The development of interactive mathematics learning media based on local wisdom and 21st century skills: social arithmetic concept

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Abstract. Learning media is one of the supporting components in learning process. In this development research, learning media is packaged using aspects of local wisdom and 21st century skills. The aim of this research is to develop an alternative learning media in accordance with the competencies of 21st century skills without leaving the values of local wisdom in the form of knowledge about the culture, habits and characteristics of the region, especially in Banten Province. The development model used in this research is ADDIE with 5 stages; Analysis, Design, Development, Implementation, and Evaluation. As a result, this research has successfully developed the AndroMath application. AndroMath application contains a summary of the material, examples of questions, practice questions and quiz games with social arithmetic material for seventh grade students of junior high school. AndroMath application is developed in smartphones with the Android operating system. The feasibility test on this application is carried out by six experts, consisting of three media experts and three material experts and students. The percentage score from all expert were 92.48% for media assessment, 89.02% for content assessment and 80.76% from student responses. The result show that the AndroMath application is worthy to use for student in the learning process.

1. Introduction

Education is an important aspect of life. Education is also a forum for organizing 21st century skills that are beginning to be appointed in Indonesia. In facing the challenges of the 21st century there needs some of abilities mastered. Some skills in the 21st century is not far from the pillars of life, namely learning to know, learning to do, learning to be, and learning to live together. Of the four pillars, there are several high order thinking skills that are expected to be able to be mastered by students, including critical thinking skills, communication, reasoning, literacy, problem solving and so on.

21st century skills is learning and innovation skills increasingly are being recognized as those that separate students who are prepared for a more and more complex life and work environments in the 21st century, and those who are not [1]. A focus on creativity, critical thinking, communication and collaboration is essential to prepare students for the future. Every education also leads to the ability of the 21st century. Likewise, mathematics learning began to be developed and refers to several high-level thinking skills such as critical thinking skills, creative, problem solving, reasoning, connection...
and communication. Mathematics is also one of the fields of education that has an important role in life. However, some students often assume mathematics is only something that is related to numbers and is not used in everyday life, whereas almost all activities in social life use mathematical calculations, such as the buying and selling process, calculating speed, distance, weight of objects and so on. The aim of learning mathematics itself is to put pressure on the structuring of reasoning and the formation of attitudes of students and also put pressure on skills in the application of mathematics [2]. Therefore, mathematics must be studied well especially in facing the challenges of the 21st century.

In fact, based on the 2015 PISA (Program for International Student Assessment) results, Indonesia ranked 63rd out of 70 countries in the field of mathematics. Its mean that the ability of Indonesian students in the field of mathematics is fairly low and still lacking. PISA is one of the tests conducted to measure mathematical skills on an international scale. This PISA test is conducted every three years.

One reason is that there is still a lot of learning that only uses lecture methods, especially on mathematics subjects. For this reason, it is necessary to have learning innovations that are expected to create innovative and creative teaching and learning activities. Learning innovations can be done from various components of learning such as the development of learning models, the selection of teaching aids, teaching materials and learning media. This can be done to attract students' attention and provide a learning atmosphere that is not monotonous. One component of learning that is widely used is learning media. Learning media can be said to be important in the process of learning. Learning media can help teachers in delivering material, making abstract material more concrete, and complicated material becomes easy to understand. The benefits of learning media including to clarify the presentation of messages in the material, improve and direct the attention of students to focus, overcome the limitations of space and time, and provide similar experiences about events in the student environment [3].

Referring to one of the benefits of learning media namely the similarity of experiences and events in the circle of students, this can be attributed to Indonesian local wisdom. So that learning media can make it easier for students to understand and add insight to students about the local wisdom of their environment. Meanwhile, based on research that the context of local wisdom in teaching materials that are suitable for everyday life received very good responses from students [4]. Learning media in the form of local wisdom is sought so as not only to increase students' mathematical skills but also to make students more familiar with the diversity of their environment and love their local culture. Local wisdom in its essence is often taught downstream or as inheritance. However, in this modern era not a few students are more familiar with outside culture than their own culture. The same thing is also stated another research that young generation less caring for their own culture [5]. Its means that the younger generation tends to be less interested in their own regional culture, they prefer to follow the development of western culture with one of the reasons being the lack of information regarding Indonesian culture young generation. So, it is necessary to deliver cultural information that is packaged in a modern form, one of which is learning media.

Nowadays, various learning media are starting to develop rapidly, especially technology-based learning media. Various learning media began to be packaged in a modern and unique way, both in the form of hardware such as pocket books, student worksheets or software such as e-books and applications for computers and cell phones which are packaged in interactive forms. This interactive learning media is often a favourite media for Indonesian students and can be improve students' interest in learning mathematics [6].
Research related to the development of interactive learning media gets results worthy of being used in learning [7-9]. Based on the descriptions above, we interested in conducting a study on the Development of Interactive Learning Media based on Local Wisdom and 21st Century Skills. This study aims to develop a learning application that improve students' interest in learning and knows the feasibility of the applications.

2. Method
The research method used in this study is Research and Development (R & D). This methods are a research method used to produce certain products [10]. The development research method contains at least three main components, namely, the development model, the development procedure and product testing [11]. The development model used is the ADDIE model which consists of five steps, namely analyse, design, develop, implement, and evaluation. The subject of this study was taken from 32 seventh grade student.

The instrument to be used in this study is a non-test instrument. The non-test instruments used were closed questionnaires. The questionnaire to be used is presented in the form of a Likert scale with five alternative answers for the expert validation and also student responses, which are strongly agree (SA), agree (A), disagree (D), and strongly disagree (SD) with a range of values from 1-4. This questionnaire was submitted to six experts, three media experts and three material experts with certain criteria. Criteria for media experts include; have competence in the field of design and application and have experience in making learning media. While the criteria for material experts include; have competence in the field of Mathematics and have a minimum of five years of mathematics teaching experience.

Product feasibility test is used to determine whether the learning media developed is feasible to use. This feasibility test is calculated from the result of expert validation and student responses. The results were analyzed by calculating the percentage (%) of achievement scores. The formula can be seen in equation (1).

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\text{Achievement Score} = \frac{\text{Total Score}}{\text{Ideal Score (100)}} \times 100\%
\]

Feasibility criteria are determined based on achievement scores. Products are feasible if only if the achievement score is more than 70%. If the achievement score is less than 70%, the product is not feasible and it has to correction based on the research objectives.

3. Result and Discussion
Learning media developed in this study can be run on Android with adobe air supporting. This application contains learning material, sample questions, quizzes and problem training. There is also a theme in this application that is local wisdom and 21st century skills. The context of local wisdom in this application is included in product design, songs in the product, examples and practice questions in the application. While the context of 21st century skills is included in quizzes and problem exercises.

One of research conclude that using gadgets in learning media is suitable and can be used by students in the City, because most students in the City already use gadgets in daily life. There was also this research conducted in Serang, Banten Province [12]. The developed learning media in this research named AndroMath. This AndroMath application elevates Social Arithmetic material for seventh grade students of Junior High School. In this application displayed social arithmetic material. There are also display applications as follows:
Figure 1. AndroMath Cover

Figure 1 shows the initial appearance of the application which contains the name of the application and the material contained in the application. There is the "start" button to start the application.

Figure 2. Application Menu

Figure 2 shows the menu or main page. In the main page a menu bar is displayed in the AndroMath application. User can directly choose which menu they want to open.

Figure 3. Learning Material

Figure 3 shows the learning material and example every learning material in Andromath application. Examples of questions taken using the context of local wisdom by using 21st century skills indicators.
In the quiz menu, researchers provide 8 questions in multiple choice forms that are in accordance with the context of the problem of local wisdom and 21st century skills. In this quiz if the user is able to answer the question correctly then he will move to the next question, but if the user cannot answer the question with right then the user must try to get the correct answer before going on to the next question.

The AndroMath application is tested by experts first. The experts in this study were divided into two groups, namely media experts and content experts with three media experts and three content experts respectively. Testing with media experts is conducted to determine the feasibility of AndroMath applications in terms of usability, display, visual communication and design listed with 12 items of statements in the assessment instrument.

Table 1. Result of media expert validation

| Aspects            | Achievement Score (%) | Total (%) | Criteria |
|--------------------|------------------------|-----------|----------|
| Expert 1 | Expert 2 | Expert 3 |          |          |
| Usability     | 91,67      | 100       | 75       | 88,89    | Feasible |
| Visual Navigation | 100       | 100       | 100      | 100      | Feasible |
| Design         | 87,50      | 100       | 78,13    | 88,54    | Feasible |
| Total (%)      | 92,48      |           |          |          | Feasible |

From Table 1 it can be concluded that the results of the overall media test involving three media experts obtained a score of 92.48% with feasible category [13]. There were scores for each aspect, among others, aspects of use 88.89% with very decent categories, aspects of visual communication 100% with very feasible categories, and design aspects 88.54% with very decent categories.

Testing with material experts was conducted to determine the feasibility of the AndroMath application in aspects of material content, mathematical concepts and evaluation. There were also 18 statement statements in the expert test instrument for this material.

Table 2. Result of content expert validation

| Aspects                | Achievement Score (%) | Total (%) | Criteria |
|------------------------|------------------------|-----------|----------|
| Expert 1 | Expert 2 | Expert 3 |          |          |
| Content          | 87,50      | 88        | 100      | 91,67    | Feasible |
| Mathematical concepts | 75,00     | 96,43     | 96,43    | 89,29    | Feasible |
| Evaluation      | 83,33      | 83,33     | 91,67    | 86,11    | Feasible |
| Total (%)       | 89,02      |           |          |          | Feasible |

From Table 2 it can be concluded that the results of the overall material test involving three material experts obtained a score of 89.02% into the feasible category. There were scores for each aspect, among others, the content aspect of the material was 91.67% with very decent categories,
aspects of mathematical concepts 89.29% with very decent categories, and evaluation aspects 86.11% with very feasible categories.

**Table 3. Result of student responses**

| Aspects     | Answer | Score | Percentage (%) | Criteria |
|-------------|--------|-------|----------------|----------|
| Interest    | 0 3 59 34 | 319   | 83.07          | Feasible |
| Usability   | 23 66 62 41 | 615   | 80.08          | Feasible |
| Design      | 0 7 52 37 | 318   | 82.81          | Feasible |
| Content     | 16 41 26 13 | 296   | 77.08          | Feasible |

Based on Table 3 above, the results of product trials were obtained by seventh grade students obtained a percentage of 80.76% with very decent criteria. In addition to questionnaire responses to the AndroMath application, students were also asked to fill in a number of questions that were provided in accordance with the material in the AndroMath application and most students were able to answer these questions correctly. This result shows that the use of Andromath is able to train students' understanding ability. These results are in accordance with several other studies which reveal that the use of interactive learning media can improve understanding ability and student learning interest [14].

4. Conclusion

Learning media developed in the form of an Android named AndroMath contains social arithmetic material which is also associated with the context of local wisdom, especially in Banten Province. In addition to the subject matter, the AndroMath application also contains examples of questions, practice questions and quizzes. There is also a theme in this application are local wisdom and 21st century skills. The context of local wisdom in the application is included in the design of the product display, music in the product, and examples and practice questions contained in the application. While the context of the 21st century's skills is included in the sample questions, practice questions and quizzes that match with the indicators.

The feasibility test on this application is carried out by six experts, consisting of three media experts and three material experts. From the six experts, the results of the percentage were 92.48% with feasible category for media assessment and 89.02% with feasible category for material assessment. Whereas the results of the field trials conducted on seventh grade students of Junior High School got a percentage of 80.76% with a feasible category. From this result can be concluded that the AndroMath application is worthy to use for student in the learning process.

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