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Design of Informatic Logic Teaching Material Application Using Ideal Problem Solving Based on Android (Case Study in Universitas Pamulang)

Tita Puspitasari

Pamulang University, Information Technology, Indonesia

Abstract. Basic physics is a part of physics subject which studies objects in nature, the symptoms of natural events, and the interactions of objects in nature. This symptom is initially what our senses experience. For example, sight finds optics or light, hearing finds learning about sound, heat can also be felt (felt). In defining a quantity in physics, there are rules for calculating the amount in question based on other measurable quantities. In basic physics, it is necessary to understand the flow of questions well to how to calculate and explain them. However, sometimes students do not understand it due to lack of calculating in formulas or understanding of material concepts. Therefore, it is necessary to implement learning methods based on mobile to improve student understanding and knowledge. IDEAL problem solving can improve students' process skills, increase motivation, and improve problem-solving abilities. The IDEAL in application implemented has overall score in 86,17%. It shows the android-based learning media more practical to learn anywhere and anytime

1 Introduction

The development of science at this time has overgrown, not only in specific fields but also has touched all aspects of scientific disciplines social or exact. In education, it has experienced various benefits from this technological development to provide fast and up-to-date information in education, quickly accessing information and activities related to the world of teaching and learning. For example, in universities various general and subjects, specific scientific fields are more familiar and apply many technological developments. Developments and applications are specialized products that humans feel in different lives. One of the developments is the field of physics, introductory courses in engineering, also plays a critical role in developing this technology. But unfortunately, many people do not know much about its role.

*Corresponding author at: Pamulang University, Information Technology, Indonesia

E-mail address: dosen01261@unpam.ac.id

In engineering, such as informatics engineering needs the tools used are primarily derived from the development of physics. Based on the reason introductory physics courses needs to teach at the beginning of the semester. It also teaches students to review the functions and roles of physics in the engineering fielf. Various kinds of results of information technology and electronic equipment around us, are real examples of the human ability to apply basic physics disciplines in various fields of life, of course, by being enriched and perfected by other multidiscipline that collaborate. The electricity, computers, television, and radio were developed based on simple mathematical rules, by combining basic principles of physics and engineering, namely informatics engineering, electrical engineering, and other fields, formed in an electronic circuit that uses a circuit which is usually indicated by on and off. One of the student learning processes is by paying attention to the explanations given by the lecturers. The explanation sometimes causes misunderstanding, boredom and students sometimes forget the explanation given by the lecturer.

In physics, both theories and formulas are presented in every material related to calculate specific quantities. It is indispensable to have basic mathematical abilities and in-depth understanding to know the theory and formulas used can be appropriately understood. Many students complain about difficulties of basic physics courses such as lack of basic calculation skills and understanding of the material. It makes the student to work and think hard to study,

The learning process is often carried out conventionally with the lecture method because it needs essential and repeated explanations from the lecturer. Due to the importance of basic physics in the engineering, many books circulating discusses basic physics but still need to be deepened with lecturer explanations or discussions with peer tutors. Therefore, it is necessary to develop a learning system to improve understanding independently, namely by learning that involves technology, one of which is by making learning using Android, which almost all students widely use, so it will be easier to access and learn.

One of the presentation techniques will be applied in this study by using the IDEAL problem solving model [1]. The disadvantages of learning using problem solving, such as students can find the difficulty than analyze the level of difficulty of the problem, learning This also requires a lot of time, students are not familiar with problem solving learning, while the advantages: this model can make the education in the classroom use directly with reality, problem solving activities can make students more flexible in dealing with all the problems that exist in the classroom. life, both individual and group problems, this learning model activity triggers students' thinking power to become deeper and broader in dealing with problems and learning activities. Based on this, with all considerations of weaknesses and strengths, the researchers are interested in using the IDEAL Problem-Solving model. This problem-solving model has steps (1) identify the problem (Identify the problem), (2) define the goal (Define the Goal), (3) explore the solution (Explore solution), (4) implement the strategy (Act strategy), (5) and

evaluate the impact of the effect (Look back and Evaluate the effect). In IDEAL model was conducted [2], personality types of students have impacted to problem solving. The result indicated that the student who Extroverts personality is 53% greater than students with introvert personality only 47%. The research recommend that mathematics teachers should create a planned learning process that focuses on the process, not just focus on the result. In a planned learning process can make the student behavior to understand the course material more critize and increase their logic and knowledge to improve their problem-solving skills.

With the rapid development of cellular phone technology at this time, the Android OS can be combined with application of the IDEAL Problem-Solving model. Android OS is smartphone operating system which compatible to multifunction deve to run mobile applications as a medium for accessing and processing information, includes education and learning fields as information in textbook. Many studies use learning applications such as hijaiyah learning research [3].

Based on identifying problems that have been found, a solution could be formulated by developing a mobile application that functions as a medium for presenting information in education that can be accessed easily, quickly, and practically. Making this smartphone application design will be discussed with the title "APPLICATION DESIGN OF BASIC PHYSICS TEACHING MATERIALS USING "IDEAL PROBLEM SOLVING" BASED ON ANDROID".

2   Literature Review

2.1   Related Research

IDEAL problem-solving modeling in higher education has begun to be carried out for several courses, including the calculus course, with the results obtained are (a) students' problem-solving abilities achieve completeness. (b) there is a significant effect between process skills and motivation on the ability to solve problems. (c) The problem-solving ability of the class applying the maple-based IDEAL problem-solving model is better than the class before the treatment [4]. For this reason, it will be tried and developed again in basic physics courses in the hope of increasing fighting power, enthusiasm, and students' ability to learn basic physics.

The problems that exist in IDEAL problem solving are contained in a study conducted by Ali Muhson [5] entitled "The Application of Problem-Solving Methods in Advanced Statistics Learning" which found that the application of problem-solving methods in advanced statistics courses was able to increase student interest in learning. The indication is that the learning process is quite enjoyable, able to increase the active role of students and the independence of students in lecture activities. With this basis, it is hoped that it can also be applied to basic

physics courses with maximum results both in terms of independence and active learning of students in studying science in basic physics subjects.

In [6], has developed research about the basic abilities to study some courses that related to between facts and academic demands. The student must good understanding in the ability of problem solving, the ability of reasoning and evidence, the ability of mathematical communication, the mathematical connection ability, and the ability of representation. Otherwise, the five basic abilities have not been specifically taught. In this study, due to time, cost, and extent of the problem, but problem solving is main concern ability to discussed.

2.2   IDEAL Problem Solving

Knowledge Bransford and Stein introduced IDEAL problem solving as a learning strategy used to improve thinking skills and solve problems [7]. This learning strategy is based on research and the work of previous experts in problem solving such as Max Wertheimer, George Polya, Alan Newell, and Herbert Simon. The explanation of five stages in IDEAL as follows:

a.   Identify the problem

The first step in IDEAL Problem Solving is identifying the problem. Identifying problem is the essential characteristic to support successful problem solving and make it an opportunity to do something more creative. This step is more critical among other steps since, and if identifying the problem is correct based on user requirement knowledge, it means the system developed more function and usable for actual user. To gather solution for problem, teachers assist students in understanding aspects of the problem, such as helping to analyze problems, ask questions, examine relationships between data, map problems, develop hypotheses.

b.   Setting goals

The second step is to set up a goal based on problem identification. The selected problem must display "researchable" because the problem could be investigated scientifically. The problem needs to be formulated clearly so that the formulation of the problem is clear so that it is easy to set goals. In this stage the teacher guides students to see data or variables that are known and unknown, look for various information, filter existing information and finally formulate problems. A problem solution depends on how the researchers' set goals, which has an essential impact on answering the questions. Key and goals could be set depending on persons' ability, thinking, and action to solve the problems. (Bransford 1984). Then different goals make users explore various strategies to solve problems.

c.   Explore possible strategies

The third step is to define possible strategies and evaluate the possibility of each strategies following goal objectives that have been set. Several people pay attention in some phenomena with various perspective and cause effects. In group, people can get more feedback and find

something idea based on group discussion than personal opinion or perspective. In this step, the teacher guides students to find various alternative problem solving, express statements, see alternative problem solving from various perspectives, and finally choose the most appropriate alternative problem-solving.

d.   Implement the chosen strategy

The fourth step of IDEAL is to anticipate the outcome and act. A strategy is an overall approach related to implementing ideas, planning, and execution activities within a certain period. In a good system, there is a coordination of work team, having a theme, and identifying supporting actors according to the principles of implementing ideas rationally, efficiently, and effectively. When a strategy is chosen, it anticipates possible outcomes and then acts on the chosen strategy. In this stage students are guided step by step in solving problems according to the chosen alternative.

2.3   Android

Android is one of the mobile operating systems based on the Linux-Operating System, including a system, applications and middleware which developed by Google. Android provides platform for developers to create their applications and modified their own code [8]. Android OS was developed by collaborating Google and Open Handset Alliance (OHA), an open mobile device alliance consisting of 47 hardware, software, and telecommunications companies to develop open standards for mobile devices. There are two kinds of Android Operating System distributors in the world today. The first is the one that has full support from Google or Google Mail Service (GMS), and the second is free of distribution without Google's support, otherwise known as Open Handset Distribution (OHD). One of the reasons for the rapid development of Android due to Android is a very good platform, applications and development tools, the Android application market and very high support from the open-source community in the world, so that Android continues to grow rapidly, both in terms of technology and in terms of technology. devices in the world.

3   Methodology

This study used the research procedure described by Luther Sutopo because this research focuses on learning multimedia. In purpose to produce learning multimedia products and will be tested on actual case and condition. According to Luther, the development of a multimedia system consists of six stages, namely concept, design, collecting material, assembly, testing, and distribution [9] In each stage of methodology is circle it means the process should be sequential from first stage to last stage but can backward into last stage if do not fulfill user requiremen. Based on six stages of LutherSutopo methodology, begining with concept and ending with distribution stage, while in material collecting, stage can be performed with Assembly stage paralel. The stages of Luther's version are described in Figure 1.
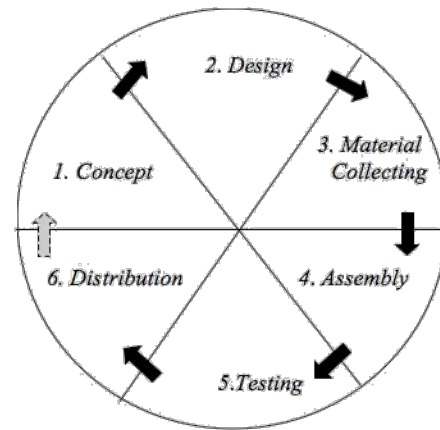
Figure 1 Research Method

1.   Concept

The concept stage is the stage to determine the goals and the users. The concept stage is the initial stage in the development of this multimedia. In this stage, research must identify the type of application such as presentation and interactive and the kind of application susch as entertainment, training, academic, learning, etc. The concept is formulated in narrative wting that express the research objective.

The researcher conducted observations and interviews with lecturers to get more data and information needed to make IDEAL model of learning multimedia. Information such as curriculum, learning media, teaching material, and learning outcomes of learning subject. In addition, researchers also conducted a literature study by collecting another book of material, journal and othe references in order to strengthen the purpose of making this IDEAL model of multimedia learning media and to obtain an accurate picture of the learning multimedia that will be made later.

2.   Design

The design is the stage to make the system function regarding the functional and non-functional requirements. Functional requirement is gathering to define what function, menus, user interaction should be existed on the system or application, whereas non-functional requirement is how factio is impact on application work such as security, time access, and compatibility of application. The specifications are made as detailed as possible so that at the next stage, namely collecting and assembly materials, new decision-making is no longer needed.

Design is performed by writing requirement, flowchart, interaction diagram and uses storyboards to describe each scene, write all multimedia objects listing and connecting to other scenes, and a flowchart to illustrate the flow from one scene to another. This stage suggests that the specification work is carried out in as much detail as possible because it will affect the next stage.

3.   Material Collecting

The material collecting stage iscollect the materials that are in accordance with the needs of multimedia products such as images, text, audio, and video. This stage can be done in parallelling with the assembly stage. But in some cases, the Material Collecting stage and the Assembly stage will be carried out in a non-parallel linear manner.

4.   Making (Assembly)

Assembly stage is developing all multimedia objects or materials in application by using program language and mobile platform. Application development is based on the design stage, such as storyboards, user interaction and navigation.

5.   Testing

Testing stage is performed by running the application and examine the erorrs while using the application. The purpose of testing is to evaluate the fulfillment of systems or components with certain functional requirements. This stage is also known as the alpha testing stage (alpha test) where testing is carried out by the maker, after that a beta test is carried out involving end users. The end users as respodents are students who use this application as a medium for learning basic physics, there are 25 students. The test result shown as Table 1.

Table 1 Application Test Results on Students

No	Aspect	Average Score	Interpretation
1	Contents	85%	Very good
2	Language	85%	Very good
3	Attractiveness	86%	Very good
4	Functionality	86%	Very good
5	Ease of use	85%	Very good
	Overall Average	85,4%	Very good

Based on student interest and ease of use of the application in undrstanding basic physics material, then based on the result of the pretest and post test given, the test indicates that there is a increase the student understanding in student learning outcomes. The table 2 show is the data of the assessment results.

Table 2 Student Learning Outcomes Test (Pretest & Post Test)

No. of Students	Pre test	Post test
1	65	75
2	60	70
3	60	75
4	58	65
5	55	70
6	70	80
7	65	70
8	60	70
9	55	60
10	56	65
11	60	65
12	65	75
13	60	70
14	58	65
15	60	70
16	55	65
17	50	65
18	40	60
19	65	70
20	45	65
21	65	75
22	70	80
23	55	65
24	58	70
25	60	75

The goal of this stage is to examine the results of making the application based on user expectation. Then, the expert validates of multimedia application to measure the extent to which the feasibility of multimedia is developed. Based on six aspects, the experts agree that the application has score 86.17%. The result of application validation is shown as Table 3.

Table 3 System Validation Result by Media Expert

No	Aspect	Average Score	Interpretation
1	Contents	90%	Very good
2	Consistency	86%	Very good
3	Attractiveness	90%	Very good
4	Format	85%	Very good
5	Font type and size	86%	Very good
6	Validity	80%	Very good
	Overall Average	86,17%	Very good

6.   Distribution

The distribution stage is the last of methodology, and if the application works fulfill of requirement and no more error and success stored in the database, it means the application is ready to distribute to the user. At this stage, we can compress the data when the storage media is not sufficient to accommodate the application, and then compression is carried out on the application. At this stage, an evaluation will also result as feedback and input for the concept stage of the following product. After finished, the learning multimedia is ready to be used as a learning medium on campus.

4   Result

4.1   Use Case Learning Module

Based on the framework developed, the use case design is obtained to determine the application to be made as shown in Figure 2.
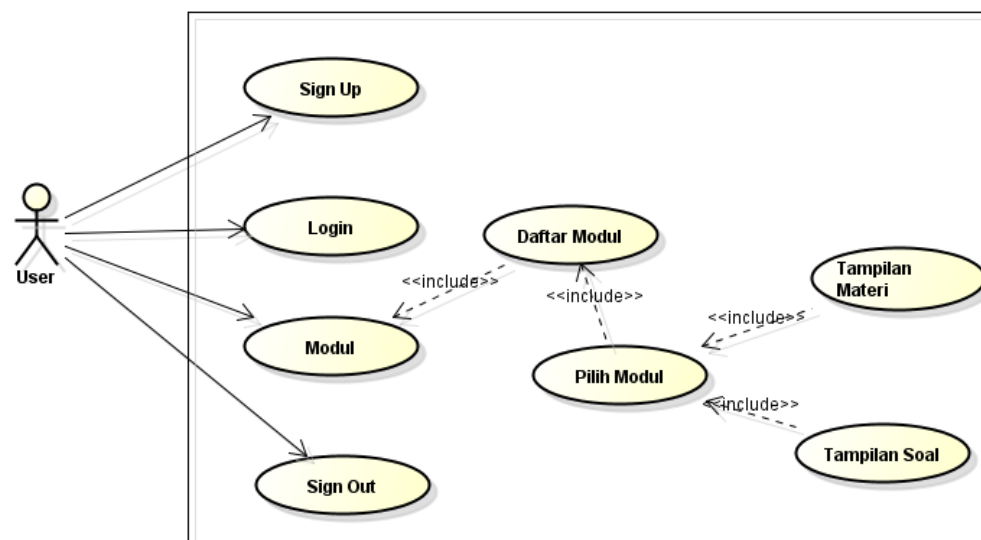

Figure 2 Use case learning module

Figure 2 consist of describe the actor who use the system, first user must sign up to register to Learning System. User who registered as user system can sign in an able to choose modul which provided. The user who has finished their activities in system can log out then the activities will be recorded.

Table 4 Use Case Diagram Description

| No.	Actor	Task
1.	Actor: User *Use Case: Sign Up*	User must register first if they do not have an account
2.	Actor: User *Use Case: Login*	User can access if they already have an account
3.	Actor: User *Use Case: Login*	User can choose the material module, Physics Module, Pamulang University, Engineering Department
4.	Actor: User *Use Case: Log Out*	User can close the application

4.2. Application View
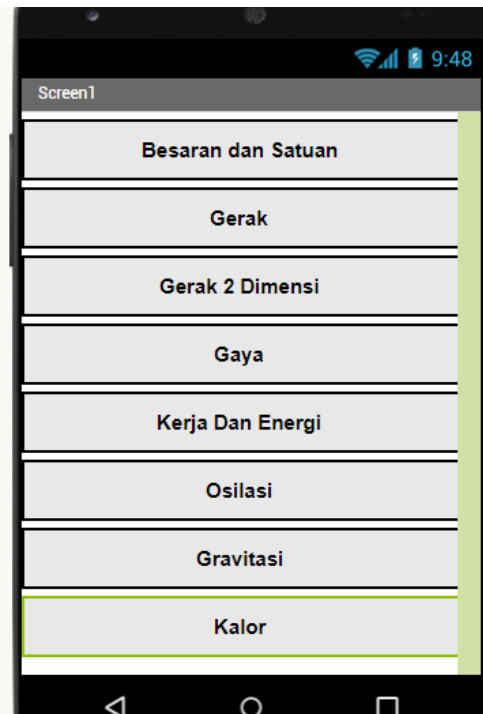
Figure 3 Module page

Figure 3 show a module page consisting of several chapters where each chapter will go down to material and questions. The material contained in this basic physics module consists of quantities and units, motion, 2-dimensional motion, force, work and energy, oscillations, gravity, and heat.

Figure 4 Discussion page

Figure 4 show a discussion page. This page fetches one material on the module page. For example, the material on Quantities and Units means that the discussion is about quantities and units. The material explained about the quantities consisting of principal quantities and system units of these quantities. Quantity can also be measured and has a value, for example, length, the unit meters, and the value depends on the problem in question. In Figure 4.3, a menu button will also return to the main menu, namely the module page, which consists of many materials. The next button is a question. This question button will refer to the next page, which is a matter of quantity and unit material.
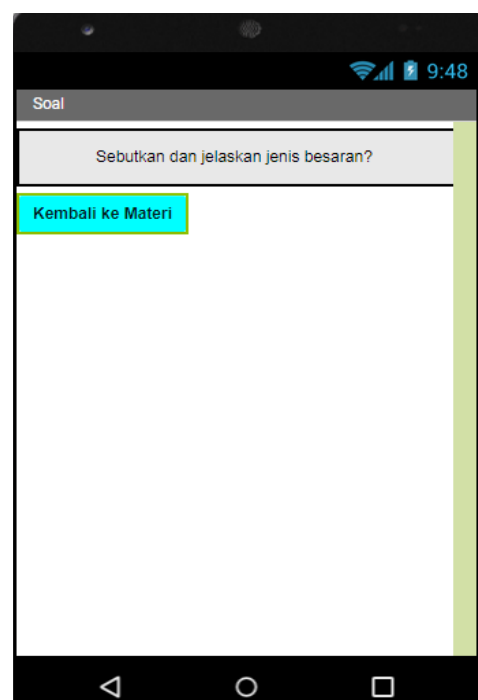

Figure 5 Question page

Figure 5 show a page contains of a question. This page is a reference for the selected material, for example, Quantity and Unit material, then the questions related to the material will appear. This question page also has a button back to the material, meaning that after the question is done, you can choose another material with a different discussion and question. The use or role of IDEAL problem solving in this research is in the learning appliction design system using the Android, which has the following stages : identifying problems, setting goals, exploring possible strategies, implementing the chosen strategy, and looking back and learning.

5   Conclusions

This application can be helpful to increase student intention and interest in learning. and can improve learning outcomes, especially for Basic Physics courses, it can be seen from the post-test result data, which has increased compared to the pre-test value. In addition, this application can be used as one of the innovative learning media because it is more practical to learn anywhere and anytime.

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