GAMIFICATION OF LEARNING:
CAN GAMES MOTIVATE ME TO LEARN HISTORY?

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ABSTRACT

This article presented empirical finding of the effect of gamification for learning. Evidence in the findings of the empirical study that explores two education games that were developed earlier with a total of 64 participants was presented. The first game was a computer game with historical themes of Ken Arok and Ken Dedes of Singhasari Kingdom. The second game was an Android-based mobile game with Historicity of the Bible themes of Moses. Prior research showed that more than 50 percent of junior and senior high school students in Jakarta demonstrated their apathy to several subjects in their school. They also disclosed that they were having difficulty in following their class in particular with a difficult subject such as History subject. With the popularity of games, the gamification of learning was investigatd to enhance the interest of the students to master a particular subject. The results show that there is a statistical significance increase of the students score and interest in history subject in a group that was using the games to help them in the subject compared to a group that reading books about the particular subject alone ($p < 0.001$). Furthermore, the participants also reported that playing games was helping them to remember difficult names and event timeline in the historical events ($p < 0.001$).

Keywords: gamification of learning, historical games, personal motivation

INTRODUCTION

Games are considered one of the most popular interactive entertainment products in the world. Newzoo's Global Games Market (Newzoo, 2016) reported there is 99.6 Billion US Dollar worth of games market around the world in 2016. Fifty-eight percent of it comes from the Asia-Pacific region.The growth is forecasted to be increasing by 6.6 percent from 2015-2019. That means there will be 118.6 Billion US Dollar worth in the games market all around the world.

With the popularity of games, the gamification of learning is investigated to enhance the interest of the students to master a particular subject. Prior research has shown that more than 50 percent of junior and senior high school students in Jakarta demonstrated their apathy to several subjects in their school. They also disclosed that they were having difficulty in following their class in particular with a difficult subject such as History subject (Chowanda & Prasetio, 2012). In addition, Hidayati (2010) reported that up to 72 percent of high school students in Indonesia have difficulty in algebra subject. In line with Hidayati, a research conducted by Eksan (2014) also demonstrated that up to 77.62 percent of junior high school students in Indonesia were having difficulty in following Mathematics subject.

In this article, it is argued that games can increase students' interest and can assist them in addressing their difficulty to follow a difficult subject. In this study, evidence is presented through findings that explores two education games developed earlier with a total of 64 participants. The first

game is a computer game with historical themes of Ken Arok and Ken Dedes of Singhasari Kingdom (Chowanda & Prasetio, 2012). The second game is an Android-based mobile game with Historicity of the Bible themes of Moses (Chowanda *et al.,* 2014). The results show that there is a statistical significance increase of the students' score and interest in history subject in a group that was using the games to help them in the subject compared to a group that was reading books about the particular subject alone. Furthermore, the participants also reported that playing game helped them to remember difficult names and event timeline in the historical events.

Ernest (2013) defines game as one type of play activities, where there are players who attempt to meet the goals in accordance with the regulations or rules which have been designed. In general, games can be divided into three categories namely casual, hardcore and serious games, although there is no universal name for the categories. Casual games are games that are easy to play, and the player's attention is not necessarily needed to play the game. Casual games can be played anywhere and anytime. On the other hand, hardcore type games emphasis more on actions, tremendously beautiful graphics and usually requires seriousness in playing the games in terms of playing times and the intensity of playing. Serious games are usually designed for a specific purpose other than entertaining the players.

Serious games have increasingly become popular in the research community. They inherit the fun element of games and are implemented to gamify learning process in a particular problem. There are a number of serious games types such as educational games, commercial games, training games, and so forth. They can be used to train professionals (Wattanasoontorn *et al.*, 2013; Graafland *et al.*, 2012; Kapp, 2012), to help learning process (Chowanda & Prasetio, 2012; Chowanda *et al.*, 2014; Kapp, 2012), to educate the public (Bowser *et al.*, 2013), make the public aware of a new product (Huotari & Hamari, 2011; Rampoldi-Hnilo & Snyder, 2013).

Schell (2014) argues that it requires four core elements to craft a game.The first is Mechanics, a set of procedures or rules in a game. Mechanics are divided into categories: worlds, objects, actions, rules, chances and skills. The second element of the game is Story that illustrates the sequence of events which describe the whole story in a game. Next element is Aesthetics that make a particular game unique with another. The feel and touch of the game are drawn in this element. The last element is Technology, where it limits the capability of games (e.g. paper and pencil, mobile phone, tablet, desktop computer, and so forth).

Serious games inherit all the four core elements of games, with one special objective which tailored with the purpose of the serious games made. General games have an explicit objective, which is to entertain the players. Where serious games have an implicit objective to serve depends on the purpose of the games (Wattanasoontorn *et al.*, 2013).That implicit objective must be designed by subject matter experts in a particular area. Figure 1 illustrates the elements of serious games argued by Wattanasoontorn *et al.* (2013).
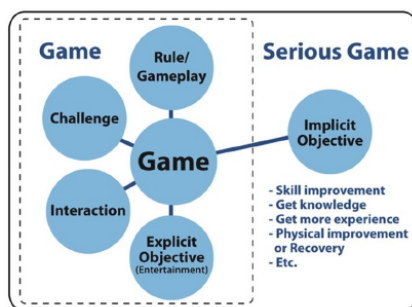

Figure 1 Serious Game
(Source: Wattanasoontorn *et al.*, 2013)

METHODS

There are a total of 64 participants from Indonesia (13 females with AVG of age = 17.49, SD of age = 2.50, MAX of age = 23 and MIN of age = 12) divided into four groups as seen in Table 1. All participants were asked to fill in a six-point Likert-type pre-questionnaire asked (translated from Indonesian) to what extent the participants agree (positive) or disagree (negative) that: Q1. Remembering names in historical events are difficult; Q2: Remembering timeline in historical events is difficult; Q3: The participants have the motivation to learn about history. Moreover, the participants were tested their knowledge about a particular history in 10 questions subject as a baseline.

Table 1 Group Classification

	Book	**Game**
Singhasari	Group A	Group B
Moses	Group C	Group D

Figure 2 describes the classification for each group. Group A (6 females with AVG of age = 17.24, SD of age = 3.36, MAX of age = 23 and MIN of age = 12)and B (6 females with AVG of age = 17.83, SD of age = 2.77, MAX of age = 23 and MIN of age = 13)with 17 participants each group were tested with the historical events that occurred in The *Ken Arok* and *Ken Dedes* of Singhasari Kingdom. On the other hand, Group C (6 females with AVG of age = 17.33, SD of age = 1.88, MAX of age = 21 and MIN of age = 15)and D (5 females with AVG of age = 17.27, SD of age = 2.12, MAX of age = 21 and MIN of age = 14)with 15 participants each group were tested with a historicity of the Bible themes of Moses.Group A and C were asked to read 10-12 paragraphs in 10 minutes about Singhasari and Moses respectively. While group B and D were invited to play a game for approximately 25 – 30 minutes about Singhasari and Moses respectively. Finally, the participants were asked to fill in post-questionnaire that identical with the pre-questionnaire. Their knowledge of a particular history subject (Singhasari and Moses) was also tested once again with the same questions such as the one that they filled previously but with a different order of questions.

Figure 2 Singhasari Game
(Source: Chowanda & Prasetio, 2012).

The games used in this article were developed by students of Bina Nusantara University, Jakarta, Indonesia, as part of their thesis. The first game is called "The Keris of Vengeance," developed in 2011 using Unreal Development Kit. The Keris of Vengeance is a 3D action game which adopted a story about Singhasari kingdom. Figure 2 shows the screenshots of the gameplay. The game story is adopted from the story of *Ken Arok* of The Singhasari Kingdom with his relationships with

other characters such as Mpu Gandring, Kebo Ijo, Tunggul Ametung, Anusapati and Penghuni Hutan. The comprehensive details of the game can be read at (Chowanda & Prasetio, 2012).
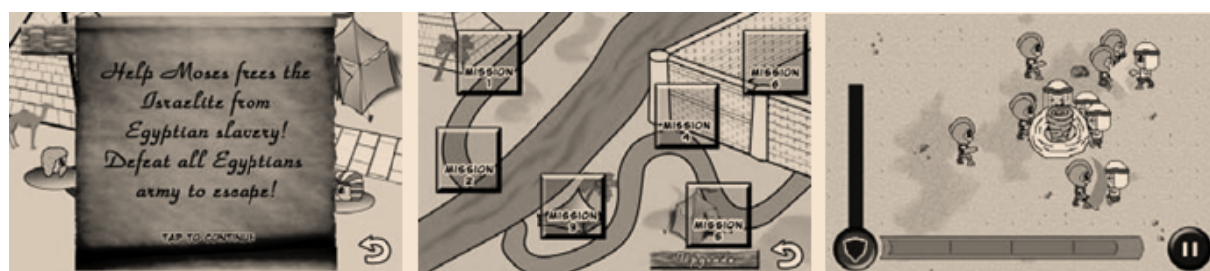

Figure 3 Moses Game
(Source: Chowanda *et al.*, 2015)

The second game is called "Tap for Battle," developed for Android smartphones. It is a casual strategy game with Historicity of the Bible themes of Moses. Figure 3 illustrates how the gameplay looks like. The game narrates the story of the struggle of the Israelites while fleeing from The Egypt with the lead of Moses. The comprehensive details of the game can be read at (Chowanda *et al.*, 2014).

In order to match the criteria of the research design, the games with the storyline that match with the paragraphs of the textbooks are extended. Hence, all information provided in the textbooks are identical with the one provided in the games. However, the information in the games is already blended in the game story. It should flow naturally as the game is progressing. The participants were not required to finish all the levels in the games. They were only required to finish one level prepared by the researchers.

RESULTS AND DISCUSSIONS

A Kolmogorov-Smirnov test indicated that all the data were more likely from non-normally distributed population ($p < 0.001$) indicates that t-Test Paired Two Samples for Means could not be applied, as the population cannot be assumed to be normally distributed. Hence, Wilcoxon Signed-Rank Test was applied as an alternative to it.

Figure 4 demonstrates the results from each group, where the darker color bars indicate pre-condition scores before treatments and the lighter color bars indicate post-condition scores after treatments (i.e. reading book for Group A and C and playing game for Group B and D). In addition, Table 2 describes the details values of the results for each group. Where the darker color rows indicate pre-condition scores before treatments and the lighter color rows indicates post-condition scores. Q1 indicates whether the participants have difficulty in remembering names in historical events. Q2 indicates whether the participants have difficulty in remembering the timeline of the events occurred in historical events. Q3 indicates how strong the participants' motivation in learning a subject about history is. Finally, Score indicates the score of participants' knowledge out of 10. In Q1 and Q2, the smaller the value, the better is the result. Meanwhile, in Q3 and Score, the bigger the value, the better is the result.

A Pearson Correlation Test indicated that there was a strong positive correlation between participants overall questionnaire and test scores between group A and Group B, $r = 0.91, n = 15, p < 0.05$. Furthermore, there was also a strong positive correlation between participants' overall questionnaire and test score between group C and group D, $r = 0.88, n = 17, p < 0.05$. As the number of group A and B are different compared to group C and D, Pearson Correlation Test could not be applied to those groups.
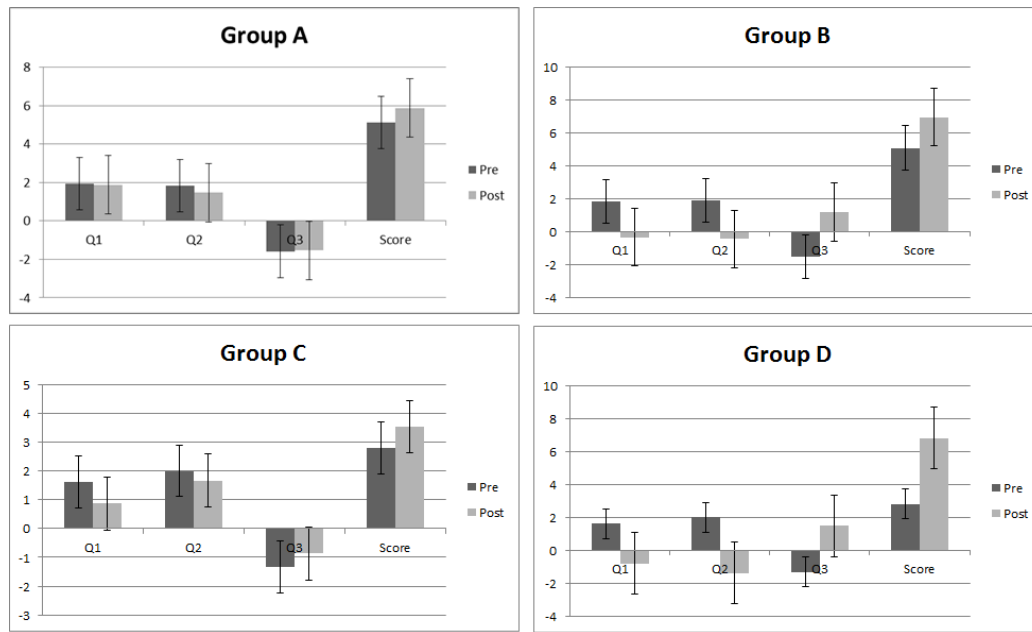

Figure 4 Results for Each Group

Based on Figure 4, it can be assumed that there were no significant differences between group A and group B results. However, pre-test scores in the group D was lower than the ones in the group B. This might indicate that the participants were more familiar with the subject in the group B compared to the one in the group D. However, as what can be seen from the figure, the increase of the test score was higher in group D. There are some factors that can influence this (e.g. game in group D is more interesting than the one in group B, the subject in group D is easier compared to group B, the information given in group D less complex or difficult compared to group B). A further test should be conducted to determine the factors.

Table 2 Results for Each Group, Where * marks represent significance at the 0.05 level
and another marked with ** indicates significance at the 0.00 level.

		Q1	Q2	Q3	Score
GROUP A	**Pre**	1.941176471	1.823529412	-1.588235294	5.117647059
	Post	1.882352941	1.470588235	-1.529411765	5.882352941
GROUP B	**Pre**	1.823529412	1.882352941	-1.529411765	5.058823529*
	Post	-0.352941176**	-0.470588235**	1.176470588**	6.941176471**
GROUP C	**Pre**	1.6	2	-1.333333333	2.8
	Post	0.866666667*	1.666666667	-0.866666667	3.533333333*
GROUP D	**Pre**	1.6	2	-1.333333333	2.8
	Post	-0.8**	-1.4**	1.466666667**	6.8**

In group A, a Wilcoxon Signed-Rank Test indicated that Q1, Q2, and Q3 post-questionnaire score were not statistically different in significance compared to pre-questionnaire score. Where Q1 ($p = 1, signedrank = 16, NS$), Q2 ($p = 0.11, signedrank = 44, NS$) and Q3 ($p = 0, signedrank = 6, NS$). This indicates that there were no statistical significance changes even though the treatment (i.e. reading book) was applied. On the other hand, there was a statistical significance increase in their post-test score compared to their pre-test score ($p < 0.05, signedrank = 3$).

Meanwhile, in group B, a Wilcoxon Signed-Rank Test indicated that Q1, Q2 and Q3 post-questionnaire scores were statistically different compared to pre-questionnaire score. Where Q1 ($p < 0.00, signedrank = 120$), Q2 ($p < 0.001, signedrank = 120$) and Q3 ($p < 0.001, signedrank = 0$). This indicates with the treatment (i.e. playing game), the post questionnaire results were statistically lower in significance than the pre-questionnaire for Q1 and Q2 and higher for Q3. Similarly, there was a statistical significance increase in their post-test score compared to their pre-test score ($p < 0.00, signedrank = 0$).

Similar to group A, in group C, a Wilcoxon Signed-Rank Test indicated that Q2 and Q3 post-questionnaire score were not statistically different in significance compared to pre-questionnaire score. Where Q2 ($p = 0.13, signedrank = 10, NS$) and Q3 ($p = 0.63, signedrank = 0, NS$). This also indicates there were no statistical significance changes even though the treatment (i.e. reading book) was applied. However, there was a statistical significance decrease in their Q1 post-questionnaire score and also their post-test scores compared to their Q1 pre-questionnaire ($p < 0.05, signedrank = 21$) and pre-test score ($p < 0.05, signedrank = 2.5$) respectively.

Finally, in group D, a Wilcoxon Signed-Rank Test indicated that Q1, Q2, and Q3 post-questionnaire scores were statistically different compared to pre-questionnaire score. Where Q1 ($p < 0.001, signedrank = 91$), Q2 ($p < 0.001, signedrank = 120$) and Q3 ($p < 0.001, signedrank = 0$). This indicates with the treatment (i.e. playing game), the post questionnaire results were statistically lower in significance than the pre-questionnaire for Q1 and Q2 and higher for Q3. Similarly, there was a statistical significance increase in their post-test score compared to their pre-test score ($p < 0.001, signedrank = 0$).

The results shown above indicate that with only reading book. Even though there was a statical significance increase in their test score after they were reading the book, there were no statistical significance changes in the participants' difficulty in remembering names and event timeline in the historical events. Moreover, there was also was no statistical significance changes in their motivation to learn a historical subject after reading book. On the contrary, in addition to an increase in their test score, the participants from the group that the treatment was playing games reported that they were more motivated to learn a historical subject and believed that playing games was helping them to remember names and event timeline in a historical event.

In addition, a Wilcoxon Signed-Rank Test indicated that Q1, Q2 and Q3 pre-questionnaire and pre-test scores from group B were not statistically different compared to Q1, Q2 and Q3 pre-questionnaire and pre-test score from group A. Where Q1 ($p = 0.83, signedrank = 31, NS$), Q2 ($p = 0.98, signedrank = 31.5, NS$), Q3 ($p = 0.79, signedrank = 27.5, NS$) and Score ($p = 1, signedrank = 39, NS$). However, Q1 and Q2 post-questionnaire score from group B were statistically lower in significance than the one from group A (Q1 ($p < 0.00, signedrank = 105$) and Q2 ($p < 0.00, signedrank = 89.5$)). Furthermore, there was a statistical significance increase from Q3 post-questionnaire and post-test score from group B compared to Group A (Q3 ($p < 0.00, signedrank = 0$) and Score ($p < 0.00, signedrank = 0$)).

Similarly, a Wilcoxon Signed-Rank Test indicated that Q1, Q2 and Q3 pre-questionnaire and pre-test score from group D were not statistically different compared to Q1, Q2 and Q3 pre-

questionnaire and pre-test score from group C. Where Q1 ($p = 1,\ signedrank = 0,\ NS$), Q2 ($p = 1,\ signedrank = 0,\ NS$), Q3 ($p = 1, signedrank = 0,\ NS$) and Score ($p = 1, signedrank = 0,\ NS$). However, Q1 and Q2 post-questionnaire score from group D were statistically lower in significance than the one from group C (Q1 ($p < 0.01,\ signedrank = 71.5$) and Q2 ($p < 0.001,\ signedrank = 118$)). Furthermore, there was a statistical significance increase from Q3 post-questionnaire and post-test score from group D compared to Group C (Q3 ($p < 0.001, signedrank = 0$) and Score ($p < 0.001, signedrank = 0$)).

The results above indicate that it is most likely that the initial data from group A and B were statistically similar as there were no statistical differences between them and they were also highly positive correlated to each other. However, after a different treatment (i.e. group A reading book and group B playing game), the group B participants reported that their difficulty in remembering names and event timeline in the historical events after the treatment were statistically lower in significance than the one in the group A. Moreover, group B participants' motivation and post test-score after the treatment were statistically higher in significance than the one in the group A.

Similarly, it can be implied that it is most likely that the initial data from group C and D were statistically similar as there were no statistical differences between them and they were also highly positive correlated to each other. However, after a different treatment (i.e. group C reading book and group D playing game), the group D participants reported that their difficulty in remembering names and event timeline in the historical events after the treatment were statistically lower in significance than the one in the group C. Moreover, group D participants' motivation and post test-score after the treatment were statistically higher in significance than the one in the group C. This indicates playing games treatment was statistically providing the better results in significance compared to reading book.

CONCLUSIONS

It is empirically proved that games can increase students' interest and assist them to address their difficulty to follow a difficult subject. Participants in the groups with a treatment of playing game (i.e. group B and D) reported that playing game facilitate them in remembering names and event timeline in the historical events. They also felt more motivated in learning a historical subject via games. The post-test score for the participants in those groups were also statistically improved in significance compared to the participants in the group with a treatment of reading book.

Moreover, the pre-test score in the participants who were in the group that was playing game about Historicity of the Bible themes of Moses was lower compared to the one in the group that was playing game about The Ken Arok and Ken Dedes of Singhasari Kingdom. However, the participants from the group that was playing game about Historicity of the Bible themes of Moses was statistically higher in significance than the one in the group that was playing game about The Ken Arok and Ken Dedes of Singhasari Kingdom. A number of factors are yet to be determined with further set of experiments.

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