Gender Differences in Motivation to Learn Math Using Role Play Game in Smartphone

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Abstract. Math is often regarded as a difficult subject, so motivation is required from students to learn it. Motivation can be improved through games, one of them is a mobile game. Role Play Game is a game that is often used, by males and females. Female students are better at mathematical thinking, but who is better at learning to use games is still confusing. Most of the previous studies only show that a learning motivation was based on the gender, however, they did not consider the math sides and the kind of games they used yet. This study aims to determine the comparison of students' learning motivation between males and females in learning using a mobile game. In this research, there were 32 students aged 12-14 years old, males (n=16) and females (n=16) that studied the same social arithmetic material using RPG. The result of this research, the males had a better score in math learning motivation based on the questionnaire before and after given treatment t(30)= -2.238, p=0.033, but female students did fewer mistakes. This paper also summarized the characteristic design of the game.

1. Introduction

Math is important for our life [1], but math is a difficult subject for students [2], as a result to learn math it is needed high learning motivation because motivation pushes the students to build knowledge and success in learning [3]. Motivated students will choose learning activities, maintain learning activities, and strive for success in learning [3]-[5]. In other words, learning motivation is one important factor in learning mathematics, because motivation can make students eager in learning. Thus, low motivation to learn will affect the low achievement of students [6]. However, based on PISA results [7], only 27 out of 70 countries have above-average motivation. This indicates that the motivation of student learning in the majority world is still lacking and requires more attention.

Motivation itself is influenced by two factors, intrinsic and extrinsic [4]. Kember [8] mentions, intrinsic motivation is defined as motivation through an interest in learning activities undertaken, and tend to give a strong influence. Extrinsic motivation is seen through rewards or external factors to an activity. Therefore, to be able to increase the motivation of learning globally in a person is necessary to trigger intrinsic motivation, one of them can be through playing smartphone games.

Smartphone nowadays quickly developed, 25.7% people or around 1.86 billion people used smartphone in 2015 and it is predicted to increase to be 35.2% in 2019 [9]. According to the gender, there is 70.3% male and 72.4% female use smartphone [10]. It indicates that the number of smartphone users either male or female are almost equal. On the other side, the smartphone users for playing a game were around 39% in 2012, and it is the highest number than it is used for another thing [11]. It means, the smartphone users' motivation to play a game is quite big, so the utilization of game using smartphone can be used to stimulate students' external motivation through a game or it is usually called as the mobile game based learning [12].
Game-based learning is the use of a game to support learning [13], [14]. A mobile game-based learning is a game which is specially used in learning using mobile equipment [15], [16]. In the U.S., the top 5 game mobile mostly downloaded is an arcade-type game (631), action-type game (615), puzzle-type game (355), simulation-type game (341), adventure-type game (318) [17]. Based on those findings, the action game is at the top rank in the most preferred game by the users. Besides that, the result finding by CyberZ [18] stated that among the males and females, the difference is not too significant for the preference on the Action Role Play Game (RPG) type mobile game, which is around 35%-38%. Action game RPG is a game emphasizing on the action series done by the player to fulfill series of the certain objective on the character development and narration component [19]. Action game RPG demands someone to explore in the narration series in the game plot and can be used to deliver learning material through that plot.

Jenson and Castel [20] told that male students are more interested in playing a game than the female students, but Chung and Chang [21] showed that did not show any significant difference motivation between both of them from learning using a mobile game. However, female students have better work on math than males students [22], [23]. In the use of a smartphone each day, female students were 64% and male students were 63% in 2014 [24]. It indicates that males and females have their own superiority in the use of smartphone and learning math. Therefore, it will be an interesting study if we compare who are more motivated in learning math using Action RPG type mobile game, the males or the females.

The former research only investigated how was the effect of the game using a computer on the gender, but it did not observe on the math subject, equipment used, and the type of the game used [25]. Therefore, this research would investigate who have better motivation in learning using the RPG game, whether they are male students or female student.

1.1. Kisah Si Kuncung: Game for Learning Social Arithmetic
This game is a Role Play Game (RPG) type game like final fantasy game for middle students aged 12-14 years old. This game entitled "Kisah Si Kuncung: Petualangan Belajar Aritmetika Sosial yang Luar Biasa". RPG game has a characteristic that differs from other games. It has narration, the plot of a story that was designed to facilitate the students in learning math and particularly in the social arithmetic material. Students will learn about profit, loss, gross, tare, net, tax, and interest [26]. This game was developed using the principles of the game made by Miller and Kocurek [27], and kive key ingredients for improving student motivation by Williams [28].

Figure 1. The Appearance of The Title of Kisah Si Kuncung.

This game has journey groove that must be accomplished by the player one by one so that the player can not directly go to the last mission. In every spot visited by the player, there is a problem that must be accomplished by the student related to trading. The problems that exist are the problems of daily life (problem-based learning), problem-based learning is a student-centered learning model that uses ambiguous but real problems[29]–[31]. The real problem is then packed with an in-game illustration. The player can find the problem by interacting with the characters in the game. Giving these real problems will encourage students’ problem-solving skills and improve their learning motivation [28].
The player can also do battle with the competitor in the game, before doing battle, the competitor will give question-related to the trading material. If the player can not answer correctly, the player then will do battle with that competitor. This is one of the learning evaluation systems in this game. This will encourage students to conquer their enemies and fears, encourage students to complete the task well, motivation will increase [28].

2. Method
This research is an experiment quantitative research which aimed to compare the learning motivation between males and females in learning math using RPG game in a smartphone. The research subjects were taken from a school. The participants were selected from 40 male and female students aged 12-14 years old that once used/had a smartphone for more than 2 weeks. There were 7 students which were not selected because they did not have a smartphone, and 1 student was not selected because he just had a smartphone in less than 2 weeks, so that 32 students, males (n=16), females (n=16) fulfilled the requirements were selected. Both male and female students did the learning by using RPG game.

The motivation questionnaires consisted of 20 items of questions with 1-5 Likert scale and the choices are ranged from very agree to very disagree so that we can get the category; more than 84 is in Very Good category, 68-84 is in Good, 52-68 is in Fair, 36-52 is Poor, under 36 is Very Poor [32]. The statements provided between before and after questionnaires are identical adapted with learning motivation indicator used, which is Choosing learning activity, Maintaining learning activity, Being enthusiastic in learning, Enjoying learning process, Trying to be successful in learning [4], [5]. This students’ math learning motivation instrument had been tested through content validity test through expert judgement. The Alfa Cronbach Score of this questionnaire showed rate 0.81 which indicates that the instrument reliability is in Good category [33].

This research took five meetings, each meeting was about 70 minutes. The students learned through RPG game using their own smartphone that they usually used them every day after they got the permission from the school. Every meeting discussed a different topic. On the first meeting, filling out the learning motivation questionnaire was conducted, then math learning using RPG game was conducted during five meetings, and after the fifth meetings, the filling out of learning motivation questionnaire was conducted. Then the questionnaires result data were analyzed, the first thing to do was analyzing how was the condition of male and female students' learning motivation before the research conducted whether it was different or not. If the first condition of learning motivation was relatively equal, then it would be investigated the differences in the learning motivation after the treatment. If the first condition was different, then it would be investigated the change in the learning motivation of each subject.

3. Result and Discussion
Firstly, it would be analyzed whether the research subject between males and females were balanced from the aspect of the amount, age, math ability from the report of the teacher and learning motivation pretest score. Males and females in the first condition were not significantly different in the aspect of the amount (n=16), age (M=12.81, SD=0.59). The result of the pre students learning motivation questionnaire indicated that the data was normal, homogeneous, and no significant difference t(30)=-0.295, p=0.770. However, the post learning motivation questionnaire indicated that male students had
higher learning motivation than the female students did. \( t(30) = -2.238, p=0.033 \). The result of the pre-questionnaire is entirely presented in Table 1.

Table 1. The Result of Motivation Research Using Role Play Game.

|                         | Males (n=16) | Females (n=16) |
|-------------------------|--------------|----------------|
| Pre questionnaire       | 72.75 (6.66) | 72.125 (5.21)  |
| Post questionnaire      | 81.81 (7.31) | 75.31 (9.02)   |
| The amount of mistakes  | 53.31 (12.25)| 33.93 (12.06)  |

From the result of the questionnaire, it can be seen that both groups were in normal and homogenous, however, after they were given the learning with mobile game, the post questionnaire indicated that the males were significantly better than the females \( t(30) = -2.238, p=0.033 \). While it was seen from the increase of the score from the pretest and posttest, males (\( d=9.06 \)) significantly also surpassed the females (\( d=3.18 \)). The preeminence of the males on learning motivation is the main finding in this study.

Male students (\( M = 53.31, SD = 12.25 \)) significantly made more mistakes than female students (\( M = 33.93, SD = 12.06 \)).

Furthermore, it would be observed whether the use of the game in learning is effective for students with the previous motivation, Very Good, Good, Fair, and Poor. The previous students were categorized as whether they had Good, Fair, or Poor motivation using pre questionnaire. From those of both groups, we got 1 student having a Very Good motivation, 18 students rated Good, and 13 students rated Fair. Students who were previously categorized having Fair learning motivation showed a higher raising (\( d=11.61 \)) than the students who were previously categorized having a Good motivation (\( d=4.05 \)). The category of high learning motivation did not encounter a significant change. It indicated that the RPG mobile game was more effective for the students having learning motivation problem, students who had low motivation would be more benefited learning using RPG game.

In line with previous evidence which suggests that students' mathematics learning motivation is better than female students [20], these results demonstrate clear benefits for improving motivation in learning mathematics using mobile games that have been investigated previously by researchers [15], [16], [27], [34]. Male students are significantly more motivated to learn. The results of Chou Tsai's research [35] also showed similar results in 535 students in Taiwan. Tomic [12] also mentioned that males are more interested in playing games than females. But the findings of Chung, & Chang [21] differ, the learning motivation of males and females did not show any significant difference. Maybe this is related to the type of game that used. Chung, & Chang use the kind of simulation game, this study uses RPG type games (adventure games), so males tend to like this type of game [36].

While female students make fewer mistakes than men. This is in line with the initial hypothesis and is consistent with earlier evidence from previous studies by Ajai [22], & Idrees [23]. This is also relevant to research from Lowrie [36], female students prefer game problem-solving. Women prefer the educational part of the game, rather than pleasure and competition [12]. The number of mistakes made by male students indicates that male students tend to experiment with all the answers [25].

Students who have a fair motivation to learn before the lesson, more experienced increased motivation to learn after learning to use the game that students who have the good motivation. This indicates that students who have previous motivational problems may be the best subjects to learn to use this game [25], [37]. Games will make students more passionate and engage in learning [12], [34]. This study provides some tangible evidence that learning packed through a game can improve learning motivation. The game would make the students more enthusiastic and get involved in the learning. This study gave a number of real evidence that the learning presented through a game could increase the learning motivation.

The obstacle found by the researchers because the requirement of the research subject was the students who had already used a smartphone for at least two weeks, not on the students individually or on a certain condition (have the certain ability). To cope with this problem, (a) chose the research...
subject in the class with the ability of the students was spread evenly according to the math teacher's suggestion and (b) confirmed that the students in two conditions were relatively balanced in the age. The trial of this game was done for five meetings in the class, so the learning did not finish in one time. It might be the determining factor of the increase of the students' learning motivation, as the research done by Clark [37], the game which uses a number of learning session is much better than one learning session.

4. Conclusion
This research was one of the math education researches which used the game as the learning media to increase the learning motivation of male and female students. This research particularly showed that by learning using RPG game of Kisah Si Kuncung, both groups underwent the rise of the learning motivation score, but the male students' group entirely had a better learning motivation than the female students. The students who previously had low motivation were benefited as the rise was so significant compared with the students who had good or high learning motivation before. The simple characteristics of the game, no need to compete with another player, single player, not complex, and the clear narration became the important factors in the rise of the students' learning motivation.

However, there was some restrictiveness should be paid attention to this research. First of all, there was the rise of learning motivation of both groups, they might later consider the learning using other methods was not interesting. Moreover, the learning using this game was only done during five meetings (short term), so that it was needed to be studied further whether the rise of the learning motivation would continue or not. Secondly, the RPG game of Kisah Si Kuncung was only for the material of social arithmetic. The research subject was also relatively little, only at a school in Yogyakarta, Indonesia. Therefore, the result might not be able to be generalized globally.

To be able to understand the effect of the use of RPG game on the gender further, further research would be designed to examine this game with the similar and random sample dimension that having the various ability, but with a longer period of time. Besides that, mobile game that was used would still be developed to know the degree of the mistake and the duration of accomplishing time automatically. Moreover, it would be analyzed further about the effectiveness of the use of mobile game referring to the cognitive aspects of the students. Whether it is similar to the research done by Ajai, & Imoko [22], Idrees, Farooq, & Tabassum [23] who stated that the females are better at thinking mathematically. Besides that, it would also be explored the difference between both groups to understand whether the students study immediately or delayed by the game given, and which one is better between them [38].

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