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# Malaysia Education Gamified: Effects on Student Gamification Experience and Academic Performance

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ABSTRACT

Gamification in education is a rising arena. Given this setting, gamification, which is using the game elements in non-game contexts, been studied, and tested in Malaysia education settings specifically within the Terengganu region. This gamification survey investigated the relations between student gamification experience and their academic performance (n=420). Results show statistically, of the respondents, reported their gamification experience (52.4%) and academic performance at high level (52.9%). However, student academic performance does not differ according to their gamification experience level.

## 1.0 Introduction

The development of today's technology has made many contributions in the advancement of various fields. Technology is the application of knowledge in a field to achieve its goals [1]. Hence, by integrating technology in education provides various benefits and advantages especially to teachers and students as an aid to facilitate their activities during teaching and learning (TnL) session [2]. The focus & usage of technology in TnL as an intermediary to develop students 21st century 4C skills; namely critical thinking, creativity, communication, collaboration [3].

The need to use Information and Communication Technology (ICT) in TnL is foreseeable [4]. The widespread use of ICT in education automatically improves the quality of TnL experience [5] as well as influence student attitudes in learning [6] especially when involves e-learning. E-learning consists of a combination of two main components, namely learning (cognitive process in knowledge acquisition) and technology (as tools and facilitators in TnL process) [7].

Figure 1.1 illustrates trend and popularity gamification term search worldwide in the last 10 years (2011-2020) that been obtained through Google Trends facility (https://trends.google.com/trends/). Figure 1.2 illustrates trend and popularity of gamification term search during the same period in Malaysia. Provenly, gamification is a noticeable (Malaysia)

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and uptrend (worldwide) in recent years and has been identified as one of the important ideas as well as having prospects in education.

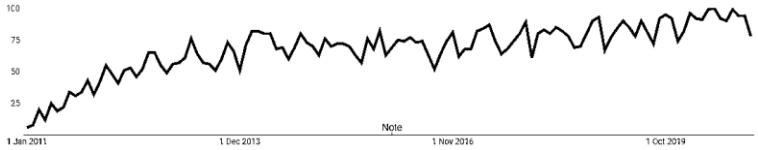


**Figure 1.1**: The Worldwide Uptrend and Popularity of Gamification Searches (2011-2020).

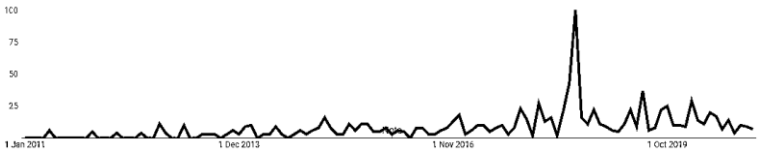


**Figure 1.2**: Noticeable Trend and Popularity of Gamification Searches by Malaysians (2011-2020).

Therefore, the scope and objectives of this research are to study the effects of gamification on form 1 male and female students from Terengganu who enrolled Basic Science Computer (Asas Sains Komputer; ASK) as their elective subject.

## 2.0 Theoretical Base and Previous Work

### 2.1 MDA Framework

Gamification concept is very interesting and suitable for use at all ages [8]. Gamification is one of today's techniques used to increase motivation and encourage active user engagement, especially in the educational domain [9]. Since the concept of gamification involves game design specifically, it is highly relevant to refer to a framework as a guide.

A popular game framework in game design is the mechanics, dynamics, and aesthetics (MDA) framework [10] triggered by [11]. The basic idea of MDA framework is to view a video game as an artifact rather than as a medium. MDA is a formal approach to describing, analysing, and understanding the design of a video game through game mechanics, game dynamics, and game aesthetics [9].

Figure 2.1 [12] explains reciprocal processing and interaction that occurs between the MDA components which able to stimulate player behaviour [11]. To create and develop a video games, game developer sets gaming rules (mechanics) before developing gaming system (dynamics) that can provide fun (aesthetics) to game player. In the meantime, game players enjoy the gaming aesthetic (fun) value first while interacts with gaming dynamics (rules) that have been developed and programmed by the developer.

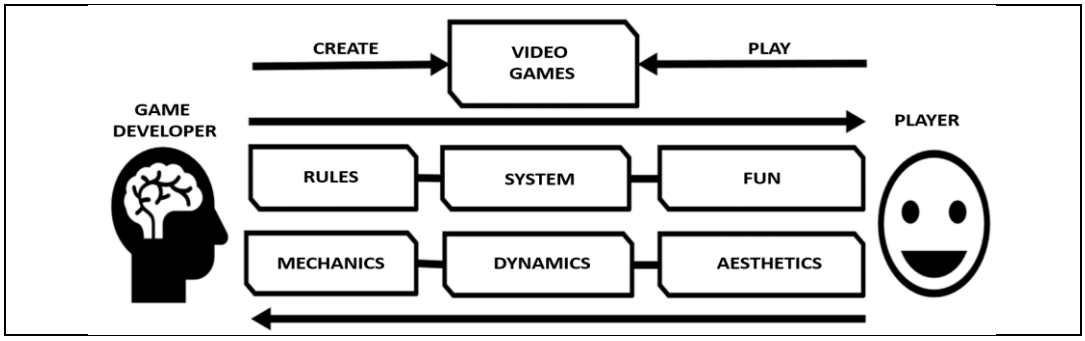


Figure 2.1: The Reciprocal Processing and Interaction Between MDA Components in a Video Gaming Environment (Hunicke Et Al., 2004; Shariful Hafizi & Kamarul Shukri, 2019).

### 2.2 Gamification in Education

Gamification can affect cognitive and motivational dimensions specifically in certain situations; (1) when gamification is used with other teaching methods, (2) when concurrent training sessions are included, and (3) when students play in groups [13]. Students are intrinsically motivated to improve their skills and engagement through learning with deep concentration, interest, and enjoyment [14]. Playing gives student, the opportunity to make mistakes repetitively, learn through experience from the mistakes made without having to feel pressure [15] [16] [14]. Students also will learn to see failure as an experience stepping stone to succeed, not as an excuse to continue to give up [17]. It is implemented by guiding and encouraging students to be more motivated to build new knowledge and experiences throughout the learning process [18].

### 2.3 Gamification Experience

In the context of video games, gamification experience is defined as positive emotions that result from interactions between players and video games being played [19]. The importance of game quality and its relevance to gamification experience has also been demonstrated by several empirical research [20] [8] [21] [22] [23] [19] [24]. Students who have become accustomed to playing with various forms of games have been found to be receptive to the conceptual approach of gamification in learning [25]. Student gamification experiences should be designed, constructed, and related to student experiences [26].

The concept of game experience in gamification is an unexpected feeling and is described by players or users when they do something that involves the context of the game [27] [23] or an effect on psychology after interacting with the environment of gamification and gamification determines the experience of gamification [28]. Gamification is also defined as a process of adding game design to produce a gamification experience [25]. Thus, clearly gamification and gamification experience are closely related to each other.

### 2.4 Gamification Effects on Student Gamification Experience

Gamification in education has several positive effects on student experience [29]. Student academic performance is always positively and directly linked to student motivation and involvement in learning. The active involvement of students in learning indirectly also stimulates positive behaviour of students, enhances high order thinking skills (HOTS) as well as builds meaningful learning experiences [30].

### 2.5 Gamification Effects on Student Academic Performance

There are about 300 articles related to video games and their impact on academic achievement [31]. The use of gamification elements in learning can influence the learning process when used to support the construction as well as integration of knowledge in an

innovative way [32]. Formative assessment systems enriched with the concept of gamification provide immediate and effective feedback to students when compared to conventional learning assessment systems [30]. The implementation of gamification in T&L has a positive impact on student achievement and attitudes [33]. Gamification also can develop skills in stages or according to level, it is not solely focused on creating competition only [34]. The improvement of student grade performance is particularly significant when student learning outcomes are designed using the concept of gamification [35].

## 3.0 Research Questions

Even though gamification research been emerged and up trending since 2011, a large number of gamification studies are dominated by researchers from North America and Europe [36] but are less from Asia region [37]. That being the case, the purpose of this gamification survey is to fulfil evidence, knowledge, practical-knowledge, methodology, empirical, theoretical and population gaps [38] predominantly in Malaysia education environment setting. Based on the explained theoretical and previous work, this study presents the following research questions:

1. What is the level of gamification experience and student academic performance?
2. Is there significant differences in student academic performance based on student gamification experience level?

## 4.0 Methodology

This survey study was conducted as cross-sectional, which involved only one time data collection by using a questionnaire instrument on the sample [39] [40] [41]. An analysis distribution of secondary school (SMK) students found that a total of 3933 Form 1 students (21.9%) from 103 SMK (89.6%) have chosen Basic Science Computer subject (Asas Sains Komputer; ASK) as lower secondary education level elective subject. Based on [42], the number of samples required was 351 respondents. However, to improve and increase accuracy research findings, the size increased to 420 respondents to ensure that the sample size is large enough to produce the desired level of precision [43] [44] [45].

To narrow the 10% number of respondents total difference (393) between male (2,163) and female students (1,770), the percentage of respondents was set to 52% male students (220) while 48% were female students (200). The number of respondents were analysed according to male and female students in each Terengganu district. The number of respondents were also determined based on the percentage of male and female students who enrolled ASK for each district with the total number of Terengganu's students who enrolled ASK subjects.

After identifying the number of respondents involved in each district and state, simple random sampling was performed to select schools. Because most schools that offer ASK subjects use a ratio of 1 student to 1 computer, the maximum number of students in an ASK class is 20 male and female students. Thus, the number of randomly selected schools is rounded by the proportion of 20 students enrolled ASK for a school. Figure 3.1 simplify the stratified random sampling procedure for selecting respondents in this study.

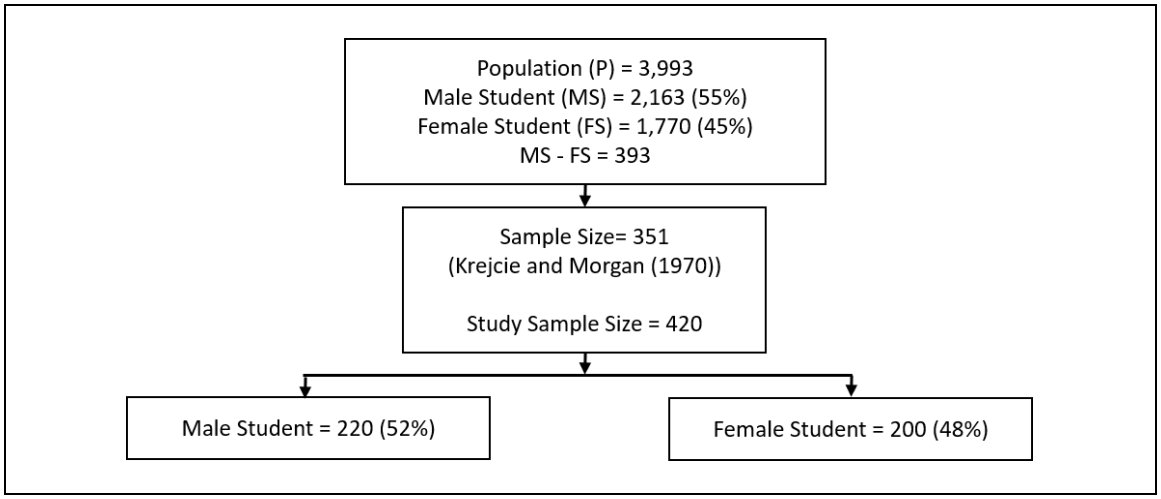


**Figure 3.1:** Stratified Sampling Procedure to Select 420 Students Who Enrolled ASK Subjects

The research instrument consists of background of students and their gamification experience. As for academic performance, this study gained student ASK final exam result, with granted permission from school and the subject teacher. The student demography section has nine items. Apart from gender and age items, other items were adapted a research [46]. This demography items have also been adapted in a gamification research [47]. The student gamification experience construct has 24 items categorised into 5 dimensions: 6 items of enjoyment, 6 items of absorption, 4 items of creative thinking, 4 items of activation and 4 items of dominance. This questionnaire was adapted from the [28]. SPSS been used to carried out the analyses with a significance level of $p < .05$. As an overview of the research variable values, descriptive statistics, and analysis of variance (ANOVA) been computed. Assumptions were tested (homogeneity of variance, normal distribution), prior to the analysis was also computed.

## 5.0 Results

### 5.1 What Is the Level of Gamification Experience and Student Academic Performance?

Descriptive statistical analysis was performed to identify the level of student's gamification experience and academic achievement. An interpretation through mathematical concepts is used by determining three mean score interpretation level as shown in table 5.1.

**Table 5.1**: Gamification Experience Construct Mean Score Interpretation Level.

| Mean Score Interpretation | Mean Score |
|---|---|
| Low | 1.00 - 2.33 |
| Intermediate | 2.34 - 3.66 |
| High | 3.67 - 5.00 |

Table 5.2 explains student's gamification experience level. 52.4% (220 students) are in high level, as much as 46.2% are at intermediate level (194 students), while 1.4% are at the low level (6 students). Overall, student level of gamification experience is at a high level.

**Table 5.2**: Overall Gamification Experience Constructs Levels.

| Level | Respondents (N=420) | Percentage (%) |
|---|---|---|
| High | 220 | 52.4 |
| Intermediate | 194 | 46.2 |
| Low | 6 | 1.4 |
| Total | 420 | 100 |

A more detailed descriptive analysis was performed on five dimensions in gamification experience constructs (enjoyment, absorption, creative thinking, activation, and dominance) as shown in Table 5.3.

**Table 5.3**: Levels of Dimensions in Gamification Experience Constructs

| Construct / Dimension | Minimum | Maximum | Mean | Standard Deviation | Interpretation |
|---|---|---|---|---|---|
| 1. Gamification Experience | 1 | 5 | 3.65 | 0.50 | Intermediate |
| 2. Enjoyment | 1 | 5 | 4.07 | 0.60 | High |
| 3. Absorption | 1 | 5 | 2.82 | 0.90 | Intermediate |
| 4. Creative Thinking | 1 | 5 | 3.99 | 0.62 | High |
| 5. Activation | 1 | 5 | 3.80 | 0.63 | High |
| 6. Dominance | 1 | 5 | 3.54 | 0.65 | Intermediate |

From the table, the minimum, maximum, mean, and standard deviation values for the construct of student gamification experience is M=3.65, SD=0.50 and each of its dimensions namely enjoyment (M=4.07, SD=0.60), absorption (M=2.82, SD=0.90), creative thinking (M=3.99, SD=0.62), activation (M=3.80, SD=0.63) and dominance (M=3.54, SD=0.65). Overall, student gamification experience is at high level where three dimensions are at a high level (fun, creative thinking, and activation) while absorption and dominance are intermediate level.

As for academic performance, an interpretation through mathematical concepts also used by determining three interpretation level (high, intermediate, and low) based on student end of year examination result as shown in table 5.4.

**Table 5.4**: Student Academic Performance Interpretation Based on End of Year Examination Result.

| Interpretation | Score Results |
|---|---|
| Low | 0 – 33 |
| Intermediate | 34 – 66 |
| High | 67 – 100 |

Table 5.5 explains student's academic performance level. 52.9% (222 students) are in high level, as much as 43.1% are at intermediate level (181 students), while 4.0% are at the low level (17 students). Overall, student academic performance level is at high level.

**Table 5.5**: Overall Student Academic Performance Levels

| Level | Respondents (N=420) | Percentage (%) |
|---|---|---|
| High | 222 | 52.9 |
| Intermediate | 181 | 43.1 |
| Low | 17 | 4.0 |
| Total | 420 | 100 |

### 5.2 Are There Significant Differences in Student Academic Performance Based on The Level of Student Gamification Experience?

A one-way ANOVA test was used to determine whether there are differences in students learning outcomes based on gamification experience. As shown in table 5.6, the high-level gamification experience mean value is M=68.01, SD=16.171, followed by the medium level mean value (M=66.01, SD=15.963) and the low level mean value (M=64.33, SD=14.459).

**Table 5.6**: Frequency, Mean and Standard Deviation of Student Gamification Experience Level Based on Student Academic Performance (N=420).

| Variables | Gamification Experience Level | N | M | SD |
|---|---|---|---|---|
| Student Academic Performance | High | 220 | 68.01 | 16.171 |
| | Intermediate | 194 | 66.01 | 15.963 |
| | Low | 6 | 64.33 | 14.459 |
| Total | | 420 | 67.04 | 16.051 |

The results from table 5.7 showed that there was no significant difference ($p > 0.05$) in student academic performance based on their gamification experience level [$F(2,416)=0.889$, $p=0.412$]. This means that student academic performance does not differ according to student gamification experience level.

**Table 5.7**: One-Way ANOVA Test for Student Academic Performance Based on Student Gamification Experience Level

| Academic Performance | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 458.192 | 2 | 229.096 | 0.889 | 0.412 |
| Within Groups | 107494.272 | 417 | 257.780 | | |
| Total | 107952.464 | 419 | | | |

## 6.0 Discussion

This research analysed the potential impact of gamification on student gamification experience and academic performance in the context of a survey study. Regarding to first research question, the results showed that adoptive gamification directed to a significantly high level of student gamification experience [48] [18]. This finding is in line with the related literature in the education domain and student academic performance in schools [49]. Hence, the result aligns with [50] and [51] theory, explaining how game characteristics influence changes in learning outcome; where in this study refers to student academic performance. In the specific case of gamification experience, several previous studies also support this finding [52]. However, it is necessary to call attention to the lack of available survey studies focusing exclusively on gamification experience and their effects on academic performance, especially in Malaysia education environment.

In terms of the second research question, following [50] and [51] theory, this research would expect that the positive effect on academic performance, would mediate a positive effect on learning, but as the results reflect, this did not happen as been researched by [53]. Possible explanations could be related to student exhaustion and lack of cooperation when filling out the research instruments [54]. Other reasons could be linked to the nature of the gamification. At the start of an implementation, student academic performance tends to be high, but when more demanding tasks are being put forward, they decrease [55] [56]. Finally, the role of teachers could also play a role. For instance, their actual attitude towards gamification could have a positive or negative impact on the overall learning experience [57].

## 7.0 Limitations and Directions for Further Research

Some limitations of the present study need to be acknowledged. First, this study did not involve TnL methodology, curriculum, classroom management and the like. This study is limited to study gamification experience on student academic performance for specific topics in ASK subject only. Gamification experience been measured because it often prioritized in discussions and defining gamification [58] [59]. Measurement of gamification experience is highly relevant to determine how successfully gamification in education [28]. Also, the number of samples is limited to Form 1 secondary school students in Malaysia who enrolled in ASK as an elective subject, which is a total of 420 students with the allocation of 220 male (52%) and 200 female (48%) students. Hence, the importance of defining some directions for future research: opt for a wider population in Malaysia and involve more subjects or fields. Further research also needed to understand the lack of connection between the aforementioned variables.

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