the analysis, the mean score for the students’ intrinsic motivation level shows an average when $M=3.38$, $SD=0.37$. While the mean score for the students’ extrinsic motivation level also shows an average when $M=3.53$, $SD=0.43$. [23] indicates that the range of mean score between 2.34 until 3.67 is considered as moderate.

| Table 2. Means, Standard Deviations, and Intercorrelations for Intrinsic and Extrinsic |  |  |
|---|---|---|
|  |  |  |

**Figure 1.** Respondent demographics percentage of gender and semester.
Motivation, and Predictor Variables (n = 63).

| Variable          | M    | SD  | Points | Reward | Level of difficulty | Avatar |
|-------------------|------|-----|--------|--------|--------------------|--------|
| Intrinsic motivation | 3.38 | 0.37| 0.59   | 0.57   | 0.61               | 0.57   |
| Extrinsic motivation | 3.53 | 0.43| 0.70   | 0.26   | 0.39               | 0.47   |

**Predictor variables:**

| Points   | 3.64 | 0.42 | -       | 0.48b   | 0.63b               | 0.66b   |
| Reward   | 3.60 | 0.55 | -       | -       | 0.73b               | 0.67b   |
| Level of difficulty | 3.66 | 0.47 | -       | -       | -                  | 0.65a   |
| Avatar   | 3.64 | 0.52 | -       | -       | -                  | -       |

*p < .05; b p < .01

Since there are many independent variables in this study, inferential statistics with multivariate analysis was used to answer the research questions. Multiple regression analysis was conducted to investigate the best prediction of students’ intrinsic and extrinsic motivation. The tabulate of means, standard deviations, and intercorrelations for students’ intrinsic and extrinsic motivation are shown in table 2.

**Table 3. Multiple Regression Analysis Summary of Point, Level of Difficulty, Reward, and Avatar Predicting Intrinsic Motivation (n = 63)**

| Variable           | B    | SEB  | β    |
|--------------------|------|------|------|
| Points             | 0.24 | 0.12 | 0.27b|
| Reward             | 0.13 | 0.11 | 0.19 |
| Level of Difficulty| 0.14 | 0.13 | 0.18 |
| Avatar             | 0.11 | 0.11 | 0.16 |

*Notes R² = .48; F(5,57) = 10.32, p < .001.

The combination of variable to predict Intrinsic Motivation from points, reward, level of difficulty, and avatar was statistically significant, F(4,58) = 13.09, p < .001, with only one variable significantly contributing to the prediction. The adjusted R squared value was .44. This indicates that 44% of the variance in Intrinsic Motivation was explained by the model. According to [24], this is large effect. The beta weights, in table 3, suggest that Points contributes most of the predicting Intrinsic Motivation.

**Table 4. Multiple Regression Analysis Summary of Point, Level of Difficulty, Reward, and Avatar Predicting Extrinsic Motivation (n = 63)**

| Variable           | B    | SEB  | β    |
|--------------------|------|------|------|
| Points             | 0.60 | 0.12 | 0.58 |
| Reward             | 0.20 | 0.11 | 0.25 |
| Level of Difficulty| -0.40| 0.13 | -0.43b|
| Avatar             | 0.33 | 0.11 | 0.40b|

*Notes R² = .64; F(5,57) = 20.48, p < .001.
\[ b_p \leq 0.05. \]

In contrast, the combination of variable to predict Extrinsic Motivation from *points, reward, level of difficulty*, and *avatar* was statistically significant, \( F(4,58) = 24.20, p < .001 \), with three variables significantly contributing to the prediction. The adjusted \( R^2 \) squared value was .63. This indicates that 63% of the variance in Extrinsic Motivation was explained by the model. According to [24], this is much larger effect. The beta weights, in Table 4, suggest that Points contributes most of the predicting Extrinsic Motivation and Level of Difficulty and Avatar also contribute to this prediction.

Gamification can be distinguished from a gaming environment and non-gaming environment. The effect of educational gamification is varied among students. There are positive effects found in the gamification approach towards motivation [25][26][3]. According to [8], a meaningful gamification design is built upon intrinsic motivation. This further reinforces that intrinsic motivation is crucial in student learning [27]. [28] find that many students exposed to the gamification approach as they are reacted or influenced by intrinsic motivation. Furthermore, an increase in intrinsic motivation will also encourage students to engage in exploring, effort, and participation, which driven by their curiosity rather than because of the reward.

[28] in their exploration studies, find that the use of gamification approaches highly increase the student’s intrinsic motivation. In some other studies, as with [29][30][3], the gamification approach shows an average effect on student’s intrinsic motivation in their learning. It is because each student has a different cognitive level and motivation in which it is related to the concept of self-determination. According to self-determination theory, gamification is capable of enhancing the intrinsic motivation through the psychological needs in autonomy and efficiency of the players while applying the gamification approach. The effect on student’s intrinsic motivation somehow depends on the capability of the gamification system as a whole, including the uses of elements and context of the learning objectives [7].

On the other hand, extrinsic motivation has commonly impacted from the combination of the gamification elements and interactive response system in student learning [30]. [31] also find that students’ extrinsic motivation after using the gamification approach in learning is at a moderate level. However, [32] in examining the relationship between individual personality traits and the level of extrinsic motivation in the gamification approach shows a higher level of motivation among the students. Although all these findings went against the author’s expectations on extrinsic motivation, it demonstrates that the students’ extrinsic motivation could be strongly or weakened affected by the use of gamification approach in their learning styles.

Based on the early findings, the uses of Quizizz application in the student learning styles shows a common effect of gamification toward the student’s intrinsic and extrinsic motivation. According to [33], both intrinsic and extrinsic motivation has to be considered in gamification development as it complements each other in human behaviour. [17] also agreed that the pressure on extrinsic motivation might have a significant impact from the gamification to achieve the satisfaction needs, even though the game design elements deployed in the gamification is to act as the intrinsic motivation affordances. Therefore, it is essential to have a better understanding of how the gamification works well and move beyond the current focus on intrinsic motivation to greater detail on the role of extrinsic motivation in gamification.
Rather than viewing extrinsic motivation as a dichotomous opposite to intrinsic motivation, it is imperative to identify the gamification mechanics that may affect the student's motivational behaviour. This study shows students, on the basis of the gamification approach, reported that the gamification mechanics of points, reward, level of difficulty, and avatar, used in their learning process had a positive association with the extrinsic motivation. In contrast, intrinsic motivation shows a negative association with the gamification mechanics of points, reward, level of difficulty, and avatar. [9] consolidated from numerous resources that developing gamification relies not only on the mechanics but also its dynamics and motives. Besides, the used of gamification foundations applies a different framework in outlining the objectives behind it [10].

This finding is consistent with findings in [32] and [34] where points in gamification have significantly associated with students’ extrinsic motivation along their learning process. It was supported by [35] where students who feel motivated would tend to contribute more to the system of social participation when they are in a bigger competitive group. Mostly, students will prefer to participate in competitive social activities and more likely to be motivated in showing off their achievement. Besides, reward is also not a functional element in influencing the students’ intrinsic motivation as it causes the student to feel lacking confident and less intrinsically motivated to stay involved with the gamification [29]. Furthermore, some studies also expressed that students are dissatisfied with the competitive system of the gamification in which it may lead to a negative effect in the student’s motivation [36][37][29].

Towards the intrinsic motivation, there are numerous studies find that all the predictors are intrinsically motivational contribute in the students learning. For instance, [38] find that the points are effective in increasing motivation and attractive to the players because it provides with immediate feedback as well as recognition in completing the activity or task given. [39][40] also argued that the students find points as their motivational support and an attention grabber while applying the gamification approach. This is because points have been the necessary element of gamification as it serves to be the feedback mechanism and reward in the games [33][3]. Other than that, the reward can also be the critical factors for students to engage and intrinsically motivated in using the gamification approach as their learning styles to be acknowledged by their teacher or facilitator. However, the finding of this study revealed a negative association between the gamification mechanic of Quizizz application and students’ intrinsic motivation entirely. Further, this application might not influence in students’ intrinsic motivation from the mechanics of points, reward, level of difficulty, and avatar, but it has the possibility in enhancing intrinsic motivation from other elements.

5 Conclusions
This paper discussed that students are averagely affected in their intrinsic and extrinsic motivation from the Quizizz application in their learning process. The results provide insights that element in gamification is among the most influenced component to the students’ motivation. Furthermore, the findings also revealed that all the gamification mechanics of points, reward, level of difficulty, and avatar, used in this study are significant in the relationship with students’ intrinsic and extrinsic motivation. However, the predictors of points has proven on its existence will increase in the students’ intrinsic motivation along with the teaching and learning through the Quizizz application. In contrast, the predictors of points, level of difficulty, and avatar has proven on its existence will increase in the students’ extrinsic motivation along with the teaching and learning through the Quizizz application. It is because the development of educational gamification must be based on the mechanics, dynamics, and motives to ensure that it is functional. Hence, this points out that the findings can be the foundation in deciding on the appropriate
elements in the development of educational gamification towards a motivational gamification design. It is also able to help the instructors in creating and creatively use the gamification as one of the approaches in their teaching styles. Therefore, this gives further evidence that education instructional design of gamification must aim to meet the students' needs as well as their motivational behaviour.

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