# The Effectiveness of Problem Based Learning (PBL) Physics E-book with Landslide Theme to Improve Student Attitude Competence

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## ABSTRACT

*The 2013 curriculum requires a balance between developing attitude competence, knowledge and skills. In addition to equipping students with knowledge and skills, students need to develop attitude competence. In the learning process, it is also necessary to use ICT. This study aims to determine the effectiveness of using physics e-books based on problem-based learning, which is integrated with landslide mitigation material on attitude competence. This study describes the results obtained during the assessment phase, especially on attitude competence. This type of research is Research and Development (R&D). The development model used is the Plomp development model, which consists of three stages: the preliminary phase, the development or prototyping phase, and the assessment phase. The instrument used in this study was a self-assessment questionnaire. This study concludes that the problem-based learning physics e-book with the theme of landslides effectively develops students' attitudes. This research implies that there is a development in students' problem-solving skills and that students understand how to mitigate landslide disasters.*

## INTRODUCTION

Achievement of competence as a learning result can be obtained by providing meaningful learning experiences to students. Meaningful learning is an important factor affecting the achievement of learning competencies (Tafakur, 2015). The competencies should also balance spiritual attitudes, social attitudes, knowledge, and skills. To Permendikbud No. 36 of 2018, students should have learning experiences to be ready for life in society by achieving a balance of competencies that students have.

Provide a good learning experience to students; the learning process is fully student-centred (student-centred learning). Student-centred learning is a learning approach that makes students the centre of learning. It is in line with Isjoni& Firdaus (2008), who state that student-centred learning is a learning approach that empowers students to become centres during the learning process. Student-centred learning will allow students to carry out learning to provide meaningful learning experiences actively. Medriati, R. (2020) supports that in the application of student-centred learning, students are expected to be active and

independent in the learning process, take the initiative and be responsible in recognizing their learning needs, try to dig up information to meet their learning needs and building and communicating their knowledge. In implementing student-centred learning, several principles need to be considered, including learning activities adapted to the needs of students and fostering student responsibility and independence in learning activities (Romadhon, S. 2020). One learning model that corresponds to student-centred learning is Problem-Based Learning (PBL).

PBL is learning that is delivered by presenting a problem, asking questions, facilitating investigations, and opening dialogue (Sani, 2014). PBL provides space for students to play a role as the main actor in the learning process. It is supported by Riyanto (2009) that in PBL, students are given the freedom to implement knowledge or experience to solve problems. PBL is a learning model that begins with presenting unstructured problems as a stimulus to train students' problem-solving and argumentation skills (Romadhon, S., 2020). PBL can help students develop their knowledge and encourage them to convey their ideas (Sari, 2020). PBL has several characteristics, including the problem of being a starting point in learning, problems raised from the real world that are unstructured, challenging students' knowledge, attitudes, and competencies, as well as learning self-direction, collaboration, communication, and cooperation (Rusman, 2012). Shoimin (2016) states that real problems characterize PBL as contexts for students to learn, problem-solving skills and knowledge acquisition.

This real problem will be better if students find it directly in their environment. It is in line with Sani (2014), who states that the characteristics of PBL include problems that may occur but are presented in an unstructured manner. Learning will be more meaningful if it is linked to daily life in the environment where students live, such as applying the material to local wisdom or regional potential (Husin, 2019). Problems can be in the form of potential regional conditions, such as potential natural disasters in the area where students live. The issue of natural disasters is something that needs attention at this time, including in the field of education. As is the case in the 2013 curriculum content standard, especially in high school physics, basic competencies include issues of natural disasters such as global warming and energy crises predicted to occur in the future (Permendikbud No. 21 of 2016). One of the frequent natural disasters is landslides.

Landslides often occur in various parts of Indonesia, such as West Sumatra. It is because the Bukit Barisan mountain range traverses the West Sumatra region with uneven land contours. One area in West Sumatra that has the potential for landslides is the city of Sawahlunto. Sawahlunto is divided into four districts where most people live in the hills (sawahluntokota.bps.go.id). If there is heavy rain or rain for a long time, the risk of landslides will be even greater. Landslide disasters are often triggered by high rainfall, steep slopes, less dense and thick soil, erosion, reduced vegetation cover, and vibration (BNPB, 2018). In the last ten years, more than 30% of the landslide events in the Sawahlunto city area of the total landslide events in the West Sumatra region (BNPB, 2022).

Landslides have a devastating impact on the environment and even the safety of living things. The impact of landslides threatens the sustainability of community life (Isnaini, 2019). The threat of landslides can cause disruption or damage to people, property, facilities, and the environment (Azeriansyah, 2017). The impact of landslide events can be minimized by carrying out disaster mitigation. According to the Decree of the Minister of Home Affairs of the Republic of Indonesia No. 131 of 2003, mitigation is an effort to reduce and minimize the effects caused by disasters.

One of the efforts in disaster mitigation is through education for students. Education effectively shapes students' attitudes and behaviour in dealing with natural disasters. It aligns with RI Law No. 24 of 2007, articles 35 and 44, which state that natural disaster management can be implemented through disaster mitigation. One form of activity that can

be carried out is in the form of education and training. In education disaster, mitigation efforts can be carried out by integrating disaster knowledge into the education curriculum in schools. The disaster education integration strategy implemented can increase students' knowledge and skills in dealing with disasters which will be transferred to the family to maximize community resilience in facing disasters (Septikasari, 2018).

Disaster material integration with the curriculum utilizes natural conditions and regional potentials to realize educational goals. It is in line with Government Regulation Number 32 of 2013 concerning the national education system, which explains that teachers can innovate in developing learning materials that contain regional potential and local uniqueness. One of the subjects that can be integrated with landslide mitigation material is physics.

Physics is a branch of natural science that studies natural phenomena. Physics examines a body of knowledge about natural objects and events. Permendikbud number 59 of 2014 explains that the objectives of physics lessons include developing experience in using the scientific method, developing reasoning abilities to explain various natural events, and solving problems both qualitatively and quantitatively, as well as mastering knowledge, skills, and attitudes. As an object of physics study, natural phenomena have a broad scope, including natural phenomena involving inanimate objects, such as landslides. Landslide mitigation material can be integrated into physics material. Integrating knowledge about landslides with learning materials can be poured into teaching materials.

Teaching materials will encourage teacher efficiency and improve student performance because their use will make learning more practical and interesting (Asrizal, 2017). One of the teaching materials by the development of information technology today is an electronic book (electronic book). An electronic book (e-book) is a digital version of a book that generally contains text, images, and videos (Rosyadi, 2019). E-books have advantages compared to printed books, such as being simpler, cheaper, and easier to obtain. Another advantage of e-books is that e-books are more durable because they can be operated via digital devices such as computers or laptops, and the appearance of e-books is more attractive than printed books (Wulandari, 2019). E-books are very practical to use in learning because of the easy way to access e-books and their attractive appearance of e-books (Hartiningrum, 2019). Other advantages of e-books are the ease of browsing and reading them, saving on paper materials, and transferring text (Prabowo, 2013). E-books can integrate sound, graphics, images, animations, and videos to make the information presented richer than in conventional books (Rosyadi, 2019).

The systematic e-book at the beginning includes the title page, publication page, preface, table of contents, list of tables, list of figures, and page numbering. The content section of the e-book consists of chapters that are divided into sections (subchapters) and subsections (subchapters) material in the form of lessons (Kemendikbud, 2016). The content section contains core competencies, basic competencies, competency achievement indicators, mind maps/concepts, coverage of material, presentation of material, worksheets, practice questions, and assessment or competency tests (Ministry of National Education, 2010).

The observations at school, namely at SMA Negeri 1 Sawahlunto, show that using teaching materials in learning physics in e-books is not optimal. The e-book used is a digital book which is often called the Electronic School Book (BSE). Electronic school books do not comply with the ideal e-book criteria and systematics and cannot meet the current curriculum's demands and technological developments. It can be seen from the contents of the e-book which are considered not rich in material, examples of problems that are directly related to the student's environment, or video shows of daily events as stimulation for students to start learning activities. In addition, the material in the e-book used does not contain local uniqueness or regional potential, such as integrating regional disaster material.

The e-book that is used specifically does not encourage students to carry out learning activities actively and independently.

Based on the results of observations related to using e-books in learning, it is necessary to develop a physics e-book with the theme of landslides based on problem-based learning models. In contrast to the e-books developed by previous researchers, the physics e-books developed contain physics learning materials and their integration with regional disaster material, namely landslides. The developed e-book is also based on Problem-Based Learning (PBL) learning steps so that it helps the implementation of student-centred learning. Thus the PBL-based physics e-book with the theme of landslides can be used as teaching material that leads students to be active and take the initiative in the learning process, able to master physics material and understand examples of natural events related to physics material, especially landslide events so that physics learning is carried out be more meaningful.

As a physics e-book teaching material that is designed, it needs to be tested for its effectiveness so that the effect and results of its use in learning can be known. Teaching materials are effective if they achieve the specified goals satisfactorily (Akmal, 2018). According to KBBI, something is said to be effective if it has influence, brings results, is effective, or has consequences. So a product is effective if it affects its users, in this case, students.

The effectiveness of using teaching materials can be seen in students' learning outcomes in the form of competency achievement. The same thing was stated by Arifin (2018) that the effectiveness of media and teaching materials is obtained from the value of student learning outcomes. Teaching material is effective if it can improve students' competence. The effectiveness of the e-book with the theme of landslides can be seen in students' learning outcomes in the aspects of attitudes, knowledge, and skills. However, in this study, the results of the effectiveness test of the special physics e-book will be presented on the attitude aspects of students.

Attitude is a person's actions in responding to something. Attitude expresses one's values or outlook (Tiara, 2019). *Attitude* is a response that arises when an individual receives a stimulus that requires an individual reaction (Puspasari, 2019). According to Kunandar (2013), the attitude competence of students includes several aspects, namely receiving or paying attention, responding, assessing, managing, and having character.

Assessment of student attitude competence during learning using the physics e-book was carried out to determine the effectiveness of the physics e-book. The formulation of the problem in this study is how the level of effectiveness of physics e-books with the theme of landslides improves students' attitudes and competence in learning physics. This study aimed to determine the effectiveness of physics e-books with the theme of landslides to improve students' attitude competence.

## METHODS

Based on the formulation of the problem and research objectives that have been put forward, this type of research is research and development (R&D). This development research type is used to develop and validate educational products (Setyosari, 2013). In line with that, Sugiyono (2017) explained that development research is a method used to produce certain products and test their effectiveness of these products. The product developed in this study is a physics e-book based on problem-based learning models with the theme of landslides.

The development model used in this study is the Plomp model. The Plomp model consists of 3 stages: preliminary research, development or prototyping, and assessment

(Plomp, 2013). Preliminary research is the initial stage in the plan development model. In this stage, preliminary research is carried out to determine the constraints or problems in learning physics. The findings are the need for developing a physics e-book with the theme of landslides based on PBL. The second stage is the development or prototyping phase (design phase). At this stage, the researcher designed a physics e-book. The physics e-book that had been designed was then assessed by the researchers and revised in the self-evaluation stage. After self-evaluation, the physics e-book was validated by expert and practitioner validators. Input and suggestions from the validator are used to revise the e-book to obtain a valid physics e-book. After that, a practicality test was carried out.

Physics e-books that have been tested for practicality include one-to-one practicality tests (one-to-one evaluation), small group practicality tests (small group evaluations), and field practicality tests (field trials). From this second stage, a good and practical physics e-book was obtained. Then the third stage is the assessment phase (assessment stage). In this stage, the effectiveness test of the developed physics e-book is carried out. The Physics e-book effectiveness test was conducted on the competency aspects of attitudes, knowledge, and skills. The presentation of the results of this study is limited to the results of the assessment phase on the competency aspects of students' attitudes.

In the assessment phase, the good and practical physics e-book is used in physics learning. The attitude competence of students is assessed during the learning process. The instrument used in the attitude assessment was a student self-assessment questionnaire consisting of three components: 1) forming attitudes towards physics subjects, 2) self-confidence and 3) being honest and objective.

The percentage of achievement indicators on attitude scores is obtained by comparing the score with the maximum score. The category of the effectiveness of the physics e-book on attitude assessment can be seen in Table 1.

Table 1. Categories of Physics E-book Effectiveness in Attitude Assessment

| No. | Percentage of achievement of Indicators | Category |
|---|---|---|
| 1. | 0-20 | Ineffective |
| 2. | 21-40 | Less effective |
| 3. | 41-60 | Quite Effective |
| 4. | 61-80 | Effective |
| 5. | 81-100 | Very effective |

Source: Riduwan (2016)

## RESULTS AND DISCUSSION

### Results

The data in this study is the attitude competency value of students. The developed physics e-book was tested at SMAN 1 Sawahlunto. Students' learning outcomes on attitude competence were then analyzed to determine the effectiveness of the e-books used in physics learning. The physics e-book that was tested was in the correct and practical category. The results of the competency analysis of students' attitudes on the aspects of forming attitudes toward physics subjects are presented in Figure 1.
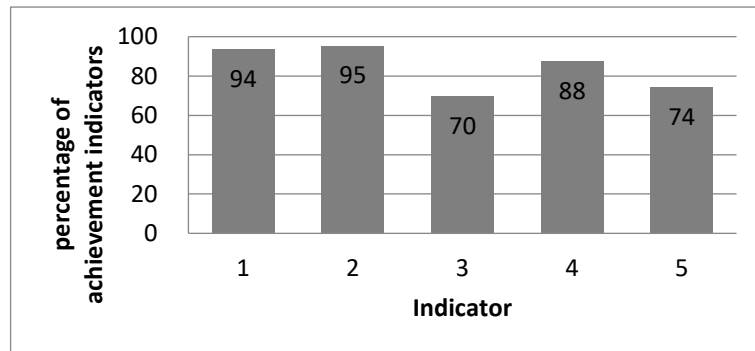
**Fig. 1**. Aspects of Forming Attitudes towards Physics Subjects

Figure 1 shows the attitude competency assessment on forming attitudes toward physics subjects. This aspect consists of five indicators. The first indicator is that students are increasingly convinced of the greatness of God Almighty after studying physics, with an indicator achievement of 94% and a very effective category. The second indicator is that students are grateful for the gift of God Almighty through learning physics, with an indicator achievement of 95% and the effective category. The third indicator is that students like physics subjects with an indicator achievement percentage of 70% and the effective category. The fourth indicator is that students respect friends' opinions when discussing physics learning, with an indicator achievement of 88% and a very effective category. The fifth indicator is that students try to help friends who have difficulty learning physics, with an indicator achievement of 74% and the effective category. The average percentage of indicator achievement in forming attitudes toward physics subjects is 84% , with a very effective category. The results of the analysis of attitude competency assessment for aspects of self-confidence are presented in Figure 2.
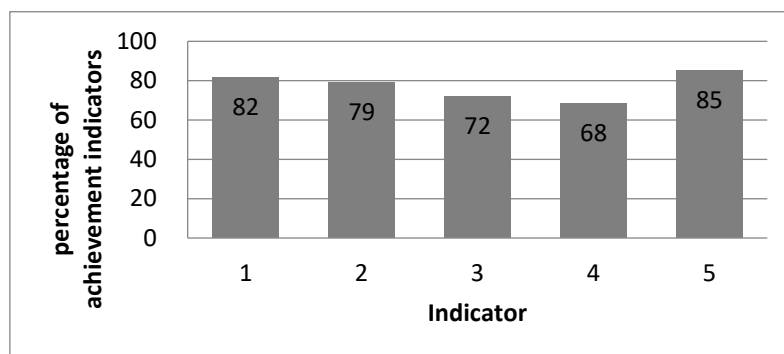


**Fig. 2**. Aspects of Self-Confidence

Based on Figure 2, the attitude competency assessment on the self-confidence aspect consists of five indicators. The first indicator is that students do not give up learning physics, with an indicator achievement of 82% and the effective category. The second indicator is that students try to do physics assignments themselves, with an indicator achievement of 79% and the effective category. The third indicator is that students re-

communicate physics concepts that are understood by achieving an indicator of 72% and the effective category. The fourth indicator is that students dare to express opinions in class with the achievement of the 68% indicator and the effective category. The fifth indicator is that students have a full sense of responsibility in completing physics tasks, with an indicator achievement of 85% and a very effective category. The average percentage of achievement indicators on self-confidence is 77% with the effective category. The results of the attitude assessment analysis for honest and objective aspects are presented in Figure 3.
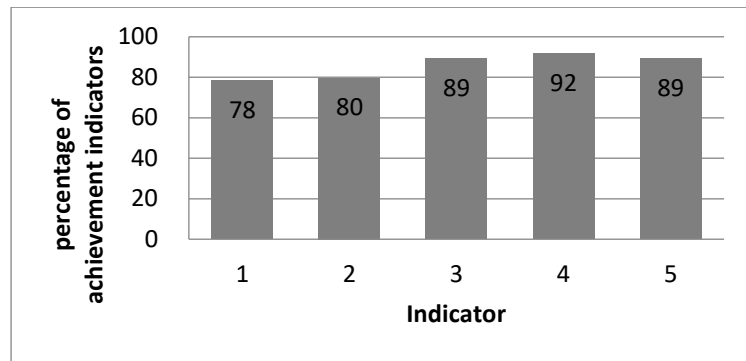


**Fig. 3.** Honest and Objective Aspects

Figure 3 shows the attitude competency assessment comprising five indicators on ethical and objective aspects. The first indicator is that students refrain from cheating when working on tests with achievement indicators with an achievement indicator of 78% and the effective category. The second indicator is that students work on exam questions without looking at friends' answers, with an indicator achievement of 80% and the effective category. The third indicator is that students dare to admit mistakes made, achieving the 89% indicator and the very effective category. The fourth indicator is that students receive input about their shortcomings from friends, with an achievement indicator of 92% and a very effective category. The fifth indicator is that students receive a warning from friends if they make mistakes with the achievement of the 89% indicator and the very effective category. The average percentage of achievement indicators on ethical and objective aspects is 86%, with a very effective category. The results of the competency analysis of students' attitudes at each meeting are presented in Figure 4.
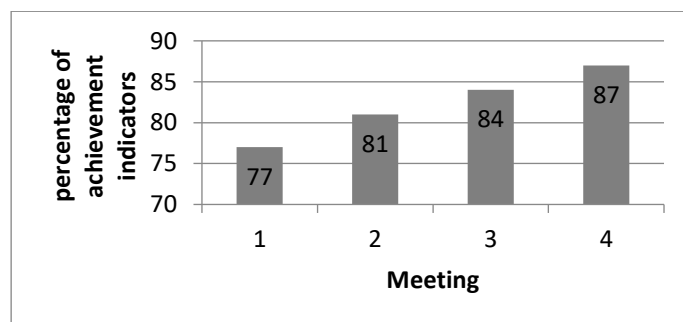


**Fig. 4.** Attitude Competence in Each Meeting

Based on Figure 4, it can be seen that the percentage of attitudinal competence indicators achieved by students in four meetings. At the first meeting, the percentage of attitudinal competence indicator achievement was 77% in the effective category. At the second meeting, the percentage of attitudinal competency indicator achievement was 81%, with a very effective category. At the third meeting, the percentage of attitudinal

competence indicator achievement was 84% , with a very effective category. At the fourth meeting, the percentage of attitudinal competence indicator achievement was 87%, with a very effective category. The average percentage of attitudinal competency indicators for the four meetings was 82% in the effective category. In addition, the percentage of attitudinal competence indicator achievement of students has increased at each meeting.

## Discussion

The data obtained shows that the problem-based learning physics e-book with the theme of landslides can improve the attitude competence of students in every aspect and assessment indicator. The physics e-book with the theme of landslides can shape students' attitudes towards physics subjects, foster self-confidence and be honest and objective. The attitude scores obtained also increased at each meeting. It is in line with the results of Wahyuni's research (2019) that increased learning outcomes indicate an effective teaching material is implemented in learning.

The development of students' attitudes towards using physics e-books during the learning process shows the influence of physics e-books as teaching materials. It is supported by the results of Haerunnisa's research (2018) which developed teaching materials in the form of worksheets to improve students' scientific attitudes; where there was an increase in students' scientific attitudes after using worksheets. The results of this study are also in line with research conducted by Susilowati (2017) that the development of science teaching materials integrated with Islamic values can improve students' religious attitudes, attitudes towards science, and science learning achievement. Kahar (2018) also researched the development of teaching materials based on local potential and obtained that the application of teaching materials can increase the attitude of caring for the environment in students. In addition, Lestariningsih (2017) researched the development of teaching materials based on local wisdom. Using these teaching materials in learning can improve students' caring character and responsibility. Gratitude (2022) researched the development of science teaching materials using a project-based learning model. His research results obtained the use of these teaching materials in learning to improve students' spiritual attitudes and social attitudes.

This study produced a PBL-based physics e-book with the theme of landslides and effectively increased students' attitude competence. Increasing the value of students' attitudes by using teaching materials in learning shows that the developed teaching materials have effectiveness or are effectively used in learning. Development research in the field of learning indicators that show the effectiveness of development products can be seen from the increase in the components of learning outcomes and student activities (Rochmad, 2012).

In this study, an effective physics e-book was produced to improve the attitude competence of students. The limitations of this study are that the attitude assessment carried out is still limited to the use of student self-assessment questionnaires, and the attitude aspects that are assessed are limited to a few indicators. For future research, more varied assessment instruments and techniques can be used and more indicators of student attitudes.

## CONCLUSION

The use of problem-based learning physics e-books with the theme of landslides influences the attitude competence of students. It can be seen from the development and increase in students' attitudes and competence values at each meeting. Thus the designed physics e-book effectively increases students' attitude competence. Physics e-books can also provide meaningful learning experiences for students because they contain physics material and its relation to events in everyday life, such as landslides.

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