# The Effects of Using a Problem Based Learning Model Supported by E-book on Students Physics Problem Solving Ability

Adventa Sinta Marito[1], Makmur Sirait[2], Karya Sinulingga[3]

{adventasintamarito@gmail.com[1], makmursirait@yahoo.com[2]}

Physics Department of Faculty of Mathematics and Natural Sciences, Universitas Negeri Medan, Indonesia

**Abstract.** This journal is time to determine the effects of using a problem-based learning model supported by e-book on students' physics problem solving abilities. The designed of this research is a quasi experiment designed with two groups of pretest-posttest design. The population in this study is all students of grade X of Senior High academic year 2021.2022. SH X-IA 1 class is as the experiment class by using the problem based learning model and X-IA 2 class by using conventional learning. The research instrument used is a test in the from of problem solving ability essay that has been declared valid. The analysis of data is using a test of Manova. The results of data analysis can be concluded that problem solving ability who are taught by using the problem based learning model supported by e-book is better than students who use the conventional learning.

**Keywords:** Problem Based Learning- problem solving ability- e-book.

## 1. Introduction

We need skilled human resources to build a nation that is able to compete with other nations and thrive in the 21st century globalization era. According to Trianto (2011), education is the only vessel that has the right method for preparing quality human resources. (HR) and visually functions as a tool to build quality human resources. The creation of quality human resources for the development of a nation is very dependent on education. The ability to manage human resources is very important for technological progress. Science and technology will not advance and become the driving force of national development without superior human resources. Life has been influenced by advances in science and technology (science and technology). In order to master science and technology, it is necessary to improve the standards of human resources by increasing the standards of education in schools. Students should be encouraged to discover and build knowledge, develop life skills, and be ready to solve problems in life through education.

Science is covered in some of the current curriculum content. The aim of the 2013 Physics curriculum is to assist students in gaining understanding and knowledge of useful physics concepts that can be used in everyday life. Physics is primarily a methodical approach to the study of nature; consequently, physics is a process of discovery and accumulation of

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facts, concepts, and principles. According to Rustaman (2007), the vision of science education is to produce students who excel in science and technology. This refers to the goals of national education. Through mastering scientific concepts, technical activities, and making meaningful use of their environment, students who understand science aim to understand themselves and their environment.

When students are able to understand what they have learned and apply it in everyday life, it shows that science education has succeeded in realizing this vision. The physics learning process must be modified by emphasizing thinking skills, problem solving skills, and practical experience. In fact, what happens in the field of learning is optimal problem-solving abilities. A study by Sirait (2019) found that the low level of learning science is due to the fact that measuring academic achievement in schools is still conceptual. Moreover, Indonesian students are not used to solving contextual problems and need reasoning, reasoning and creativity to solve them. This is the nature of TIMSS queries. Based on the results of the interpretation of the TIMSS survey on the abilities of the cognitive aspects (knowledge, application and reasoning) of Indonesian students it shows that they are still able to know on average.

Based on the empirical data above, we need to make major and fundamental changes in the implementation of scientific learning. Improving learning requires various efforts that ultimately lead to higher quality learning processes and outcomes, preparing students for the future. Based on the analysis of observational data using a problem-solving-based evaluation rubric to create questions that describe students' problem-solving abilities. About 23% of the data was collected during the problem solving strategy implementation phase, and another 77% reached the strategy phase. At school, the facts from the first two observational activities become the foundation for problem-solving skills.The problem-based learning model is an alternative learning model that provides opportunities for students to learn about scientific processes and problem-solving techniques. Arends (2008:41) a learning method in which students learn by acquiring knowledge, asking questions, and solving real-world problems to improve their thinking skills, independence, and self-esteem.

The problem-based learning model has been shown to have a positive effect in a number of studies. Students learn how to solve problems and understand the scientific method. Technology advances at a rapid pace over time, giving educators a variety of options for classrooms and other learning environments. Teachers must look for new and innovative breakthroughs to innovate in line with developments in science and technology to deal with these possibilities. The transformation of textbook learning into electronic books is one of the innovations in educational technology. Electronic books, or e-books, are digital versions of books. Mataya (2010) electronic book is a single file that contains digital text, images, and audio. In order for students to understand the concept of material, this combination helps them visualize abstract learning materials. E-books are especially attractive because of the demand for a mix of multimedia and e-books. In addition, many students find it difficult to explain what they are testing during the exercise, which requires additional instruction. Students may not always have access to this guide due to limited time and space for face-to-face meetings. During development, the e-book may be viewed on a computer or other electronic device, depending on the author. E-books are considered a good learning tool for physics classes. E-books also assist educators in streamlining and maximizing study time. E-books make it easy to carry lots of files around, ensuring that teachers never run out of content for their students.

Researchers found that every student has a smartphone. Since students themselves use smartphones to access social networks such as Facebook, Twitter, Instagram, WhatsApp, web browsing, games and music, smartphones play a minor role in education. E-books are used to equip students with teaching materials to utilize technology in the learning process. Based on these problems, the problem posed is to see the problem-solving abilities of students who are taught using a problem-based learning model assisted by E-Books are better than students who are taught using conventional learning and increase (gain) problem-solving abilities using a problem-based learning model assisted by E -Books.

## 2. Theoretical Study

### a. *Problem Based Learning* Model

*Problem Based Learning* Model is more comprehensive than learning strategies, methods or procedures. Glossary There are four unique characteristics of the learning model that are not unique to learning strategies or methods: 1) The teacher constructs theoretical and logical justifications. 2) Learning objectives that must be met. 3) necessary educational procedures that allow the use of learning methods. the best learning model; 4) learning arrangements needed to achieve learning objectives; It can be seen from the characteristics of the learning model that each model helps students achieve various learning objectives and competencies and guides learning design. Thus, the way of learning is essentially a mapped form of learning that is presented by an educator from beginning to end. To maximize learning outcomes, the learning model is a type of learning activity stage which is part of the interaction. In addition, there are four groups of learning models, namely as follows: 1) social interaction models; 2) A model for processing information; 3) individual examples; and 4) models to change behavior. In practice, educators must remember that there is no one learning model that is most suitable for all circumstances. Therefore, the conditions of the students, the nature of the teaching materials, the available media facilities, and the conditions of the educators themselves must be considered in choosing the appropriate learning model.

Student-centered education is problem-based instruction. Teaching is not about what students do, but how they think while learning. In problem-based learning, the teacher basically functions as a guide and facilitator, enabling students to think critically and learn how to solve problems. In this type of learning, the teacher's role is to present and explain something to students. Riswari (2018) claims that problem-based learning helps in acquiring basic knowledge that is relevant to the real world, scientific thinking skills, and awareness of the importance of teamwork goals.

Problem-based learning emphasizes problem-driven learning. So, problem-based learning starts with problem solving, and the problems given to students need to give them new information (knowledge) so they can learn new things before they can solve problems. .It is there. Finding the right answer is not the only aspect of continuous learning. In addition, students interpret problems, collect important data, determine potential solutions, weigh their options, and reach conclusions.

### b. Electronic Book

Ebooks are travel guides in digital form that can be accessed on any electronic device. Electronic goods include: gadgets, cellphones, computers and others (Fausih, 2015) similar to traditional books, e-books primarily function as a means of education asking for knowledge from e-books or conveying knowledge to e-books. E-books written by many people can teach

you a lot. In addition, there are free e-books available in various formats. E-books are more accessible than traditional books. You can quickly get the ebook you want by sitting in front of your computer or other online device. The e-book can also be downloaded for free online.

**c. Problem solving skills**

Physics students need to understand that problem solving is a complicated process. Most of the time, physical problems stem from everyday life. According to Santrock (2011), finding the best way to achieve a goal is the basis of problem solving. Teachers can pose narrative problems, decision-making problems, closure and diagnosis problems, strategy implementation problems, problem analysis problems, concepts for solving problems, and other types of problems (Jonassen, 2004). Students with problem solving skills use relevant theories and concepts to solve problems. Students deepen their understanding of research fields, build knowledge, gain new perspectives, and make decisions when they solve problems (Rohanum, 2013).

Students often forget the teacher's formula without fully understanding its basic meaning. According to Purnamasari (2017), students are often given material and equations to understand static fluid material without having to find the physical concept itself. Students are not able to understand the concepts involved in solving everyday problems because these problems are presented repeatedly in physics lessons. In addition, Dewey and Polya argue in Petrina (2007) that the definition of problem solving is "finding a way out of a difficulty, avoiding obstacles, achieving certain goals. , or solve the problem using another solution. The inability of students to solve physics problems is mainly caused by a lack of practice and the habit of asking questions.

Heller , et al (1991) made a problem-solving step in science learning through five stages. First, *visualize the problem* . In this step, visualization of land issues from words into visual representations, making a list of known and unknown variables, identification of basic concepts. Second, *describe the problem in physics description.* In this step, the visual representation is converted into a physical description by creating a free-body diagram and selecting a coordinate system. Third, *plan the solution* , which is planning a solution by - changing the physical description into a mathematical representation. Fourth, *execute the plan* , carry out the plan by performing mathematical operations. Fifth, *check and evaluate* , evaluate the solutions obtained by checking the completeness of answers, marks, units and values.

## 3. Research Methods

. This research was conducted at School Medan. The time of the study was carried out from November 10 to December 13, 2022 class X semester I of the 2021/2022 academic year with the subject matter of Static Fluids. The population in this study were all students of class X semester I of SMA Swasta Mentari Bangsa Medan which consisted of 2 classes .

The variables in this study in terms of their roles, consist of independent variables and dependent variables. In this study, the independent variable is the *problem based learning model* , while the dependent variable in this study is problem solving ability .

In the experimental class with the model *problem based learning* while the control class uses a conventional learning model. The design used in this study was *pretest-posttest control group design* .

**Table 1.** Pretest-posttest control group design

| Class | Pretest | Treatment | Postest |
|---|---|---|---|
| Experiment | Y1 _ | $X_1$ | Y2 |
| Control | Y1 _ | $X_2$ | Y2 |

**Information :**

$X_1$ = Learning with a problem based learning model

$X_2$ = Conventional learning

$Y_1$ = Pretest of problem solving ability given before treatment in the experimental class and control class

$Y_2$ = Posttest of problem solving ability given after treatment in the experimental class and control class

In order to make it easier to carry out research, the steps or flowchart of the research procedure are presented in Figure 1

**Table 2. Problem Solving Ability Scoring Guidelines**

| No | Stage | Indicator | Maximum Score |
|---|---|---|---|
| **1** | Understanding the problem | Make a quick sketch<br>Gathering information in problems<br>Make a problem affirmation<br>Determine the approach to solving problems in the form of physics concepts | 1 0 |
| **2** | Interpreting the problem | Create a free body diagram/sketch that describes the problem (eg in Cartesian coordinates)<br>Identifying variables in the form of symbols<br>Making quantitative relationships between variables | 1 0 |
| **3** | Planning strategy | Build specific equations<br>Applying physics concepts to problems<br>Designing problem solving through equations from physics concepts | 1 0 |
| **4** | I carry out the strategy | Modify equations and make substitutions<br>Perform calculations using the selected equation | 1 0 |
| **5** | Evaluating solutions | Evaluating unit<br>Determine the logic of the answer | 1 0 |

## 4. Research Result

The results of the pre-test and post-test it is known that there is a difference in the average score of students' problem solving abilities in the experimental class and the control class. The difference in the average results of the pre-test and post-test of students' problem solving skills. Therefore, we need to determine the rate of increase. The N-gain improvement rate of students' problem solving skills can be calculated by the normalized gains of the two sample classes. The calculation of the percentage increase in N-gain normalized problem solving ability is shown in Table 3.

**Table 3.** The calculation of the percentage increase in N-gain normalized problem solving ability

| Ability | Pretest | Posttest | N-gain % | Category |
|---|---|---|---|---|
| Experimental Problem Solving | 30.03 | 71.8 | 60 | Medium |
| Control Problem Solving | 33.6 | 61.8 | 42 | Medium |

Based on Table 3, calculate the percent increase in the N-gain problem-solving ability of the experimental class students by 60% compared to the control class by 42%. The percentage calculation shows that the increase in N-Gain problem solving abilities is higher in the experimental class than in the control class. It can be concluded that students in the experimental class who were taught with a problem-based learning model using e-books performed better than the control class who were taught with conventional learning. Calculating the percentage increase in N gain for the next problem solving skill is an analysis of the gain per item. This analysis helped confirm the increase in the size of students' problem solving skills in the way that was given to the experimental and control classes. The average percentage increase in N-gain per indicator of problem solving ability is shown in Table 4.

**Table 4.** The average percentage increase in N-gain per indicator of problem solving ability

| KPM Indicator | Average N-gain per Indicator Problem Solving | | | |
|---|---|---|---|---|
| | Control | Category | Experiment | problem |
| Understanding the | 37 | moderate | 66 | moderate |
| Interpreting the problem | 40 | moderate | 72 | high |
| Planning a strategy | 43 | moderate | 65 | moderate |
| Implementing the strategy | 48 | moderate | 56 | moderate |
| Evaluating solutions | 35 | moderate | 39 | moderate |

Based on Table 4 it can be seen the difference in the percentage of N-gain increasing problem solving abilities for each indicator of students in the experimental class and control

class. The increase in the N-gain level for each index of problem solving ability in the experimental class was higher than that of the control class in all aspects. The N-gain increase rate indicates that the experimental class taught using a problem-based learning model outperforms the control class taught using conventional learning to improve problem-solving skills.

## 5. Conclusion

Based on the results of the analysis and discussion in this study, it was concluded that the results of hypothesis testing using the *Manova test's analysis of between subjects effects* on problem solving ability showed an F value of 15.496 and a significance value of $2.06 . 10^{-4}$ at the 0.05 level . The sig value obtained < 0.05 indicates that there is an effect of the *problem based learning model* on the students' physics problem solving ability in the classroom.

The average percentage of N-gain and each indicator of problem-solving ability is higher in the class that uses the *problem-based learning model* compared to using conventional learning. This shows that the increase (gain) of students' problem solving abilities using the model *problem based learning* is better than using conventional learning.

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