Teacher's and prospective-teacher's perceptions of mobile math game "Proadventure" implementation in mathematics learning

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Abstract. Teaching mathematics through mobile games has been praised because of its potential as a motivating and engaging learning strategy. Yet, it is still a debatable issue in education and has received several criticisms. Modern teaching methods believe that involves student actively in the learning process may improve learning outcome. Although the current curriculum has design learning process to make students to be active in the classroom, but it does not adjust to the character of students in the 21st century. They are familiar with smartphones, internet, and mobile games. Mobile games are among the most popular application for student in primary schools and junior high schools. Student learning activities tend to be less because students are more interested in using their time to play games than to study from books. Theoretically, well designed gamification can improve learning, but qualitative investigations are required to disclose how a mobile game should be from teacher's perceptions. This qualitative research aims to describe teacher's and prospective-teacher's perceptions on the use of mobile game "Proadventure". Based on data collected via online questionnaires, the study acquires the possibility of the influence from the use of mobile games edutainment to support the process of learning mathematics.

1. Introduction

Today, technology has spread to all fields of life, even to mathematics education. Technology offers an opportunity as well as presents challenges for education practitioners to utilize this technology in education. One form of technology used today is Smartphone. "Smartphones have become part of everyday life" [1] and offer a variety of interesting features such as communication, information, entertainment, education, and other freedoms [2]. Smartphones are increasingly being used for economic development [3]–[5], health tools and device [6], [7], and educational activities [8], [9] since it has internet features and processor capabilities like a computer [10]. However, according to survey which is conducted by comScore (2018), entertainment is one of the major applications that have "highest average percentage growth" [11]. People are more interested in spending their time to follow entertainment than to learn. Although there are implicit values of lessons that can be taken from entertainment content [12].

1.1 The use of mobile game-based learning

There are many variations of technology development that can be used in class [13], one of the most recent is mobile game-based learning [14], [15]. Mobile game-based learning itself has pros and cons related to its use for learning. There are parties who support their use [16]–[19], and there are those who oppose it [20]–[22]. But this happened a few days ago. Rapid technological development certainly affects the culture and mindset of the people [23]. Community demands are essentially very complex and diverse, because this is closely related to the psychological conditions of each individual. Individual differences related to their development, socio-cultural background, and the factors brought about from their birth are things that need attention in developing the curriculum. So, it is very important to know how they are currently thinking about the use of mobile games-based learning in the learning process.

To gain understanding in the use and perception of teachers towards mobile game-based learning, we use survey research targeted at teachers and prospective teachers. The mobile game-based learning which used as an example in this study is Android game's Proadventure that can be downloaded from Play Store or direct link https://play.google.com/store/apps/details?id=tech.codefans.proadventure. Figure 1 illustrate some of the scene of Proadventure playthrough.

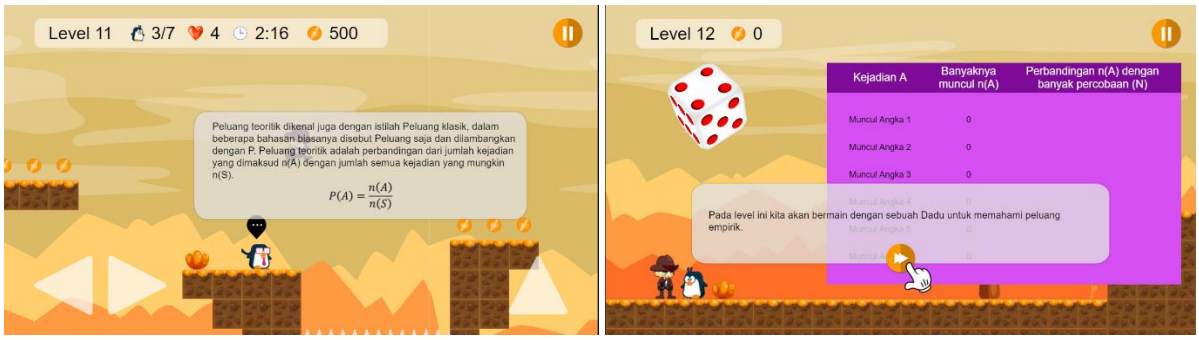

Figure 1. The scene of Proadventure

1.2 Edutainment

Proadventure is a mobile game that designed to be edutainment learning media that contains Probability subject from mathematics subjects for eight grade students. The term edutainment is a "distinctive form of entertainment" [24] which is intended to provide education to participants. Edutainment is a combination of the words education and entertainment which mean learning that involves entertainment using technology [25]. Edutainment content is any type of media formatted, sounds, visuals, forms, etc. Many studies have empirically proven that learning using edutainment media can provide a more interesting learning experience and more fun [26]–[29].

1.3 Mobile games genre

There are many variations on the types of mobile games. But there is no standard grouping [30]. The most used game classification are eight genres: "action, adventure, battle, puzzle, role playing, simulation, sports, and strategy" [31]. In addition, there is also a genre called casual games, which is a game that allows playing occasionally, usually requiring low level skills [32]. In this study, several groups of mobile games were taken, namely: Puzzle, Card, Arcade, Adventure, MMORPG, and Education Games.

1.4 Learning Motivation

Learning motivation is crucial in the learning process. In fact, weak learning motivation is still a problem in the current educational process. Weak self-motivation to learn in students turns out to be a problem that is so confusing for teachers, as well as parents. For example, many students spend sleep during class hours, students ignore the teacher's explanation, students are more engrossed in the device than reading books, and others.

Students spend more time playing mobile games than learning from books. This is an opportunity for developers to create mobile games that can provide subject matter. Game-based learning can be used as a solution or alternative to increase students' learning motivation [33]–[35] in the age of digital native generation.

1.5 Guided Inquiry

Proadventure is developed with the orientation of guided inquiry learning methods. Guided inquiry is one type of Inquiry learning method [36] which in practice provides sufficient guidance for students. The guided inquiry method is very suitable with the students' character in the 21st century [37], [38] because this method can bring out the "information literacy, learning how to learn, curriculum content, literacy competence and social skills" [39].

In finding a concept or material students can use various methods such as group discussions, question and answer between teachers and students, through experiments or through demonstrations. Guided inquiry leads students to conduct investigations [36] through simulations and demonstrations using the given device [37]. Hanson [40] gives 5 steps in the Guided Inquiry learning process as in Table 1.

Table 1. Guided Inquiry Learning Activity

	Activity
Orientation	Students creating interest, provide motivation, generates curiosity, and build new information with prior knowledge.
Exploration	Students make observations, collect and analyze information, and build hypotheses based on the problems proposed by the teacher.
Concepts formation	Students find relationships between concepts and encourage students to think critically and analytically to construct conclusions.
Application	The concept of new knowledge that has been obtained is applied in various situations such as exercises that allow students to apply it to simple situations to real life problems.
Closure	Students report their findings, reflect what they have learned, to consolidate their knowledge

Theoretically, Proadventure has met the criteria for learning resources that are suitable for use today. Therefore, qualitative studies are needed to find out the opinions of teachers and prospective teachers on Proadventure. The results of this study can also be used for future development of other mobile game-based learning and can also be used for the development of an education system that utilizes technology in learning.

2. Method

The participants of the study are 126 people consisting of 56 teachers and 70 prospective teachers. The participants voluntarily filled out surveys from various regions in Yogyakarta and Kalimantan. Participants fill out an online questionnaire containing questions about their perspective on mobile game Proadventure. The surveys item using multiple choices, 5 Likert-type scale, and some descriptive answer. Data obtained from the results of the questionnaire were analyzed using descriptive statistics with qualitative methods.

3. Results and Discussion

This article will cover the perceptions of teachers and prospective teachers on mobile games education, especially mobile games Proadventure. All respondents who filled out the questionnaire stated that they had an Android smartphone and they have downloaded the Proadventure from Google Play Store.

3.1 Smartphone usage

Table 2. Smartphone usage

Survey respondents (N = 126)		Percentage
Frequency	Rarely	0.8
	Sometimes	14.3
	Often	24.6
	Very often	60.3
Usage for	SMS / Phone call	65.9
	Streaming	61.9
	Chatting	91.3
	Playing games	56.3
	Updating status	34.9
	Browsing	4

In the survey (Table 2), 60% respondents say they use smartphone very often. Almost all respondents (91%) use smartphone for chatting, but only 56% of respondents that use smartphone for playing mobile games. From Table 3, respondents say (42%) they rarely play mobile games, while only around 12% are used to playing mobile games. Only 18% of respondents says they never playing mobile games. This is enough to indicate that the acceptance of mobile games among teachers and prospective teacher is quite high. These results are correspondent with the findings of other studies [41]–[43].

3.2 Mobile games usage

Table 3. Mobile games usage

Survey respondents (N = 126)		Percentage
Frequency	Never	18.3
	Rarely	42.1
	Sometimes	27.8
	Often	6.3
	Very often	5.6
Played game type	Puzzle	50.4
	Card	8.7
	Arcade	33.1
	Adventure	29.1
	MMORPG	10.2
	Education games	38.6
Most played game type	Puzzle	27.8
	Card	4
	Arcade	15.9
	Adventure	14.3
	MMORPG	6.3
	Education games	17.5
	Others	14.2

Based on surveys, Puzzle (50%) and Education games (39%) are the most widely played types of mobile games, but only Puzzle games (28%) that most played mobile games. This shows the teacher and prospective teacher are more experts when developing and using Puzzle type games for learning. These

results are in line with the results of reports issued by the Entertainment Software Association (ESA) about the most often played mobile games is Puzzle [44], [45].

3.3 Students' character

The teachers are given questions about the character of students today. Teachers commented as follows:

> Students learn to use existing technology, conventional learning methods are not attractive to students; More often using smartphones than learning; Easy to blend, easy to accept something new, like something practical, easy to get bored in learning; Very closely related to technology; Students (especially those in urban areas) can easily get facilities to access the internet; They tend to be selfish. They seem to have their own world on their gadgets. They don't care with what is happening around them; They are very creative, do not like monotonous learning processes, they prefer to experiment;

From these comments, a hypothesis can be drawn that students are currently very familiar with technology, especially smartphones. It is known that students are currently digital natively in line with other studies [46]–[48]. Thus, learning is expected to be able to use smartphone facilities. In order for learning to be attractive to students, learning media can be used in the form of mobile games.

3.4 Today learning should be

After seeing the character of students today, the teachers were asked for their comments of how learning that should be applied according to the current character of students. They say:

> Learning should use learning media, choosing the right learning model; Learning while playing, learning that can help improve students 'skills, enhance students' creativity and learning interests; Learning that makes them interested, is easily understood and applied and can be accessed at any time; Game-based learning by prioritizing the content of material content, not the game so that students are able to analyze and complete the subject matter; using technological sophistication such as smartphones; Learning that is appropriate to the character of students today should be designed based on technology, for example making learning groups through social media, or through interesting educational games. But there must be limitations such as educational game content must be in accordance with the learning objectives. Another limitation is that the application of online games is not excessive, thus reducing and even disrupting student learning time.

From some of these comments shows that teachers are very accepting of current technological developments, especially the opportunities for using mobile games in learning. This is in accordance with the research that has been done [41]–[43], [47], [49].

3.5 Teacher's and prospective-teacher's perceptions of using Proadventure

Teachers and prospective teachers simply accept Proadventure as a learning media. As the results of the survey (Table 4), 75% of the participants chose Proadventure during the learning hours. However, only 39% of respondents agree Proadventure are used during interclass, and only 52% of respondents agree Proadventure are used when students returned home. This is due to the teachers and prospective teachers still lacking in confidence students can learn by themselves without the teacher.

Table 4. When can Proadventure be used by students?

Survey item	Percentage
During class hours at school (Proadventure as Learning Media)	74.6
During interclass (Proadventure as refreshment)	38.9
When students at home (Proadventure as mobile games)	52.4

Teachers and prospective teachers believe that Proadventure mobile games can provide learning outcomes as shown in Table 5 especially for cognitive and learning interest which has been proven

through similar experiments [50]–[52], although there are some percent of respondents who are still in doubt. This shows that it is necessary to test the validity and reliability of media in various places.

Table 5. Proadventure Benefit

Survey item	Percentage		
	Yes	Maybe	No
Do you think Proadventure can improve students' cognitive?	77	23	0
Do you think Proadventure can improve students' affective?	57.9	41.3	0.8
Do you think Proadventure can improve students' psychomotor?	60.3	33.3	6.3
Do you think Proadventure can make learning time more efficient?	46	48.4	5.6
Do you think Proadventure can increase student learning interest?	82.5	16.7	0.8

Table 6 shows the results of the assessment by teachers and prospective teachers on Proadventure. The question was 5 Likert-type scale. From the average and standard deviation, it can be concluded that Proadventure has a good enough score to be widely used.

Table 6. Proadventure Rating

Rating	M	SD
Overall design	3.41	0.82
Graphics	3.36	0.75
Music	3.30	0.77
Gameplay	3.35	0.77
Probability subject matter	3.48	0.82
Guided Inquiry integration	3.53	0.76

4. Conclusion

Based on the results and discussions that have been described, it can be concluded that students today need learning media that is in accordance with their character that is close to technology [46]–[48] that provides learning pleasure. Thus, the use of mobile game-based learning media can be used as an alternative solution [33]–[35], [38]. Furthermore, Proadventure is considered to have a positive effect on learning outcomes and learning interest and is considered efficient to be used in learning Probability subject in the eighth grade of junior high school. Research and development of mobile game-based learning media need to be improved to increase teacher and prospective teacher confidence in the use of mobile games in the learning process.

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