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Integration of Local Wisdom in E-Modules of PjBL Model: Facilitating Understanding Concept and Learning Independence of High School Physics Students

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Abstract. This study aims to determine the level of feasibility and effectiveness of the e-module PjBL model that integrates Local Wisdom. The type of research conducted is development research with the 4D model, which includes Define, Design, Develop, and Disseminate.. The samples used were 36 students for limited testing and 3 MIPA XI classes consisting of 108 students for field testing which were divided into experimental classes, control class 1, and control class 2. The instruments used included e-modules, lesson plans, pretest-posttest questions, learning independence questionnaires and student response questionnaires. The data obtained were analyzed using inferential statistical analysis and descriptive analysis. Based on the analysis of validation of experts, practitioners and student response questionnaires, the results showed that the developed e-modules were feasible to use in improving concept understanding and learning independence. Based on the field test, the developed e-module is effective to be used in improving students' concept understanding and learning independence.

Keywords: e-module model PjBL, conceptual understanding, self-directed learning

1. Introduction

Physics was born and developed through various observations, formulation of problems, formulation of hypotheses, conducting experiments, conclusions and discovery of theories and concepts. This is what makes physics an important subject because physics studies cover almost all areas of life. Through concepts, a person can simplify their thinking by using one term for several events that are related to each other [1]. Good concept understanding has an important role as a basis for building higher order thinking abilities. In Bloom's taxonomy, understanding is one level higher than remembering, this indicates that when students are able to understand a concept well, these students are not only able to remember but they can also interpret, explain, exemplify, classify, and compare one concept with another [1]. Therefore, when students still have difficulty in understanding a basic concept correctly they will also have difficulty in linking basic concepts with other related concepts.

Understanding basic concepts in physics needs to be considered by both students and students. Understanding the concepts and principles of physics is a condition for the success of physics learning and a condition for increasing student interest in understanding physics [2]. Concepts are the basis for someone to see and understand events that occur in this nature. Learners must have an initial concept that is built by their own understanding before knowing the basic concepts of physics. With this difference in concepts, the difference in concepts will have an impact on students in understanding more complex physics concepts.

Concept understanding is one of the main aspects that must be considered in physics learning because it can affect student learning outcomes [3,4],[5] stated that there are still many students who say that

physics subjects are difficult and boring, especially in thermodynamic material. This is a factor inhibiting students in understanding physics concepts, especially thermodynamic material. Based on Puspendik Kemdikbud data (2019), it shows that the learning outcomes of students listed as national exam scores on thermodynamic material show the lowest results, especially in temperature and heat material, which is 33-35%. This is corroborated by research conducted by [6] regarding the difficulties experienced by students in understanding temperature and heat material during physics learning.

The low learning outcomes of students based on test results are also a factor that indicates that the understanding of concepts possessed by students is still low. This is reinforced by the results of an interview with one of the high school physics teachers in Bantul, that the results of students' tests on temperature and heat material are still low and far below the existing KKM. In addition, the level of learning independence possessed by students is also still low. This is evidenced by the large number of students who cheat on tests and do not do homework. [7,8] state that the level of student learning independence is very low, especially in physics lessons. This is in line with the results of preliminary observations at schools in Bantul with indicators of learning independence including responsibility, discipline, initiative, self-confidence, and motivation.

Learning independence is a person's ability to take the initiative, be responsible and believe in themselves. Learning independence is a person's ability to improve knowledge and skills independently without involving others, and be responsible for their abilities [9,10],[11] state that indicators of learning independence include discipline, responsibility, motivation, confidence, and initiative. This means that students' learning independence is the ability of students to solve a problem independently, take responsibility, and be confident in their own abilities. However, looking at the reality that occurs where there are still students who cheat on tests, sleep during class hours, and wait for teacher orders to do something without any initiative from students indicates that the level of independence of students is still low. This is reinforced by the results of initial interviews at schools in Bantul and in line with research conducted by [12] that the level of learning independence of students in Bantul High School is still relatively low based on the average of the five indicators. This indicates the need for learning models and teaching materials that can increase students' understanding and learning independence.

Technological developments in the field of education can be utilised in various ways, one of which is as a support in learning [13]. Technology that continues to develop can be a solution to overcome the problems of learning independence and understanding of the concepts of students who so far still tend to be less active during the learning process. With this, there is a need for new innovations that are more interesting in teaching physics concepts and materials, especially temperature and heat materials. [14] states that learning media is an intermediary, tool, means, and connector to convey, disseminate, or carry messages and ideas so that it can stimulate the thoughts, actions of students during the learning process. Learning media can be a useful learning resource for the learning process of students [13].

Learning media is used to increase learning efficiency and make it easier for students to understand the material. The form of learning media can vary, one of which is electronic learning media or e-modules [15–17] . E-modules are modules in digital form consisting of images, text, and videos produced and published via computers that can be accessed via mobile phones and computers [18]. The combination of e-modules with the PJBL learning model in physics learning should be able to actively involve students, so that the developed PJBL model e-modules can be used as a solution to improve students' concept understanding and learning independence.

Based on the description above, the development of e-modules of the PJBL model integrated with local wisdom is carried out, which aims to determine the feasibility of PJBL model e-modules and the effectiveness of PJBL model e-modules in improving students' concept understanding and learning independence in temperature and heat material of high school students.

2. Method

This research is an R&D (research and development) study with the 4D model, which includes Define, Design, Develop, and Disseminate.. The details of the stages in the research are: (1) Define, which is the stage where it is carried out to determine and define the needs needed in the learning process which begins with an analysis so that it can find out what is needed for research. This stage includes five main

steps that must exist, namely initial analysis, learner analysis, task analysis, concept analysis, and specification of learning objectives. (2) Design, which is a stage that aims to prepare prototypes of learning devices. At this stage, a design is also carried out to create a learning media e-module of PJBL model with temperature and heat material for class XI high school students. In this stage there are several steps taken, namely (a) Preparation of Test Standards. (b) Media Selection. (c) Format Selection, and (d) Initial Design. (3) Develop, which is a stage that aims to determine the feasibility and effectiveness of the product that has been prepared at the planning stage. This stage consists of several steps, namely: (a) Validation, (b) Revision I, (c) Limited Trial, (d) Revision II, (e) Field Test. And the last stage is (4) Disseminate, at this stage the final product is obtained in the form of an e-module model of PJBL integrated with local wisdom which is feasible and effective to be used to improve students' concept understanding and learning independence [19].

The research was conducted in August 2023 - September 2023. The data collection instrument used a learning independence questionnaire and pretest - postest questions. The trial of the e-module of the PJBL model involved expert validators, practitioner validators, and students. The trial was conducted twice, the first was a limited trial conducted in class XII MIPA with 36 respondents. The results of the limited trial were used to obtain preliminary data and as a basis for improving research instruments before being used as a field trial. The second is the field trial, the field trial was conducted in class XI MIPA involving three classes and a total of 108 respondents. The three classes were divided into experimental classes, control class 1, and control class 2 which were selected by random sampling technique. Before conducting limited trials and field trials, all instruments to be used were first validated by expert validators and practitioner validators. Data analysis used the scale method with a modified linkert scale.

Tabel 1. Skala Linkert.

Scale Value	Interpretation
1	Not very good
2	Not good
3	Good
4	Very good

The data collected was then analyzed using the following equation

$$\textbf{Expected score} = \text{Highest scale value} \times \text{Number of Instruments} \quad (1)$$

Media feasibility data by expert validators, and practitioner validators and students as respondents were analysed using the following equation.

$$\text{Percentage of Feasibility (\%)} = \frac{(Score\ obtained)}{(Expected\ score)}\ x\ 100\% \quad (2)$$

Tabel 2. Aspects of e-module feasibility assessment.

Aspects of E-Module Feasibility Assessment
1. Content of E-Module of PPA model integrated with local wisdom
2. The contrast of the E-Module of the PPA model integrated with local wisdom
3. Display of the E-Module of integrated PPA model of local wisdom
4. Language

Tabel 3. Interpretation of feasibility rating scale.

Scale Value **%**	**Interpretation**
76.00 - 100.00	Feasible
56.00 – 74.00	Decent Enough
40.00 – 55.00	Less Feasible
0 – 39.00	Not Feasible

After calculating all the feasibility percentages, the values obtained are then interpreted to determine the feasibility level of the learning media developed based on the Table 3.

3. Results and Discussion

3.1. *Feasibility of E-modules of PJBL model*

The e-module products developed in this study are as follows:

Figure 1. *E-modules* developed.

Based on the results of the analysis that has been carried out, it is known that:

(a). Based on the results of expert and practitioner validation analysis
Based on the analysis of expert and practitioner validation, it is known that the physics e-module developed which contains aspects of content, graphics, media and language obtained an average score of 3.46 with a very good category. This can be seen in Figure 2.

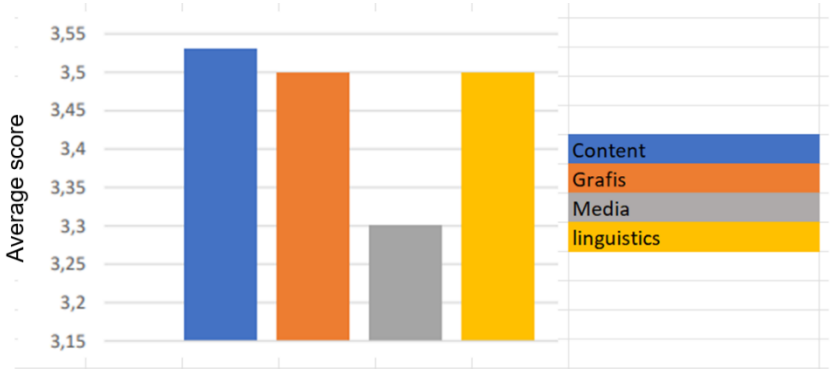

Figure 2. Media feasibility analysis results.

Based on the picture above, it is known that for all aspects of the assessment, the average value shows a very good category. This is in line with research conducted by [20] which states that teaching materials with the PJBL model are feasible to develop and use which contains aspects of content, graphics, media, and language. Thus, the PJBL model e-module developed by researchers is suitable for use based on expert and practitioner assessments.

(b). Learner Response
Based on the results of the analysis of the students‘ response questionnaire, it is known that the students’ responses are good and quite enthusiastic. This can be proven by the results of the analysis of the learner response questionnaire, which has an average of 3.6 in the very good category. The Figure 3 shows the value of the results of the analysis of students' responses.

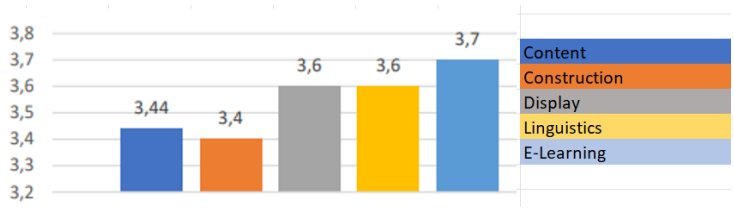

Figure 3. Results of analysis of learner response.

Based on Figure 3, it can be seen that the results of the analysis of media feasibility obtained an average score of 3.6 with a very good category in all aspects, namely content, construction, appearance, language, and e-learning. This shows that e-learning can be easily understood by students. This is in line with the results of research conducted by [21] that the use of e-modules of PJBL model in physics learning can make students more active and enjoyable, and feasible to use both at school or outside school. Thus, based on the results of the analysis of students' responses, the learning media developed by educators are suitable for use to improve the understanding of concepts and learning independence of high school students on temperature and heat material.

3.2. *Effectiveness of e-modules of PJBL model*

The effectiveness of the e-module of the PJBL model can be known through trials of the use of e-modules in the learning process. In this study, it was analysed using statistical analysis, namely descriptive analysis and inferential analysis.

(a). Effectiveness based on inferential analysis.
Inferential statistical tests were carried out as a basis for drawing conclusions from the effectiveness of the use of learning media developed by researchers, namely e-modules. The data used is data that can improve each variable used which is then analysed using N-gain statistical analysis. The results of this analysis are the normality value data which obtained a significance value> 0.05 which indicates that the values are normally distributed, then the homogeneity test which obtained a significance value> 0.05 which means that the data has homogeneous characteristics. If the data analysed has stated normal and homogeneous then further tests are carried out, namely the correlation test.

Based on the correlation test results, it was found that the class data were correlated. Furthermore, the Manova test was carried out which resulted in a significance value of <0.05, which means that H0 is rejected and H1 is accepted. This indicates that there are differences in increasing concept understanding and learning independence in the experimental class, control class 1, and control class 2. Furthermore, the effect size test was conducted to determine how much difference in improvement between the two variables. Furthermore, the post hoc test was conducted to determine which class had the highest order of increasing concept understanding and learning independence. From the analysis, it is known that the experimental class has the highest difference value, followed by control class 1, and control class 2. This is in accordance with the results of research conducted by [16] that the use of PJBL

e-modules can be used to improve students' concept understanding. [16] in their research found that the use of PJBL-based e-modules successfully improved students' learning outcomes.

(b). Effectiveness based on descriptive analysis
Descriptive analysis is used to calculate the value of increasing concept understanding and learning independence of students. The data used were obtained from three classes, namely the experimental class, control class 1, and control class 2 with each class consisting of 36 students.

- Product effectiveness on increasing concept understanding
The increase in concept understanding can be seen from the results of the analysis using N-gain. The following are the results of the analysis:

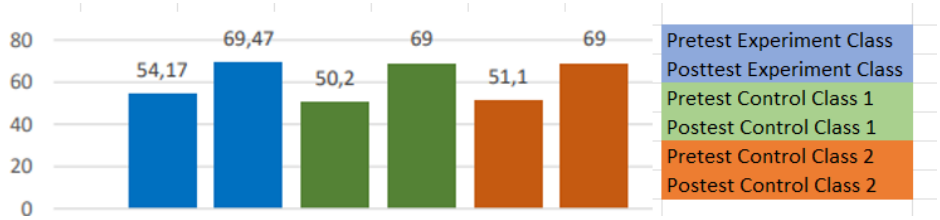

Figure 4. Results of improved understanding of concepts.

Based on the picture above, it can be seen that there is an increase in concept understanding obtained from the results of the analysis of pretest and posttest scores. The improvement value in each class has a different value, the results are as follows:

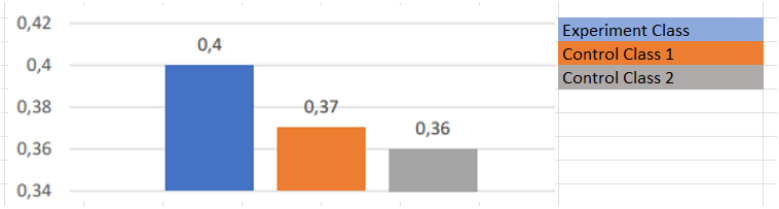

Figure 5. N-gain improvement in understanding of concepts.

Based on the figure above, it is known that the largest gain value is owned by the experimental class. This means that the experimental class experienced the greatest increase in concept understanding, followed by control class 1, and control class 2. This is because the experimental class uses the e-module of the PJBL model integrated with local wisdom developed in accordance with research conducted by [22] and [4], that the use of e-modules of the PPA model integrated with local wisdom is proven to improve students' understanding of physics concepts, especially in physics material.

- Product Effectiveness on Increasing Learning Independence
The following is a diagram of the results of the analysis of increasing understanding of the concepts of the experimental class, control class 1, and control class 2.

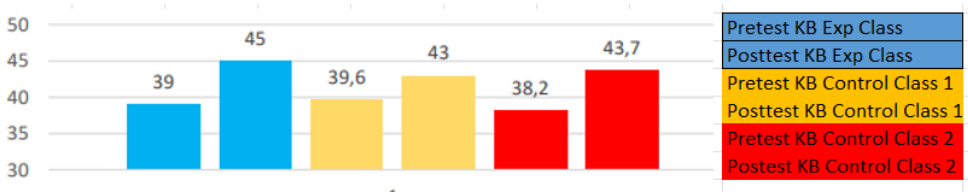

Figure 6. Improvement of learning independence score.

Based on the picture above, it can be seen that there is an increase in learning independence obtained from the results of the analysis of the learning independence questionnaire. The value of improvement in each class has a different value, the results are as follows:

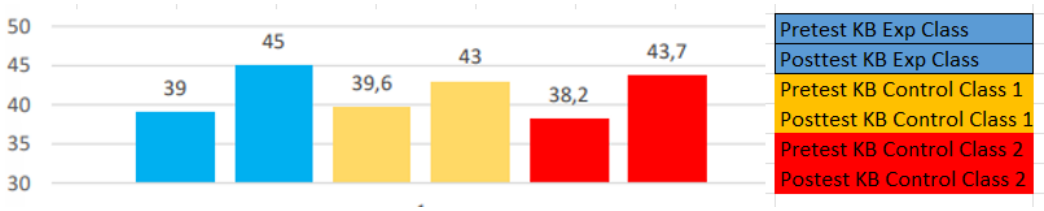

Figure 7. N-gain of independence learning.

Based on Figure 6, it is known that the largest gain value is owned by the control class 2. This means that control class 2 experienced the greatest increase in learning independence, followed by control class 1, and the experimental class. The experimental class has an average increase in learning independence of 0.43 with a moderate category. These results show an increase in the indicators of learning independence in students. Research conducted by [12] ,that based on the analysis of the level of learning independence in students is still in the low category so that based on this research it can be seen that the use of PJBL e-modules integrated with local wisdom can be used to increase students' learning independence.

4. Conclusion

Based on the results of this development and research, it can be concluded that the learning media e-module model of PJBL integrated local wisdom is categorised as feasible based on the assessment or validation of expert validators and practitioner validators as well as based on student responses. In addition, the e-module of PJBL model integrated with local wisdom is also proven to be able to improve students' concept understanding and learning independence based on manova test and hypothesis test. Therefore, researchers recommend the use of e-modules of PJBL model integrated with local wisdom for teachers and students in learning physics, especially temperature and heat material.

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