Development of Android-based Edutainment game on Numerical Ability

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Abstract: Learning mathematic cannot be separated from the mathematical symbol and a numerical skill, which is required as ability to perform calculation and related matters with the numbers. This research is aimed to improve the numerical ability of students. The method used was based on Borg and call, which consisted of ten main stages involved. The first research result is the validation of android-based mobile games edutainment, that is, the average value of the three experts is 78.33% with valid criteria. Then the average validation results of the android mobile game test questions based on edutainment is 77.77% with valid criteria. The second is the value of simplicity, seen from the value of the questionnaire which was filled in by all fresh graduates which was accumulated so that a percentage of 85.84% was obtained with very practical criteria. Furthermore, the effectiveness is seen from the increase in scores workmanship of fresh graduate pretest and posttest which is calculated by the formula T test results obtained by increasing the pretest posttest score then ability numerical increase so that it is categorized as effective. Thus it is concluded that the development of android mobile games is based on edutainment on numerical ability is categorized valid, practical, and effective for used.

Keywords: Component; formatting; style; styling; insert

INTRODUCTION

The development of information technology and communication is currently growing rapidly and it causes changes the behavior and community activities in daily life. One of the technologies that are currently developing in a rapid pace is information and communication technology via what so-called smartphone. This such advanced technology is not only used as a means of communication but as means of facilitating users in their daily life as well. Facilities that attract a lot of user interest in the development of mobile technology is a mobile game. According to David (2016) the mobile game, which is a type of game, is designed and made specifically to run on mobile devices such as smartphones and tablets. At the current, the mobile game is not only a means of entertainment but it poses an extensive function that can be used as learning tool, business purposes and professional gamer. A fun learning activity which is packaged in the form of the android-based game application tend to encourage people to learn enjoyably and not getting bored easily. Therefore, the packaging of interesting learning games will definitely cause serious attention for the people who play it. Santoso (2018) stated that the learning process, which was designed by combining educational and entertainment content harmoniously, would cause learning activities taking place in a pleasant way.

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Learning mathematic cannot be separated from the mathematical symbol and a numerical skill that is required as ability to perform calculation and related matters with the numbers. Indrawati (2015) explained that numeric ability is the capacity to count numbers for knowing how well someone can understand ideas and concepts which stated in form number as well as how much easy somebody could think and solve problems with numbers. According to Astuti et al (2013), numerical ability is a skill that related to accuracy and acceleration in use of basic arithmetic function. Meanwhile, Indrawati (2015) said that ability with numerical talent was the intelligence using numbers and reasoning. This intelligence was able to think with abstract concept to find the relationship of things and solve problems logically especially in manipulating numbers. If the numeric and memory ability test is performed then it would reveal someone's intellectual ability in arithmetical reasoning and logical thinking.

According to Oktaviana and Nurmaningsih (2019), every student must have basic concepts of numeracy skills as this such skill would help student to understand and solve problem of mathematics. If the basic concept in mathematics is not mastered, it will be difficult for students to master the advanced concept. Therefore, the ability to count must be owned by every student.

Based on this problem above, it ultimately becomes a challenge for researchers to create an educational mobile game that enable to train the numerical abilities of students. Fuadi (2020) developed an educational game in the form of an Android-based game where it increased the learning outcomes of students. Thus, this research work attempts to conduct Research and Development (R&D) with the title "Development of Android Mobile Game Based on Edutainment against Numerical Ability". Based on the formulation of the research problem, the research objectives this is generally "to know the development process development of Android Mobile Game based on Edutainment numerical ability". The android-based numerical game would be focused on fresh graduate students who would like to improve their numerical ability. The method used is based on the research and development model based on (Gall, Borg, and Gall 1996). Afterwards, the data analysis which covered the criteria of validity, simplicity and effectiveness of the android-based numerical game would be performed to see the enthusiasm and interest of the students.

METHOD

The research method used in this study is Research and Development. According to Sugiyono (2013) research and development method was used to produce the product specific product, and test the effectiveness of the product. The research design used in this R&D research was a development model according to Gall et al. (1996). There are 7 modified steps, as can be seen in Figure 1, which are carried out including (1) Potential and Problems (2) Data collection (3) product design (4) design validation (5) design revision (6) product trial (7) revision product. In this section, each researcher expected to be able to make the most recent contribution related to the solution to the existing problems. Researchers can also use images, diagrams, and flowcharts to explain the solutions to these problems. The data collection was carried out through indirect communication, questionnaire with likert scale, and question tests to fresh graduate students. Afterwards, the experts were asked to assist the product validation and to assess the design, as a result, that further known weakness and strength could be identified. The quantitative data collected, which covered validity, simplicity and effectiveness, would be analyzed to know whether this android-based game application could be used or not for students.
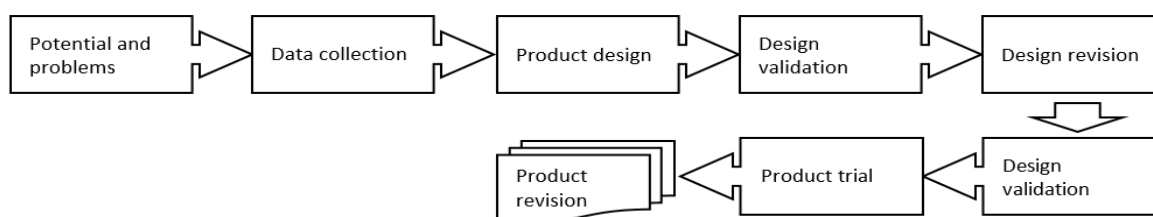

Fig. 1. Modified method of Research and Development

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Analysis Data

1. Validity

Quantitative data is used to process data in the form of values or percentages obtained through a media assessment questionnaire using a Likert scale with five of criteria as can be seen in Table 1. It was then analyzed by the formula percentage score.

Table 1. Guidelines for Assessing the Validity of Development Products

Percentage (%)	Criteria of validity	Remark
81 - 100	Very valid	No revision
61 - 80	Valid	No revision
41 - 60	Fairly valid	Half revision
21 - 40	Less valid	Revision
0 - 20	No valid	Revision

In this study, the validity value was determined with the criteria of criteria of at least "Valid". If the validator gives a value with the criteria "Valid" criteria, then the android mobile game developed can be used by doing some revisions.

2. Simplicity

The data obtained from the response questionnaire is in the form of quantitative data using a Likert scale with five-level criteria, and then analyzed using the percentage score technique. As a basis for making decisions in determining practicality and revise the android mobile game, the following assessment criteria are used assessment criteria shown in Table 2.

Table 2. Guidelines for Assessing the Simplicity of Development Products

Percentage (%)	Criteria of validity	Remark
81 - 100	Very practical	No revision
61 - 80	Practical	No revision
41 - 60	Fairly practical	Half revision
21 - 40	Less practical	Revision
0 - 20	No practical	Revision

In this study, the validity value was determined by the criteria of criteria of at least "Practical". If the validator gives a score with the criteria "Practical" criteria, then the android mobile game developed can be used by doing some revisions

RESULT

The media developed in this research is android-based educational game on numerical abilities. Research results on the development of this android mobile game is based on 7 modified steps development procedure on a modified Borg and Gall model. Description of edutainment-based android mobile game development on numerical ability is presented in the sections below.

Product design

In the design of this product required steps for designing an edutainment-based android mobile game media. In this case it is necessary to design innovative applications in order to improve fresh graduate numerical ability. In this step product development is done through several stages including:
   a) Determine the place where the application will be used.

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This game is made to run on any operating system android and cannot be run on other operating systems, such as
Windows, Linux, iOS, and others.

    b)   The right tools selection

In this process, researchers use Construct 2 tool to make a game, as can be seen in Figure 2. Because of the language the programming used is simpler and easier.

Fig. 2 tools construct display

    c)   Determine the name, design the appearance of the questions and the appearance of the game.

The Android mobile game developed is named Numeric Riddle because it is adjusted to the numerical ability. Game developed is designed as interesting as possible using Photoshop CS6 as depicted in Figure 3.
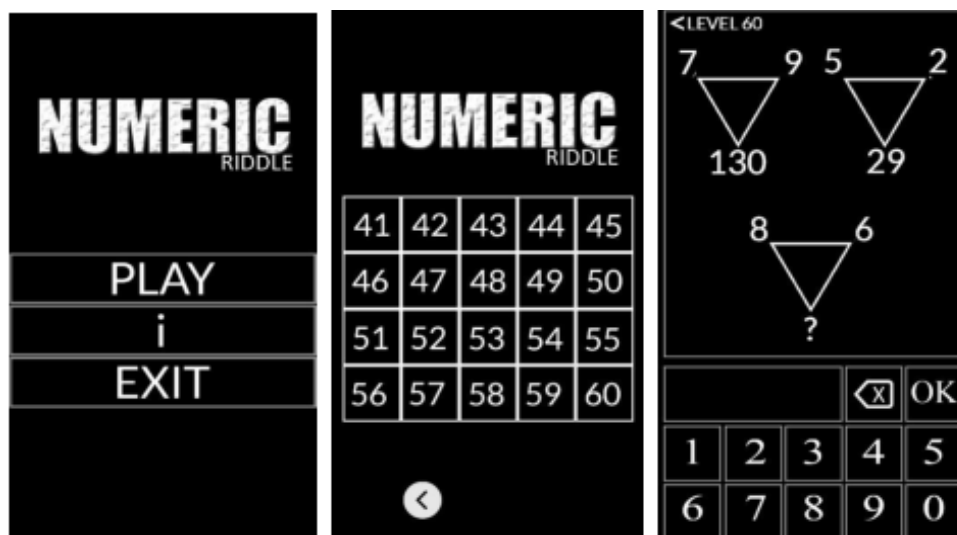

Fig. 3 The display of numeric riddle

    d)   Creating a programming language (coding)

Researchers translate or give orders according to flowchart using construct 2 as the programming language, both letters, numbers, and symbols that make up the program used to run the game.

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Design validation

In this study, the validation series process was carried out by three validator person who is expected to be able to provide input or suggestions for improving the media. Suggestions from the validator will be used as material to revise android-based mobile games this edutainment. The aspects in the application are assessed by the three validators are the media aspect and the test questions aspect. Sub aspects in the media include program aspects, display aspects, and visual communication aspects. Whereas sub-aspects in the test questions include aspects of questions and aspects of language. The results of the pocket book validation of the three validators can be seen in table 3:

Table 3. Validation result

Research instrument		Validator			Average value	Validation
		I	II	III		
Android mobile game	Media	78.33	78.33	78.33	78.33	78.05
	Question test	76.67	73.33	83.33	77.77	

The table shows that the average media validation results edutainment-based android mobile game is 78.33% with valid criteria. Then the average validation results for the Android mobile test questions edutainment-based games is 77.77% with valid criteria. So that the results of the validity of the media and test questions are 78.05 with the criteria valid. The results of validation by the three validators are also in the form of comments and suggestions on the media of android mobile game applications developed and instruments to be used in research. Validation results, comments, and suggestions from the three validators used by researchers to revise or improve the android mobile game media application developed. In this section, the researcher will explain the results of the research obtained.

Revision

The revision of product design is an improvement of the existing product developed and assessment instruments based on input, suggestions, or comments from the validators can be seen in Table 4. Therefore, the media mobile android application games can be used for research purposes, training users in improving numeric capabilities, as well as product specifications can be applied to a wider environment.

Table 4. Revision of android mobile game display

Point of revision	Before revision	After revision
The command		

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The level of game selection		
Play		
Developer		

Product trial

This trial aims to see the Simplicity and effectiveness android mobile game as edutainment based game developed in numerical abilities. Practicality in trials seen from the results of the undergraduate response questionnaire, while the effectiveness of android mobile game seen from the increase in pre-test and posttest. after conducting research according to the schedule in the table about the details of the research, as for the results of trials conducted in this research are as follows:

(a) Simplicity

The simplicity of android mobile games can be seen from the results of the response questionnaire bachelor. The results of the questionnaire are used to revise Android mobile games become the final product. The following are the results of the questionnaire scholar response to android mobile game:

Table 5. The response of fresh graduate student

Respondent	Score	Criteria
Fresh graduate	85.84%	Very simple

Based on the Table of Results of the Graduate Response Questionnaire, it is obtained the results of the undergraduate response questionnaire to the android mobile game are 85.84% with the criteria of "very practical".

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(b) Effectiveness

The effectiveness of android mobile games has increased in value from pre-test to posttest that has been done by fresh graduates in accordance with aspects of numerical ability. Average score from the pre-test is 3.75 out of a maximum score of 10 and an average score post-test is 6.95 out of 10. Based on calculations using the t test then di obtain the results of the effectiveness that the numerical abilities experience improvement of pre-test and post-test scores

DISCUSSIONS

This research aims to develop an android mobile game using the Research and Development (R&D) research method by using the development model according to Gall et al. (1996). In this model there are 7 steps out of 10 steps that are carried out including (1) potential and problems (2) data collection (3) product design (4) design validation (5) design revision (6) product trial (7) product revision.

The Borg and Gall design that was carried out aims to see the simplicity and effectiveness of android mobile games. Selection of android mobile game is adjusted to the problems experienced by undergraduates who are still difficult in working on numerical ability questions. The development of android mobile games is considered appropriate to overcome these problems, in line with the function of android mobile games. This is in accordance with the opinion of Daling and Haryadi (2017) which stated that the product of development research must fulfill the following requirements and three characteristics, namely valid, practical, and effective. Android mobile games must pass the validity first so that it can be tested on a limited basis through validation results by validators, then determining its simplicity and effectiveness based on the results of the response questionnaire. Effectiveness based on the results of the response questionnaire and the results of the pretest and posttest.

The validity of the android mobile game is obtained from the results of validation by the three validators. Android mobile games can be declared valid with a percentage average index of validity of 78.33%. The validation results are also in the form of comments and suggestions on the android mobile game developed and the instruments to be used in the research. Instruments that will be used in research. Before being tested android mobile game goes through a revision stage first based on the results of validation, comments, and suggestions from validators. Validation results, comments, and suggestions from validators.

Practicality and effectiveness are obtained based on the results of the field test. Field test by using the results of the fresh graduate undergraduate questionnaire, as well as the pretest posttest results. The questionnaire used in this study is closed questionnaire. A closed questionnaire is a questionnaire that has provided alternative answers so that the answers of the respondents are in accordance with the limitations of the answers provided. Based on the results of the undergraduate questionnaire given at the time of the field trial, the average percentage index of practicality was obtained of 85.84% with very practical criteria. Based on the results obtained from the undergraduate response questionnaire, then the android mobile game can be said to be very practical for scholars in practicing numerical skills.

Effectiveness is seen from the results of the increase in pretest and posttest done by student. In the pretest and posttest questions, revisions were also made based on the validator's suggestion that the questions made were improved so that they were not too easy. The results of the field trial obtained that there was increase in numerical ability based on the results of the pre-test and posttest, which then the android mobile game is categorized as effective. Based on this shows that the edutainment-based android mobile game on numerical skills, students already have an increase in numerical skills.

CONCLUSION

Based on the results of the research and discussion that has been presented previously, it can be generally concluded that the development of android-based educational game on numerical skills using the Borg and Gall design model modified into 7 model is feasible and very practical to be used by fresh graduate scholars to train numerical skills. This game is categorized as valid with minor revisions, therefore, it can be continued to the product use. This game can improve the numerical

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ability of fresh graduate scholars. As a result, it is categorized as effective to be used as an exercise activity before taking an academic numeric test.

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