C6_Developing Maths Edutainment Setyaningrum_2018

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Developing mathematics edutainment media for Android based on students' understanding and interest: a teachers' review

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Developing mathematics edutainment media for Android based on students' understanding and interest: a teachers' review

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Abstract. This paper aimed to describe the development of interactive edutainment mathematics media using Construct 2 software for grade 7 Junior High School, and to determine the quality of the interactive edutainment media developed in regards to improve students' understanding and interest. This research employs Research and Development design, which media was developed using ADDIE model consisting of analysing, designing, developing, implementing and evaluating. This paper focuses on the steps of development and validity of the interactive media from teachers' point of view. The teachers review focuses on three aspects – instructional, audio-visual and operational design. The review suggested that the media was very good in regard to the three aspects, with the average score was 144.55 from the maximum score of 175. Several contexts used in the game, however, need to be adjusted to students age.

1. Introduction

Several Indonesian students assumed that mathematics is one of difficult subjects taught at school. Students often experience difficulties in learning mathematics such as lacked in mathematical skills, and solving mathematical problems [1]. Based on the data of Trends in International and Science Study (TIMSS) 2011, Indonesia was in the 40th rank out of 59 participating countries with mathematics' average score 386 compared to 500, which is the global mathematics average score. These results indicate that the mathematics skills of Indonesian children are still far below the average of international score.

One of the methods to improve students' mathematical skills is using instructional media that can facilitate student learning. Instructional media plays important roles in teaching and learning mathematics. They help students visualize mathematical objects especially the abstract ones [2]. The use of instructional media can increase students' interest [3] and enhance students' understanding of mathematical concepts [4]. Moreover, instructional media can make the learning process more interesting (joyful learning), and it reduces the level of learning material abstraction [5]. Therefore, the use of appropriate instructional aids has a positive impact on learning outcomes [6,7].

On the other hand, technology has affected most of all aspects including education. Technology enriches the classroom with digital learning tools such as computer, interactive boards and a lot of educational software. It allows teachers to restructure and redesign the classroom in order to develop higher-order thinking skills [8] and increase student collaboration, one of the effective method in learning [9].

Considering the advantages of technology and the instructional aid in teaching and learning mathematics, teachers are encouraged to use it in the classroom. However, there are still limited instructional aids which use technology and have good quality in Indonesia. The media commonly used by teachers today is still in the form of print media images, graphics, or books. In addition, instructional aids are often high-priced due to profit-based company manufacturing, which causes inability of Indonesian teachers and students to buy those products.

In the digital era where students have already been familiar with technology, it is recommended to employ technology in the classroom in order to increase students' interest and engagement to the material they learn. One of the ways to infuse technology in the classroom is mathematics software or game enhanced by technology. This paper discusses the results of an R&D study and focuses on the steps of development and the validity of the interactive media from teachers' point of view. The R&D study aimed to develop an instructional aid for smartphone especially Android. Android is selected because its operating system is widely used in Indonesia [10].

The number of android-based instructional aid is still limited. Juraman [10] states that many Indonesians use Android to access information or entertainment (playing games) and to have self-actualization. Therefore, it is important to develop an easily accessible learning media for Android which is based on edutainment. According to Yosuf, et al. [11] "edutainment" is a combination of the word "education" and "entertainment". Therefore, edutainment refers to using entertainment in conjunction with education [12]. This learning media has elements of education and entertainment. The existence of entertainment element is intended to create a fun learning atmosphere without ruling out materials that must be studied by students. There are many types of edutainment, such as game, video, and film. This paper, therefore, reported the results of developing game as an instructional media. Game is one of effective media in the classroom [13] that can affect motivation [14], can provide greater learning opportunities compared to the traditional approach of teaching [15].

2. Methods

There are three instructional aids, in the form of game, which were developed in this study. The instructional aids were developed by using the ADDIE model i.e. Analyze, Design, Develop, Implement and Evaluate (Figure 1). This method was applied as it provides simple yet clear steps in developing the instructional aids.

a. *Analyse*. This step focuses on analyzing curriculum (main competencies, standard competencies, and teaching material), students' character, and situation. It also includes instructional design analysis aimed to determine the learning objectives and technical analysis aimed to determine media specification
b. *Design*. This step involves designing the instrument for evaluating the media that consists of validity form for media experts, teachers and students. It also includes determining actor, and designing interface, flowchart and storyboard as a guidance in developing media.
c. *Develop*. This step comprises coding program, developing interface, developing actor and content.
d. *Implement*. In this step, the media was uploaded to *Playstore* in order to get feedback from the users.
e. *Evaluate*. Feedbacks from the users (teachers and students) and the expert were followed up in this stage.

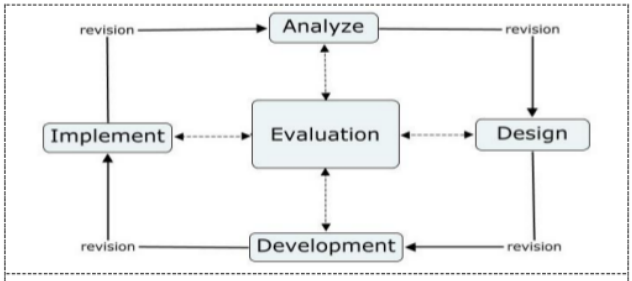

Figure 1. ADDIE's development model by Branch

The validity of the media was assessed by using expert judgement and users' review. In addition, the user reviews were also used as feedback for improvement. This paper discusses the results of review process by teachers. The review of the media focuses on three aspects namely instructional design, audio-visual communication, and the operational design. The instructional design referred to the suitability between the content of the game and the current curriculum. The audio-visual communication aspect included the quality of audio visual in the game. The last aspect examined the easiness in operating the media. These three aspects were elaborated into 35 questions with five options (Likert scale 1 to 5). The questions had been validated in terms of the contents by two experts. The ideal maximum score in the review process is 175 and the minimum score is 35. The average score of the reviewers' responses ($\tilde{x}$) were then categorized into certain criteria based on Table 1 below. The criteria are determined based the criteria in Table 1 that modified from Widoyoko's categories [16].

Table 1. Criteria of instructional aid

Skor	Kriteria
$\tilde{x} > 139.99$	Very good
$116.67 < \tilde{x} \leq 139.99$	Good
$93.33 < \tilde{x} \leq 116.67$	Fair
$70.01 < \tilde{x} \leq 93.33$	Poor
$\tilde{x} \leq 70.01$	Very poor

3. Result and Discussion

The instructional media developed in this study consisted of three games. Each game has different features and teaching approach, which was aimed to provide a variety of choices for the users – teachers and students so that they can choose the appropriate one. The first game employs scientific approach, therefore the game is structured based on five steps of scientific approach [17] namely observing, questioning, experimenting, associating, and communicating. Figure 2 illustrates the interface of associating steps in the game developed based on this approach.

Figure 2. Example of the game's interface based on scientific approach

Meanwhile, the second game was developed based on Van Hiele Theory for learning geometry. According to this theory, there are five levels of thinking: visualization, analysis, abstraction, deduction and rigor [18]. Therefore, second game were developed using these five levels of thinking. The example of game's interface in the visualization step is illustrated in Figure 3.

Figure 3. Example of the game's interface based on Van Hiele Theory

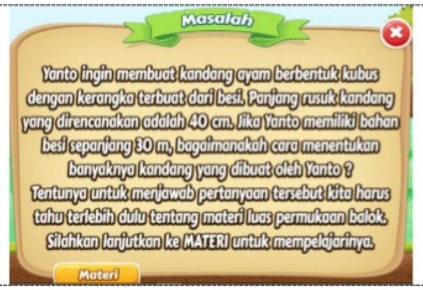

Figure 4. Example of the game's interface based on problem solving approach

Meanwhile, the third game employs problem-solving approach, in which the game starts with presenting a problem to solve while acquiring mathematical concepts. The example of interface for presenting problem is shown in Figure 4.

The media were reviewed by ten mathematics teachers who had experience in using ICT when teaching mathematics at Junior high school. Each teacher reviewed the instructional aid containing three mathematics games for Junior High School students. The review includes instructional design, audio visual communication, and operational design. The average score of the teachers' review is 144.55 which implied that the media was very good. The average score of each aspect is shown in Table 2.

Table 2. Average score of each aspect of review

Aspect	Average Score
Instructional design including	144.74
Audio visual communication	144.38
Operational design	140

Table 2 indicates that the overall score for each aspect can be categorized as very good. The instructional design involved the curriculum's appropriateness such as the competencies developed in the media are in line with the curriculum, the material accuracy and the suitability of the media structure to students' level of thinking. The average review score for instructional design is 144.74 which is very good. The review result for audio visual communication aspect was very good. This implied that the media utilizes appropriate language, accurate symbols, illustration, audio and feedback. In relation to the easiness in operating the media, the teachers believes that students can use the media as it has clear instructions.

In general, the reviewers believe that the three media were very good. This result is in line with a previous study about students' review on these three media which reported that the games were interesting and could help them in acquiring mathematical concepts [19]. Apart from the good results, according to teachers, these media still need to be improved. One of the teachers' concerns was the appropriateness of the context in the game with the age of the users (students). For example, one problem in the game asks the users to pretend to ride a motorcycle but the users in fact have not got a license to ride. Therefore, according to teachers, this situation should be adjusted with the users' real life. Another suggestion is related to the availability of summary and rewards in each level of the game. Both are suggested to be available in the end of every level of the game as a reinforcement for the users.

Regarding to the contribution for students' interest and learning outcomes, the teachers believe that the game has positive impacts on students' interest in learning mathematics as it is very interactive and fun yet easy to operate. The use of rewards would also increase user's curiosity and motivation. As suggested by previous empirical studies, motivation is part of interest that influence learning outcome [20, 21]. Therefore, it is believed that the game developed in this study can affected on students' interest and learning achievement. Moreover, the review from the teachers also pointed out that learning activities and mathematics problems in the games were presented in very appropriate and interesting ways. According to the empirical studies, students who are interested in their learning activities are likely to report high competence or high achievement levels [22, 23].

4. Conclusion

The game developed in this study was considered by the teachers to be a very good game in terms of instructional design, audio visual communication, and operational design. It is also convinced that it would be an interesting game that could have impact on students' interest and achievement in learning mathematics. A previous study on students' reviews on these media were also reported similar findings. Recommendations for further studies include the need to implement the game to the users who are students of Junior High School in order to get the empirical data of the effectiveness of the game for the users' interest and their learning outcomes. There is also a need to examine the effectiveness of the game in regard to other cognitive or affective aspects in learning, such as student's metacognitive skills and self-regulated learning.

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References
[1] Tambychik T and Meerah T 2010 *Procedia - Social and Behavioural Sciences Journal* **8** 142
[2] Berney S and Betrancourt M 2016 *Computers & Education* **101** 150
[3] Ogochukwu N 2010 *African Journal of Mathematics and Computer Science Research* **3** 107
[4] Goodwin K 2010 *Curriculum and Leadership Journal* **8** 1
[5] Cope L 2015 *Delta Journal of Education* **5** 10
[6] Chiu T and Churchill D 2015 *Computer & Education* **82** 280
[7] Moyer-Packenham P, Ulmer A and Anderson K 2012 *Journal of Interactive Online Learning* **11** 103
[8] Kurt S 2010 *New Horizons in Education* **58** 65
[9] Keser H, Uzunboylu H and Ozdamli F 2012 *World Journal on Educational Technology* **3** 103
[10] Juraman S 2014 *Jurnal Acta Diurna* **3** 78
[11] Yusof A and Song H 2010 *E-Project Based Learning Using Animation in Primary Schools* Paper presented at the EDULEARN10 Conference, Barcelona, Spain, July 3–8.
[12] Benckert S and Petterson S 2008 *Eurasia Journal of Mathematics, Science and Technology Education* **4** 121
[13] McLester S 2005 *Technology and Learning* **26** 18
[14] Charsky D 2010 *Games and Culture* **5** 177
[15] McLren B and Richard M 2017 *International Journal of Game-Based Learning* **7** 21
[16] Widoyoko E 2009 *Evaluasi Program Pembelajaran Panduan Praktis Bagi Pendidik dan Calon Pendidik* (Yogyakarta: Pustaka Pelajar)
[17] Roheni, Herman T and Jupri A 2017 *Journal of Physics: Conf. Series* **895** 012079
[18] Van Hiele P 1999 *Teaching Children Mathematics* **5** 310
[19] Setyaningrum W and Waryanto N 2017 *Jurnal Mercumatika* **2** 102
[20] Fisher P, Dobbs-Oates J, Doctoroff G and Arnold D 2012 *Journal of Educational Psychology* **104** 673
[21] Fadlelmula F, Cakiroglu E and Sungur S 2015 *International Journal of Science and Mathematics Education* **13** 1355
[22] Skaalvik E and Klassen R 2015 *International Journal of Educational Research* **72** 129
[23] Koeller O, Baumert J and Schnabel K 2001 *Journal for Research in Mathematics Education* **32** 448

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