

# Improving The Ability of Problem Solving in Physics Using Android-Based Teaching Materials

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**Abstract.** This study aims to develop interactive teaching materials to improve the problem solving. The research used Research and Development (R&D) method that develop by Robert Maribe Branch with the ADDIE development model that includes Analysis, Design, Development, Implementation, and Evaluation. The validity of teaching materials was obtained from material and media experts. The practical was obtained from students and one teacher. Student trials included small groups of 5 students and field trials of 20 students. The results showed that the interactive teaching materials developed were valid and suitable to be used based on a very good assessment category by the experts with a percentage score of 87% by material experts and 86% by media experts. Teaching materials are also practical which can be seen from the results of student needs. The effectiveness of teaching materials can be seen from the impact of these teaching materials which can improve students' problem solving abilities with an n-gain analysis of 0.49 (medium category). Based on this description, the interactive teaching materials that have been developed are valid, practical, and effective so that they can improve problem solving skills.

**Keywords:** *R&D research, interactive teaching materials, problem solving*

## 1 Introduction

The development of science and technology increasingly encourages renewal efforts in the use of technological results in the learning process. The learning process carried out in educational units must be carried out in a fun, interactive, inspiring, challenging, fun, and motivating way for students to participate actively, and develop creativity according to their talents and interests. In addition, learning must also be carried out to develop students' physical and psychological aspects. This is following Permendikbud number 22 in 2016 concerning Standards for Primary and Secondary Education Processes. The development of teaching materials is one way to increase the creativity of educators. Educators are required to be creative to make teaching materials that are interesting, innovative, varied, and by the level of student needs. Teaching materials are an important component of learning. Students' reading

interest in Indonesia is still relatively low. This is known from the percentage of students who visit the school library or regional library. Rapid technological developments change student learning patterns.

According to Djamarah & Bahri (2002) problem solving method is not just a teaching method but also a method of thinking, because in solving problems using a method that starts from looking for data to drawing conclusions. Prastowo (2011:327) said the rapid development of information technology turned out to have a broad impact to the area of teaching materials, one of which is that the application of these teaching materials has various forms of variation, some are in the form of game questions, and some are in the form of teaching materials. This is certainly a positive side of information technology for the world of education.

Based on the results of observations made in one of the high schools in the city of Medan , most of the students have used technology in their daily lives. This can be seen from the completeness of the digital facilities owned by the school, for example holding the Computer-Based National Examination independently, wifi facilities, and adequate computer laboratories. Students on average already have a smartphone or laptop, and a private internet network. The lack of variation in the physics learning process can result in teacher communication in delivering teaching materials to students ineffective and inefficient, allowing for differences in understanding of physics concepts between teachers and students. If left unchecked, it can result in the low quality of the student learning process which results in the low problem-solving ability of students in physics subjects. Problem-solving skills are needed by students in learning physics. This is because problem-solving activities can help students to construct new knowledge and facilitate learning physics (Mukhopadhyay, 2013).

The development of teaching materials can answer or solve problems or difficulties in learning (Depdiknas, 2008). The interactive teaching materials developed in this study were modified by making them an application that can be used or studied using an android tablet/smartphone. The choice of android is due to its very high popularity of android. Previous research conducted related to this development conducted by (Simon 2019) revealed that interactive-based learning can improve student learning achievement, while the results of Ari's research (2016) show that problem-based teaching materials accessed on smartphones can build students' problem-solving abilities.

Based on the descriptions above, the researcher is interested to develop an interactive teaching materials that is valid, practical, and effective.

## **2 Methods**

This type of research to develop interactive teaching materials used Research and Development (R&D) method that develop by Robert Maribe Branch with the ADDIE development model that includes Analysis, Design, Development, Implementation, and Evaluation.. The aim of this study was to develop Android-Based teaching materials with qualities (valid, practical and effective) that could improve the ability of problem solving. The research carried out includes the analysis stage which consists of material analysis, situation analysis, analysis of aspects of teaching materials, and analysis of student characteristics, and the design stage, namely the preparation of storyboards, then the development stage which consists of preparation, manufacture, review and editing, assessment by experts, and the implementation stage, namely the teaching materials trial. The last stage is the evaluation of teaching materials by teachers and students as respondents that aims to determine the quality

of android-based interactive teaching materials that have been developed. The scope of this assessment is as follows: (a) aspects assessed by material experts and aspects of learning and content aspects, (b) aspects assessed by media experts are aspects of display and programming, and (c) aspects assessed by teachers and students covers aspects of use.

### **3 Results and Discussion**

#### **3.1 Analysis**

Analysis is the first phase of this research. At this phase, We need to carried out needs analysis, curriculum analysis, and analysis of student characteristics. According to the findings of researches' observations, pupils generally follow learning activities pretty effectively. Less active learning occurs when lectures are used as the teaching approach. The teacher will assign pupils to work on the questions they have been given from the interactive teaching materials in order to engage the class. When the teacher provided the assignment, the researcher saw that several pupils who had previously been less active became active. Because they can make learning more enjoyable and effective, these interactive teaching tools are thought to be able to improve students' excitement for participation in their studies. For this reason, teaching materials that stimulate learning and help students develop their problem-solving skills are important. They should also inspire students to learn both on their own and in collaboration with teachers.

#### **3.2 Design**

Design is the second stage in the development of teaching materials. The result of the design stage is a flowchart that describes the sequence and structure of teaching materials, a storyboard that includes a template design plan, and also an interface design. The flowchart that has been made is then used as a guide for designing storyboards so that a planning design is produced by the structure of teaching materials. Flowcharts are used to see how the application's material is presented in order. The user will first arrive at the start page of the application, which contains the name of the instructional material. The user will then be sent to the home page's main menu, where there are numerous menu buttons to access different pages. Basic competences, indicators, content with sub-materials, questions and conversations, assessments, references, and pages to show the compiler's profile are all included on these pages.

Including navigation buttons, page layouts, text placement, and other elements found in teaching materials, the storyboard design comprises the basic design for the appearance, layout, and determination of content in teaching materials.

#### **3.3 Development**

Development is the stage of product development and testing, where the results of the analysis and design are developed into a finished product.

1) Product development

The design that has been made using the iSpring Suite 10 software, is then implemented into product development in the form of an application using the Website 2 Apk Builder Pro software.



**Fig 1.** Display of the teaching materials in Android

## 2) Evaluation of media experts and subject matter experts

An evaluation of the media is done to judge the validity of the content and the visual appeal of the interactive educational materials developed for Android.

**Table 1** Results of Validation by Media Experts

No	Aspect	Score	Maximum Score	Percentage	Category
1	Display	32	36	90%	Valid
2	Programming	11	12	92%	Valid
3	Language	16	20	80%	Valid

**Table 2** Results of Validation by Material Experts

	Aspect	Score	Score Maximun	Percentage	Category
1	Display	18	20	90%	Valid
2	Learning Materials	23	28	82%	Valid
3	Content	24	28	86%	Valid
4	Usefulness	10	12	83%	Valid
5	Language	19	20	95%	Valid

### 3.4 Implementation

The implementation stage is the stage where the teaching materials that have been produced are used in learning. This Android-based interactive teaching material is in the form of an application, which is sent via student group WhatsApp. Students can download the .apk file and install it on their respective smartphones.

#### 1) Small Group Test

A small group consisting of 5 students.

**Table 3** Results of Assesment of Teaching Materials by Small Groups

No	Aspect	Percentage	Category
1	Content	92%	Practice
2	Graphic	85%	Practice

#### 2) Large Group Test

A large group consisting of 20 students.

**Table 4** Results of Assesment of Teaching Materials by Large Groups

No	Aspect	Percentage	Information
1	Content	87%	Practice
2	Graphic	83%	Practice

#### 3) Teacher Response

**Table 5** Results of Assesment of Teacher Response

No	Aspect	Percentage	Category
1	Usefullnes	92%	Practice
2	Design and Display	96%	Practice

#### 4) Test students' problem solving skills

Interactive teaching materials are used in 3 meetings. The first meeting, the teacher uses teaching materials as a tool in instilling the initial concept of sound waves in students, this is done so that students know the description of the material to be studied. The second meeting, the teacher uses teaching materials as a tool in explaining the nature of stationary waves on sound-producing devices. The third meeting, the teacher uses teaching materials as a tool in explaining the intensity and level of sound intensity.

## 4 Evaluation

The last stage of this development is to evaluate the teaching materials that have been implemented. Evaluating what is meant in this case is to clarify the use of teaching materials in improving students' problem solving abilities in the physics subject of sound wave material. Measurement of the increase in students' problem solving abilities by giving students problem

solving ability questions, where the questions were given two treatments, namely, before using teaching materials and after using teaching materials (pretest and posttest).

**Table 6** Result of Measurement of Problem-Solving Ability with Test-Gain

No	Treatment	Students
1	Average Pretest Score	40,24
2	Average Posstest Score	70,16
3	Maximum Score	100
4	N-Gain	0,49
5	Conclusion	Medium

## 5. Conclusion

Based on the results of research and discussion that have been described in this study, it can be concluded that Android-based interactive teaching materials developed to improve problem solving skills are valid. This can be seen from the percentage score of the material expert team's assessment of 87% and the percentage of the media expert team's assessment score of 86% in the very good category. Android-based interactive teaching materials to improve problem-solving skills are practical when used. This can be seen from the results of student questionnaires and teacher responses which state that these teaching materials meet the needs of students from an attractive appearance, language that is easy to understand so that it is practical for students to use. Android-based interactive teaching materials to improve problem-solving skills have been effective, which can be seen from the impact of these teaching materials which can improve students' problem-solving abilities. The results of data processing with N-gain analysis showed that teaching materials were able to improve students' problem solving skills with an N-gain calculation of 0.49 (medium N-gain category).

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