



# E-Book Development Effectiveness Problem Based Learning with Quizing in Physics Learning

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**Abstract:** This research was based on observations made at one of the Dhamasrya public schools, SMAN 1 Koto Baru, which found several shortcomings in the learning system carried out, one of which was the lack of variation in the learning carried out and the lack of teaching materials based on the 2013 curriculum in study. The formulation of the problem that can be given is how to develop an E-Book Based on Problem Based Learning. Accompanied by Giving Quizzes to Class X High School Physics Learning. This research belongs to research with the type in this research is Research and Development and the development model used is the Plomp development model. The development analysis uses the stages of validation, practicality and effectiveness. Assessment of effectiveness using knowledge assessment test sheets, self-assessment for attitudes and skills assessment for performance and the N-Gain value of the achievement of student competencies. Analysis of the effectiveness using the N-Gain value and completeness of students who are above 80% of all students. The results obtained in this study are a product in the form of an E-Book Based on Problem Based Learning Accompanied by Giving Quizzes to Class X High School Physics Learning that is effective for use by students and for use by teachers. Analysis of the effectiveness assessment using cognitive learning outcomes with almost all completeness results or 80% of students who participated in the study were declared complete. The results of the affective assessment carried out using the self-assessment sheet obtained results in a good category and psychomotor learning outcomes assessed using the worksheets obtained results in a good category. In addition, using the N-Gain equation obtained high scores. Based on the results obtained, the developed E-Book can be declared effective.

**Keywords:** Problem Based Learning; Quiz; Effectiveness

## Introduction

Education in a general sense is a process of transmitting knowledge from one person to another. Education in Indonesia must be able to play a positive role in this era of globalization. One alternative is to prepare human resources through the educational process (Nurkholis, 2013). Education plays an important role in improving the welfare of society. Efforts to improve the quality of education are expected to raise the dignity of the Indonesian nation. One of the sciences that plays an important role in education, especially the development of the times, is physics. Physics is one of the subjects that is often considered difficult by high school (SMA) students, but learning physics will be

easier if it is taught with the right method (Simbolon & Siregar, 2019).

In addition, to be able to teach physics material well, a teacher must use a variety of learning strategies and also use the right teaching materials. The selection of strategies and teaching materials that are not appropriate with the material to be delivered will cause conditions to be passive, unmotivated and cause boredom for students. Although various efforts have been made, the reality in the field is that efforts to improve student learning outcomes are still not optimal. Based on observations that have been made at SMAN 1 Koto Baru, the curriculum applied at the school is the 2013 curriculum. From the observations it is also seen that the average learning process is still teacher-centered (Mondal and Das, 2020). According to the results of the

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interview, it was found that, learning was still teacher-centered, the available teaching materials had not been able to realize learning that was in accordance with the 2013 curriculum model perfectly.

In addition to conducting interviews, needs analysis was also carried out through questionnaires and student characteristics. The questionnaire was given to physics teachers and students at school. Needs analysis is seen from performance analysis, SKL analysis and learning difficulties analysis. Performance analysis, namely the identification of teachers can be categorized as good. This is illustrated by the percentage of performance analysis, which is 82.14%. Teachers have used learning models but their implementation is still not optimal, the teaching materials used, especially e-books, are not based on learning models or not in accordance with the 2013 curriculum. The students reasoned that if it was only a theory with the existing formulas, it would make them dizzy (Tan and Chee, 2021). The data also reveals that 100% of students own a smartphone. The use of smartphones for learning has not been maximized, only 20% is used for studying or looking for learning materials while the rest is for playing games and social media (Özden, 2018). During learning, students are allowed to use smartphones to find additional learning material if needed, but with a time limit that has been determined by the teacher (Outhwaite et al., 2017).

Responding to these problems, researchers are interested in developing teaching materials in the form of e-books to facilitate students in learning (Cruz and Rivera, 2022) The development of this e-book is adapted to the right learning model and method, in order to increase the competence of students. An e-book is an electronic version of a book (Mahliatussikah, 2022). While books generally consist of a collection of papers containing text or images, e-books contain digital information which can also be in the form of text or images. Appropriate learning methods, learning resources and learning experiences greatly affect the competence of students (Sathappan and Gurusamy, 2020). Problem-based learning Problem Based Learning (PBL), is one of the innovative learning models that can provide active learning conditions for students. PBL is a

learning model that involves students to solve a problem through the stages of the scientific method so that students can learn knowledge related to the problem and at the same time have the skills to solve problems (Mohamed, 2020). The difference between PBL and other learning models lies in the learning outcomes (Anggraeni and Harlita, 2022). Reduce students' interest and motivation in learning to provide a basis for developing an E-Book with quizzes in the process of the PBL model used (Djamas et al., 2018).

According to Salju et al. (2020) Quiz aims to foster motivation and enthusiasm of students in learning, namely through healthy competition or competition among students in getting the best possible grades. By giving quizzes to learning, students will be more enthusiastic, serious and active in learning activities. So that the solution to the existing problems is by developing an E-Book based on the Problem Based Learning model accompanied by giving quizzes for learning Physics in High School Class X. The formulation of the problem that can be given is how to develop an effective E-Book Based on Problem Based Learning Accompanied by the Giving of Quizzes in Class X High School Physics Learning. The purpose of this research is to create an effective E-Book Based on Problem Based Learning Accompanied by the Giving of Quizzes in Class X High School Physics Learning.

## Method

The type of research that will be conducted is research and development. (Research and Development/R&D). Research and Development is a research method used to produce certain products, and test the effectiveness of these products (Dalimunthe, 2022). The e-book development model based on the PBL model with quizzes refers to the model proposed by (Plomp, 2013). The model development stage (Plomp, 2013) consists of three stages, namely: preliminary research (early investigation stage), Development or prototyping phase (design and prototype stage), and assessment phase (assessment stage) (Ilyas et al., 2022). Each stage will be grouped as shown in Table 1.

**Table 1.** Evaluation Criteria in Each Stage of Development (Plomp, 2013)

Phase	Criteria	Description
Preliminary Research	Emphasis is mainly on content validity, less on consistency and practicality.	Problem analysis and literature review (past and present). The results are in the form of frameworks and interventions
Prototyping Phase	Initial Stage: consistency (construct validity) and practicality, then prioritizing practicality and gradually leading to effectiveness	The prototype will be piloted and revised based on formative evaluation. The initial prototype was only based on formative evaluation sheets which were carried out through expert assessments which resulted in the expected practicality.
Assessment Phase	Practicality and effectiveness.	Assess whether users can work with this product and will apply it in learning (relevant and ongoing), and also whether the product is effective.

The type of data taken in this study is primary data, namely effectiveness data from the results of student observations and evaluations. The effectiveness instrument was used to develop data on the effectiveness of e-books based on the PBL model along with giving quizzes to improve students' science process skills. The data collection instrument for the effectiveness test is a test with multiple choice questions for knowledge competence, self-assessment sheet for attitude competence and skill observation sheet. Table 2 can be seen a summary of the list of instruments used in this study.

**Table 2.** List of Instruments Used in Research

Step	Instrument
Student analysis	Questionnaire
Needs analysis	Questionnaire
Material analysis	Analysis sheet
Product Validation	Questionnaire
Product practicality test	Student Questionnaire Teacher Questionnaire
Product effectiveness test	Multiple choice test Self-assessment sheet Skill observation sheet

The analysis of the effectiveness test uses three domains of assessment of learning outcomes and the value of N-Gain with the following explanation:

*Knowledge Aspect Achievement Analysis*

The knowledge competence of students is categorized as complete if they have reached the Minimum Completeness Criteria that has been set by each educational unit. To analyze student competency data used descriptive analysis. Completeness of student competencies according to Arikunto (2008) both individually and classically for knowledge competence using Equations (1) and (2):

$$KI = \frac{SB}{SM} \times 100\% \tag{1}$$

$$KK = \frac{JT}{JS} \times 100\% \tag{2}$$

Where KI is individual completeness, KK is classical completeness, SB is the correct score obtained, SM is the maximum score, JT is the number of students who completed, JS is the total number of students.

Improving the knowledge competence of students using e-books based on the PBL model is accompanied by giving quizzes through giving tests before and after using them. The data were analyzed and measured using the N-Gain analysis adapted from the N-Gain formula (Hake, 1999).

$$\langle g \rangle = \frac{\% \langle s_{post} \rangle - \% \langle s_{pre} \rangle}{100 - \% \langle s_{pre} \rangle} \tag{3}$$

Where  $\langle g \rangle$  is the increase in knowledge competence (N-Gain average),  $\langle s_{pre} \rangle$  is the average pretest value,  $\langle s_{post} \rangle$  is the average posttest value. The N-Gain calculation is then converted using the criteria shown in Table 3.

**Table 3.** Normalized-Gain Kriteria Criteria

Interval	Category
$\langle g \rangle > 0.7$	High
$0.7 < \langle g \rangle > 0.3$	Medium
$\langle g \rangle \leq 0.3$	Low

(Hake, 1999)

*Skill Competency Achievement Analysis*

Skill competency data analysis was calculated using Equation (4).

$$\text{Skill Value} = \frac{\text{Gain Score}}{\text{Maximum Score}} \times 100\% \tag{4}$$

The category of student skill assessment is according to Table 4.

**Table 4.** Categories of Attitude and Skills Assessment

Interval (%)	Category
$\leq 55$	Less
$55 < N \leq 70$	Enough
$70 < N \leq 85$	Goof
$85 < p \leq 100$	Very Good

(Directorate of Senior High School Development of Primary and Secondary Education, 2017)

*Attitude Competency Achievement Analysis*

Attitude competency data analysis uses Equation 5.

$$\text{Score} = \frac{\text{Gain Score}}{\text{Maximum Score}} \times 100\% \tag{5}$$

Category of student skill assessment according to Table 5.

**Table 5.** Categories of Attitude and Skills Assessment

Interval (%)	Category
$\leq 55$	Less
$55 < N \leq 70$	Enough
$70 < N \leq 85$	Goof
$85 < p \leq 100$	Very Good

**Result and Discussion**

The results of the research conducted are products in the form of E-Book as show below



Figure 1. Cover E-Book

Product effectiveness means a measure that states whether or not there is an effect or influence of the product being developed on users, namely on students. The effectiveness was observed in the learning process using an e-book based on the PBL model accompanied by the provision of quizzes. Effectiveness is assessed by the following results

*Knowledge Aspect Achievement*

The achievement of the knowledge aspect is assessed by looking at individual mastery and group completeness as well as testing from the N-Gain with the results as shown in Table 6.

Table 6. Knowledge Achievement Results

Pre-Test	Explanation	Post-Test	Explanation	N-Gain	Conclution
38.9	Not Complete	86.1	Complete	0.8	High

Table 6 explains that the average score obtained in the pre-test is 38.9 with the average completeness being incomplete. Meanwhile, the average post-test score is 86.1 with an average of completeness. After both pre-test and post-test results were calculated, N-Gain was tested to see the improvement in learning experienced during the study by obtaining a score of 0.8 with a high category. So it can be concluded that the development of an E-Book based on the PBL model with quizzes provides a high increase in learning outcomes in the realm of student knowledge.

*Skill Aspect Achievement*

The achievement of the psychomotor aspect is carried out by holding practicum related to research material, namely measurement material with the help of the developed E-book. Psychomotor results on average students are 78.1 with good category.

*Attitude Aspect Achievement*

The achievement of the attitude aspect is done through self-assessment which is filled directly by students to see the level of understanding and knowledge of students. The results of the assessment of the attitude aspect obtained 85 results in the good category. So that the overall results obtained by students after using the E-book can be seen in the Figure 2.

The three results of the knowledge assessment obtained results above the learning minimum completeness criteria so that they were classified as complete, the skills results were classified as good and the attitude results were classified as good (Maba, 2017). The three assessment domains obtained good results so that it can be concluded that the developed E-Book is able to improve student learning outcomes (Rany et al., 2022).

The result research same with Susilawati et al. (2022) with result efektif and Gusman et al. (2022) with result very high for validity and practicality. The PBL model is very suitable for use in the development of E-Books. According to Kristyaningsih et al. (2015) and Nurlatifah et al. (2021) the development of PBL model-oriented E-Books has been proven to be effective in learning (Lu and Yang, 2018). These results are in accordance with the research conducted, although the materials and subjects differ. Product effectiveness is done by assessing the value of N-Gain. N-Gain is a guideline in measuring the improvement of students' abilities (Cresswell, 2014). The N-Gain value was obtained by conducting pre-test and post-test to the sample class. According to Elizabeth & Sigahitong (2018) the value of N-Gain is one of the testers to see the level of effectiveness of using a treatment. A high N-Gain value proves that the results have a good influence on the research subject. In addition, the improvement experienced by students during the study from the three assessment domains experienced a significant increase in knowledge, skills, and attitudes. Referring to the research of Muga et al. (2017) who got good results of knowledge on the teaching materials developed and Istifarida et al. (2017) who got good results for knowledge, skills and attitudes. These results also cannot be separated from the role of quizzes given during learning to increase students' learning

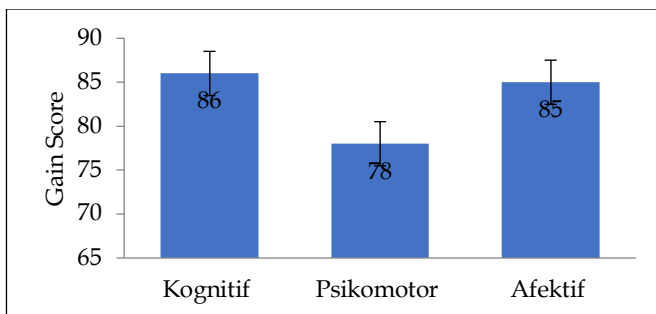


Figure 2. Assessment Results in the Three Assessment Areas

motivation and make students more enthusiastic. This result is in line with the research of Melatih et al. (2022) who conducted research on the development of e-books by taking quizzes in the midst of learning to obtain good results (Yoon, 2014).

## Conclusion

The results of research and development of E-Books based on the Problem Based Learning model accompanied by the provision of quizzes in class X physics learning are effective. Effectiveness is based on learning completeness and the value of N-Gain in the high category. The N-Gain value obtained after carrying out the final test is in the high category. In addition, the determinant of the effectiveness of the product is also assessed from the students' mastery in carrying out learning which is assessed through a final test to students. The results obtained are the total number of students in the complete category.

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