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Development of Business and Energy Module Based on Problem Based Learning

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Abstract: The problems of this research are results of observations at SMP Negeri Air Satan, it shows that science learning in schools has not been implemented in an integrated manner. One of the causes of the non-implementation of science learning is that science teachers, especially the material of effort and energy in junior high school, are not ready because there is no science teaching material on effort and energy. This research aims to 1) Design a module of Effort and Energy based on Problem Based Learning 2) Measure the feasibility of science modules based on Problem Based Learning in terms of validity, practicality and effectiveness. The method used is a research and development approach which is usually known as the R&D research method. The development design used is the 4D model development design. The results showed that the average of the analysis of the three validators, namely material, media and language experts, scored 26 in the good category. Analysis of student practicality in limited group trials obtained a score of 77% meeting practical criteria. The results of the calculation of the student practicality questionnaire in the large group trial obtained a score of 87.36%, meeting the criteria for being very practical. The increase in student learning outcomes was 0.61 with a moderate category.

Keywords: Business and energy module; Development; Problem based learning

Introduction

Education is a valuable asset for the country's progress and a reflection of a country. A good education will reflect a good country because education affects the quality of Human Resources (HR) in the country (Fau et al., 2025; Holmes, 2019; Novitasari et al., 2024; Austria & Banayo, 2024). Education has an important role in the development process of a nation. The world of education is expected to provide professional human resources to advance the country with its science and technology. National education functions to develop abilities and shape the character and civilization of a dignified nation in order to educate the nation's life (Monica et al., 2021; Muhasim, 2019; Sugianto et al., 2018).

Education is an inseparable part of human life. In achieving the desired educational goals, one of them is the existence of teaching materials that are in accordance with the needs and characteristics of students. Lack of optimization in the development of teaching materials and limited science teaching materials in supporting learning by teachers makes students unable to carry out learning according to the characteristics of science and student needs (Gurupada et al., 2016; Kinta, 2013; Mardianti, 2020; Rosa, 2015). The importance of developing appropriate and effective teaching materials to meet student needs in the form of modules in science subjects (Dodridge, 1999; Fitrah et al., 2024; Mutiawati et al., 2023; Sugianto et al., 2018).

The achievement of a learning process is indicated by a change in better behavior which involves changes

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in knowledge (cognitive), skills (psychomotor), as well as those concerning values and attitudes (affective). The achievement of these changes is caused by several things including educators, students, the environment, learning methods, and teaching materials. One form of teaching material is a module.

Module is a set of learning materials, both information, tools and texts that are arranged systematically, both written and not, and used in the learning process so that students master the subjects in certain educational units (Bhosale & Shinde, 2022; Firanti et al., 2025; Hermayanti & Setyasto, 2025; Lubis et al., 2021; Prastowo, 2017). Modules have a strategic function for the learning process that can help teachers and students in learning activities, so that teachers do not present too much material. In addition, the module functions as a tool used by teachers to support the learning process. This will have a positive impact on the teacher, because some of his time can be devoted to guiding student learning. The positive impact for students can get used to learning independently.

Science is a science related to how to find out about natural phenomena and systematically, so that science is not only mastery of a collection of knowledge in the form of facts, concepts or principles, but also a discovery process. This shows that science learning is a science that must be learned through direct observation. Not all material can be delivered or is suitable using the lecture method. This is one of the factors in the lack of maximum student achievement in learning. In accordance with the recommendations launched by UNESCO 1996 (Juita et al., 2024; Poedjiadi, 2010; Shaifuddin & Nashir, 2022) that "formal and non-formal learning is expected to provide experiences for participants through "learning to know, learning to do, learning to be and learning to live together". This opinion reinforces that science learning is learning that is easily learned through direct observation. This opinion explains that in the learning process, media is needed to attract students' attention and curiosity about the lesson, one of the media that can be developed is in the form of modules because it can be used by students to learn independently (Hayati et al., 2023; Holmes, 2019; Jain, 2024; Sumantri, 2022; Tiara et al., 2023).

Thus teachers are required to master not only one learning model, because each material has different characteristics, the learning model used is also different. The Problem Based Learning (PBL) model in this study is very suitable for the development of science, because in problem-based learning, learning is designed in the form of learning that begins with a real problem structure related to the science concepts to be learned.

Based on the results of observations at SMP Negeri Air Satan, it shows that science learning in schools has not been implemented in an integrated manner. One of the causes of the non-implementation of science learning is that science teachers, especially the material of effort and energy in junior high school, are not ready because there is no science teaching material on effort and energy. One of the teaching materials that is felt to be able to help students and teachers in the process of learning science, especially the material of effort and energy is a module, because with modules students can teach themselves and exercise their own control over the intensity of their learning. then it is necessary to develop a module of effort and energy.

The novelty of this research lies in the integration of the concepts of effort and energy with the PBL approach into a learning module that not only presents the material contextually, but also directs students to find solutions to real problems that are relevant to everyday life. This module is designed to support active learning, increase learning motivation, and develop students' critical thinking skills, which have not been found in previous similar modules. Research Objectives: 1). Develop a physics learning module on the material of effort and energy based on the Problem Based Learning (PBL) approach that is feasible to use in learning; 2). Knowing the feasibility of the developed module based on the assessment of material experts, media experts, and student responses; 3) Analyzing the response and effectiveness of the module on improving physics problem solving skills of junior high school students. Urgency of this research is based on the low problem solving ability of students in physics learning, which is caused by the use of teaching materials that do not support the development of higher order thinking skills. In addition, the independent curriculum that emphasizes project-based learning and problem solving requires innovation in the development of teaching media that is in line with this approach. Therefore, the development of PBL-based modules on effort and energy material is important to overcome these problems, as well as to support learning that is more meaningful, contextual, and oriented to 21st century skills.

Module Definition

Modules are teaching materials that are independent, so that students are required to be independent without direct teacher guidance. The existence of modules is very necessary to support the success of the expected learning objectives because it is able to provide information and help students' learning activities to be more directed (Dewi et al., 2019; Monica et al., 2021; Pratiwi & Tyas, 2025; Dhany & Yulianti, 2025; Sarip et al., 2022). Furthermore Ardi et al. (2025), Prastowo (2017), Puspitowati et al. (2022), Sumantri

(2022), and Yasmin et al. (2023), a module is a teaching material that is systematically arranged in a language that is easily understood by students according to the level of knowledge and age of students, so that they can learn on their own (independently) with minimal assistance or guidance from the teacher. According to Arifin et al. (2024), Khilyati et al. (2024), Mamalampac (2023), Remindima et al. (2024), and Austria et al. (2024) a good module is a module that meets the three components of eligibility according to the National Education Standards Agency (BSNP), namely the components of content eligibility, language eligibility, and presentation eligibility (Ayubi et al., 2024; Chotimah et al., 2024; Faizah et al., 2024; Sarip et al., 2022).

Learning in the 21st century is very suitable for using modules in learning science in junior high school, given the systematic, coherent nature of modules, and being able to turn arguably complicated science material into simpler ones (Lubis et al., 2021). Students can repeat what they learn at any time, so that students better absorb the contents of the module. In addition, the module functions as a tool used by teachers to support the learning process (Hariyanti, 2021; Lovisia & Febrianti, 2024; Novitasari et al., 2024).

Module is one of the learning media that can be used by students as a learning resource in learning science. Learning using modules can make students measure their own level of mastery of the material discussed in each module unit, so that if they have mastered it, students can continue at the next level. Conversely, if students have not been able, students will be asked to repeat and learn it again (Hariyanti, 2021; Hayati & Aiuby, 2023; Larasati, 2024; Lovisia & Febrianti, 2024; Novitasari et al., 2024; Prastowo, 2017; Sumual et al., 2024; Hanh, 2023). A good module is not only interesting but also must be able to foster student curiosity about the knowledge learned. If students have a high curiosity about learning materials, then students will be more motivated to learn so that they can improve learning outcomes.

From the above understanding, it can be concluded that a module is a teaching material that is arranged systematically using language that is easy for students to understand according to their level of knowledge and age so that students can learn independently with minimal guidance from the teacher.

Problem Based Learning (PBL)

Problem Based Learning (PBL) is a series of learning activities that emphasize the process of solving problems faced scientifically. During the learning process with the PBL model, students are not expected to just listen, record and then memorize the subject matter, but with PBL students actively think, communicate, search for data, and finally conclude. With such a learning process that directs students to think using the scientific method. And the most important thing is to use problems as the key to learning. If there is no problem, then there will be no learning process. So, problem-based learning challenges students to learn on their own. In problem-based learning, students are more invited to form knowledge with little teacher guidance or direction. Thus, learners are given the opportunity to play an active and constructive role in monitoring and controlling motivation, cognitive and behavior to achieve the learning objectives that have been formulated.

Meanwhile Chotimah et al. (2024), Imamora et al. (2020), Khilyati et al. (2024), Larasati (2024), Lovisia et al. (2024), Shavkidinova et al. (2023), Wintribrata et al. (2025) states that the advantages of the PBL model are: (1) providing opportunities for students to conduct research; (2) building critical thinking skills; (3) recognizing subject matter content and building goals according to concepts; (4) empowering students to become experts in certain fields; (5) allowing students to produce more than one form of solution; (6) stating uncertainty and the need to develop assumptions; and (7) motivating students to learn. The stages of the Problem Based Learning (PBL) model according to (Hariyanti, 2021) are as follows:

Table 1. Phases of the Problem Based Learning (PBL) Model

Phase	Teacher Activity
Phase 1 Orienting students to the problem	Explains learning objectives, logistics required, motivates students to be actively involved in the selected problem-solving activity.
Phase 2 Organizing students to learn	Helping students define and organize learning tasks related to the problem at hand
Phase 3 Guiding individual and group investigations	Encourage students to gather appropriate information, conduct experiments, and search for explanations and solutions
Phase 4 Develop and present work	Helping students plan and prepare appropriate work, such as: reports, videos, and models and helping them to share their work with their peers.
Phase 5 Analyse and evaluate the problem-solving process	Helping students reflect on the investigation and processes used during problem solving.

Learning Outcomes

Learning is a process where students are required to be actively involved. Through this learning process students are expected to experience changes. Changes that occur in students from the learning process are called learning outcomes. From the formation of an effective and efficient learning process, it will make learning outcomes more meaningful and useful for individuals who are learning. Learning outcomes are the abilities that students have after they receive learning experiences, namely cognitive, affective, psychomotor abilities and are able to apply them in everyday life. According to Asfiah et al. (2013), Dewi et al. (2019), Dimyati et al. (2016), and Sugianto et al. (2018) "learning outcomes are the result of an interaction of learning and teaching actions".

Learning outcomes as a benchmark used to determine the level of student success in knowing a subject matter. A person is said to be successful in learning if there has been a change in behavior in him both in the form of knowledge, skills and in the form of attitudes and traits in a positive direction. As stated by Sudjana (2014) which states that, "learning outcomes are the abilities possessed by students after they receive their learning experience".

Thus, learning outcomes are all changes in behavior after the learning process, namely from practice and experience. These changes are formed from changes in knowledge, habits, skills and aspirations in terms of attitudes and values. Student learning outcomes occur mainly due to teacher evaluation. Evaluation of learning outcomes is essentially an activity to measure changes that have occurred in students after the learning process. The main purpose of evaluating learning outcomes is to determine the level of success achieved by students after learning, where the level of success is marked by numbers, letters or words.

Method

Time and Place of Research

The place of this research is at SMPN Air Satan Musi Rawas Regency. the research was conducted in February 2025

Tools and Materials

Problem Based Learning-based energy and effort module. The data collection techniques used in this research are as follows:

Observation

Observation is a data collection technique by directly observing a situation or situation of a research subject. How to collect data with observation techniques is divided into two, namely participant observation and non-participant observation. Participant observation, researchers are directly involved in feeling the circumstances and situation of a research subject. While non-participant observation, researchers do not participate directly in conducting research, only observing the object under study.

Interview

Interviews aim to obtain information related to facts, beliefs, feelings, desires needed to fulfill the research objectives. Interviews are conducted by asking questions directly to the research subject. Interviews can be conducted face-to-face, can also be done by utilizing communication media.

Questionnaire

The questionnaire used in this study is a closed questionnaire containing questions that will be given to validators and students to find out the extent of the practicality of the modules made by researchers.

Test

Researchers conducted tests to students to determine the increase in student learning outcomes after implementing learning using the effort and energy module.

Research Methods

This research uses a research and development approach method (Reseach and Develop Strategy) known as the R&D development research method. The research and development method is a research method used to research in existing efforts (innovation) or to create new products (creation) that are tested. The research and development method is a research method used to produce certain products, and test the effectiveness of these products. To be able to produce certain products, research is used to analyze the needs and to test the effectiveness of these products (Imamora et al., 2020; Rustandi & Rismayanti, 2021; Sugiyono, 2016; Sumual et al., 2024).

This research is a type of development research (research and development). The development model used refers to the 4D development model. The 4D (Four D) development model design is part of a variety of learning device development model designs. The device development model as suggested by Thigarajan et al. (1974) is the 4-D model. This model consists of 4 stages of development, namely define, design, develop and disseminate or adapted to the 4-P model, namely defining, designing, developing, and disseminating (Siregar et al., 2024; Pradana et al., 2021; Pratiwi & Tyas, 2025; Shavkidinova et al., 2023; Trianto, 2012). With the development using this model, it can produce a product,

namely, a module of effort and energy based on Problem Based Learning on student learning outcomes.

Research Stages

Preliminary Research

Conduct a literature review related to learning modules, Problem Based Learning (PBL) approach, and energy and effort materials. Analyzing the needs of students and teachers through observations and interviews to find out the weaknesses of the modules that have been used so far. Develop a conceptual framework of the module based on the results of the needs analysis.

Design

Developing the initial design of PBL-based modules, including module structure, PBL scenarios, and learning activities that contain problem solving. Develop validation instruments such as material expert assessment sheets, media experts, language experts and student response questionnaires.

Develop

Develop the first version of the module based on the initial design. Conduct expert validation: Validation by physics material experts; Validation by learning media experts; Linguist validation. Revise the module based on expert feedback.

Limited Trial

Implementing the module on a small group of students (9 students) to determine student responses and the feasibility of the content and appearance of the module. Observing the implementation and initial effectiveness in the learning process.

Module Revision

Improving the module based on the results of the limited trial and feedback from students and teachers.

Main Trial / Field Test

Implementing the module in a larger group (experimental class). Using pretest and posttest instruments to assess the effectiveness of the module on students problem solving skills.

Data Analysis

Data analysis techniques are used to analyze data obtained through validation questionnaires from validators, student response questionnaires and student learning outcomes. The data to be analyzed in this study are as follows:

Analysis of Product Validation Results

The analysis at this stage is an analysis of the feasibility of developing products based on the research of experts, namely material experts, linguists, and linguists. The data obtained from product validation by linguists, materials, and media are analyzed using the following formula:

Calculating each average score of each instrument item; Calculating the average value of the total score of each component (Widoyoko, 2019).

$$x = \frac{\Sigma x}{n} \quad (1)$$

Description:

x = Average score

Σx = The sum of each rater's score for a particular component

n = Number of Appraisers

Comparing the average score of each component with the following criteria:

Table 2. Mean Component Score with Criteria (Widoyoko, 2019)

Formula	Value	Criteria
$\boldsymbol{X > \overline{X_i} + 1.8 \times sbi}$	A	Very good
$\boldsymbol{\overline{X_i} + 0.6 \times sbi < X \leq \overline{X_i} + 1.8 \times sbi}$	B	Good
$\boldsymbol{\overline{X_i} - 0.6 \times sbi < X \leq \overline{X_i} + 0.6 \times sbi}$	C	Simply
$\boldsymbol{\overline{X_i} - 1.8 \times sbi < X \leq \overline{X_i} - 0.6 \times sbi}$	D	Less
$\boldsymbol{X < \overline{X_i} - 1.8 \times sbi}$	E	Very Less

Description

$\bar{X}_i$ Ideal average)= $\frac{1}{2}$ (ideal max score + ideal min score)

sbi (ideal standard deviation)= $\frac{1}{6}$ (ideal max score-ideal min score)

In this study, the feasibility value was determined with a minimum value of "C" with a sufficient classification. So if the results of the assessment by the expert on average give the final result of "C", then the product of this development is said to be suitable for use. So the development of Problem Based Learning-based energy and effort modules is considered feasible to use.

Questionnaire Data Analysis

Table 3. Student Response Assessment Score Guidelines

Instrument item answers	Score (Negative statement)	Instrument item answers	Score (Positive statement)
Strongly agree	1	Strongly agree	4
Agree	2	Agree	3
disagree	3	disagree	2
Strongly disagree	4	Strongly disagree	1

The total assessment score in data analysis can be found using the formula:

$$P = \frac{f}{N} x100\% \quad (2)$$

Description:
P= Percentage of questionnaire data
f= Total score obtained
N= Maximum number of scores

In converting the product validity score, the following guidelines were used:

Table 4. Quantitative-Qualitative Data Scores

Value	Percentage	Qualitative Data
A	84%-100%	Very practical
B	68%-84%	Practical
C	52%-68%	Practical enough
D	36%-52%	Not practical
E	0%-36%	Very impractical

In this study, feasibility was agreed with a minimum score of sufficient category. If the results given by students obtain an average score of sufficient, then the development of Problem Based Learning-based energy and effort modules is considered practical to use.

Test Data Analysis

The achievement of improved learning outcomes was analyzed using N-gain as follows:

$$\text{N-}gain = \frac{Posttest\ score - Pretest\ score}{Smaximum - Pretest\ score} \quad (3)$$

Description:
Pretest Score = score before using the module
Posttest Score = score after using the module
$S_{maximum}$ = maximum score

Table 5. Criteria for Improving Collaboration Skills

N-gain value	Criteria
$\boldsymbol{g \geq 0.7}$	High
$\boldsymbol{0.3 \leq g \leq 0.7}$	Medium
$\boldsymbol{g \leq 0.3}$	Low

Result and Discussion

Initial Product Development Results

Validation of teaching modules based on Problem Based Learning (PBL) by experts

Media Expert

Before the module is used in learning trials, a validation process is carried out by media experts to assess the feasibility of the appearance, design, and readability of the developed module. This validation aims to ensure that the module has met the quality standards in terms of presentation, aesthetics, and ease of use by students. The results of this validation were used as the basis for making revisions before the module was implemented in the limited trial stage. The following are the results of media expert validation of the developed module:

Table 6. Media Expert Validation Result Data

Number	Statement	Score
1.	Ke-1	4
2.	Ke-2	4
3.	Ke-3	4
4.	Ke-4	4
5.	Ke-5	4
6.	Ke-6	4
7.	Ke-7	5
8.	Ke-8	4
9.	Ke-9	3
$\boldsymbol{\Sigma x}$		36
Classification		Good

In addition to the assessment of the aspects assessed in the validation sheet, media validators also provide suggestions or input on the Problem Based Learning (PBL) based teaching module developed to be improved by the revision stage. The following are suggestions and input given to the inquiry-based teaching module 1) The addition of images and the use of colors in the teaching module is less attractive, 2) The use of pictures of work steps must be clear.

Linguist

In addition to validation by media experts, the module was also validated by linguists to assess the linguistic aspects which include readability, clarity of sentences, appropriateness of the use of terms, and language structure used in the module. This validation is important to ensure that the module is easily understood by students and does not cause confusing interpretations. Feedback from linguists is used as a basis for improvement in the preparation of sentences and presentation of information to be in accordance with good and correct Indonesian language rules. The following are the results of the linguist's validation of the developed module:

Table 7. Data on Language Expert Validation Results

Number	Statement	Score
1.	Ke-1	4
2.	Ke-2	4
3.	Ke-3	4
4.	Ke-4	4
$\boldsymbol{\Sigma x}$		16
Classification		Good

In addition to the assessment of the aspects assessed in the questionnaire, language validators will also provide suggestions or input on the PBL-based teaching modules developed in order to improve through revision. The following are suggestions and input given to the inquiry-based teaching module 1) The use of uppercase letters in the middle of a sentence, 2) English words must be italicized, and 3) Writing formulas must use the appropriate font.

Material Expert

Validation by material experts was carried out to assess the accuracy of the concept, depth of content, and suitability of module material with the curriculum and characteristics of students. This assessment is important so that the developed module really contains content that is accurate, relevant, and in accordance with the learning objectives of physics, especially on the topic of effort and energy. Input from material experts is used to revise and improve the content of the module so that it is suitable for use in the learning process. The following are the results of the material expert validation of the developed module.

Table 8. Data on Material Expert Validation Results

Number	Statement	Score
1.	Ke-1	4
2.	Ke-2	4
3.	Ke-3	4
4.	Ke-4	3
5.	Ke-5	4
6.	Ke-6	3
7.	Ke-7	4
Σx		26
Classification		Good

Based on the assessment of the aspects assessed in the material expert validation sheet, the material validator will also provide suggestions or input on the PBL-based energy and effort module developed. The following are suggestions and input given to the PBL-based energy and effort module 1) Adjustment of sample problems with the material taught, 2) The derivation of the formula must be the same as that written in the example problem, and 3) The use of powers should be adjusted.

Development Testing

After the Problem Based Learning (PBL) based teaching module becomes learning media, it will be tested first in development testing. This trial aims to perfect this PBL-based teaching module to make it easier to use. This development testing consists of three categories, namely high, medium and low. They will fill in the suggestion sheet on the teaching module that has been provided in each sub-chapter of the effort and energy material taught. The following are the suggestions they made to improve the improvement of PBL-based teaching modules 1) High ability provides suggestions for sample problems to be reproduced in each activity, 2) Medium ability gave feedback to improve the formula and explain in detail and given a picture, and 3) Low ability gave advice to explain the material with interesting media because they are easily bored.

Trial

The trial was conducted using two groups, namely small groups and large groups. The small group amounted to 9 students who had different abilities high, medium and low, conducted before carrying out research on large group trials. While the large group used VIII.1 class students totaling 18 people.

Small Group Trials

In small group trials using 9 students who have high, medium and low abilities, the selection of these students is based on the recommendation of the physics teacher. The selected learners were then asked to open and study the PBL-based energy and effort module first in the teaching module that had been given by the researcher. Researchers explained how to use PBL-based teaching modules, then students studied the modules provided.

Based on 9 students with different abilities have suggestions and responses to the PBL-based energy and effort module, among others 1) High ability learners suggest adding sample problems, and the use of media, 2) Medium ability learners provide suggestions for simplifying formula derivatives and adding time, 3) Low ability learners suggest learning in groups and giving enough assignments in each meeting. The results of learners' suggestions for the teaching modules they have studied are recorded in the column of each sub-chapter provided.

The purpose of providing suggestions for each sub-chapter on the material of the module of effort and energy that has been done is to refine and be able to improve the module of effort and energy to be used in accordance with the wishes of students with consideration from several experts before the product will be used in large groups. The average small group trial stage provides suggestions for adding and reducing a few activities in each sub chapter, but basically they are very interested in this PBL-based energy and effort module because they do practicum activities to better understand each material taught. Therefore, the developed product has positive suggestions to be used then the product can be tested in large groups.

Large Group Trial

The large group trial stage was conducted in class VIII. 1 with the number of students 18 people. After the PBL-based teaching module has been tested on expert validation and the small group has been said to be feasible, then the product is used in the large group In the large group trial, it aims to determine the practicality of the module that has been developed.

Improved Learning Outcomes

After the Problem Based Learning (PBL) based energy and effort module was implemented in learning, the students' learning outcomes were measured through pretest and posttest. The purpose of this measurement is to determine the effectiveness of the module in improving students' problem solving skills. The data of the learning outcomes were then analyzed and presented in the form of a graph to facilitate the interpretation of the improvement that occurred. The following is a graph of the increase in student learning outcomes before and after using the module:

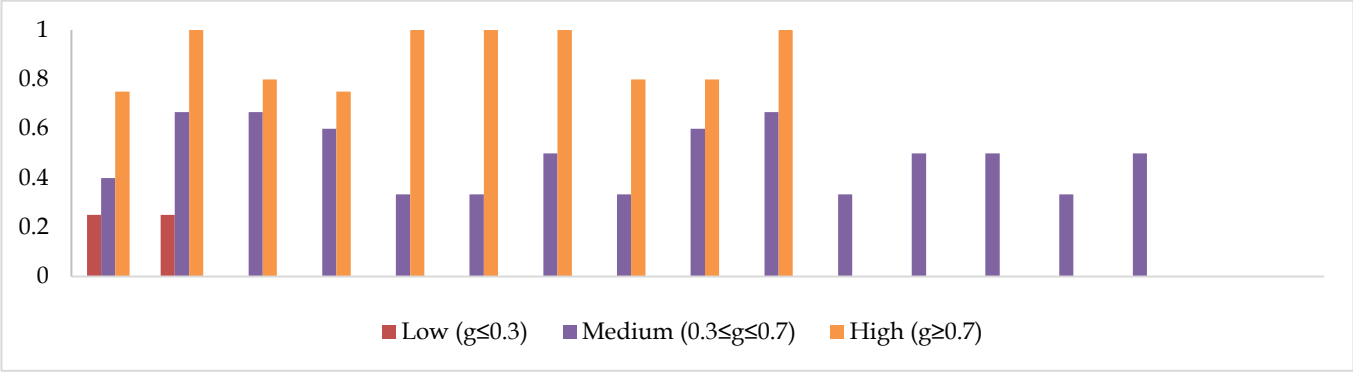

Figure 1. Improved student learning outcomes

Discussion

This research is to produce a module of effort and energy based on Problem Based Learning. This module is designed accordingly. The module produced uses the 4D research design, define, design, develop and dissemination, but in its application it only applies to the 3D stage, namely: Define: Front end analysis, task analysis student analysis, concept analysis and formulation of learning objectives; Design: Benchmark test development, selection of appropriate media objectives and format selection; Develop: Expert lecturer validation, small group trial, and large group trial.

Based on the evaluation of the validity of the calculation of the results of the assessment by media experts, it can be seen that the assessment by media experts is 36. The value is converted to the level of achievement in the range $30{,}6 < X \leq 37{,}8$. This means that the module is in good classification, based on the calculation of the results of the assessment by the material expert, it can be seen that the assessment by the material expert of 26 values is converted to the level of achievement in the range of $23{,}82 < X \leq 29{,}46$. This means that the material in the module is in a good classification. based on the calculation of the assessment results by linguists, it can be seen that the assessment by linguists of 16 values is converted to the level of achievement in the range of $13{,}62 < X \leq 16{,}86$. This means that the language in the module gets a validity value in the good classification.

After the learning module was revised in accordance with input, criticism and suggestions from experts, then the Problem Based Learning-based energy and effort module was tested at school, namely SMPN Air Satan. In the limited group trial, an open questionnaire was given regarding the practicality of using the module to 9 students. The results of the limited group trial student response questionnaire with an average of 77% then the student response is categorized as practical.

From the results of the limited group trial, the Problem Based Learning-based science module was classified as good. Furthermore, the trial was conducted in a large group where the subject was class VII.1 as many as 18 students as a research sample, who were given treatment using the Problem Based Learning-based science module. In the large group test, trials were conducted to obtain comprehensive information about the quality of the Problem Based Learning-based science module products. The results of the large group response questionnaire were fairly good with student assessments getting an average value of 87.36% categorized as very practical.

Furthermore, the increase in student learning outcomes after applying the Problem Based Learning-based Effort and Energy module can be seen from the test scores in the form of pretest and posttest scores, from the results of the N gain analysis an average value of 0.61 was obtained in the moderate category, so that there was

an increase in student learning outcomes, thus the learning module developed was good, very practical and there was an increase in student learning outcomes.

From the findings conducted by researchers that a good Problem Based Learning-based science module can help students in learning activities, because it is considered something important in supporting student learning success, so that it can improve the learning outcomes of students in class VII.1 SMPN Air Satan. This is in accordance with research conducted by (Imamora et al., 2020) which states that the physics module based on the SETS approach has met the criteria very valid with a percentage of 92%. In addition, the SETS-based physics module has met very practical criteria with the results of the percentage of teacher and student response questionnaires respectively 93%, and 90.56%. In addition, this SETS-based physics module has also met the effective criteria with the acquisition of N-gain value of 0.76 (effective).

Conclusion

From the research conducted, it can be concluded that: 1) This research design uses the 4D (Four-D) design where the application is only up to the 3D stage, the defining stage (define), the design stage (design), and the development stage (develop); 2) The results of the three validators of the learning module were classified as good and met the criteria with an average of 26, during the limited group trial obtained 77% with practical criteria, and the large group obtained 87.36% with a very practical category. The increase in student learning outcomes was 0.61 with a moderate category. Thus the learning module developed is good, very practical and there is an increase in student learning outcomes. Overall, this study supports the importance of developing and using systematically tested learning modules as part of learning innovation to improve the quality of education.

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Conflicts of Interest
The researchers in this study were assigned by institution with the aim of improving the lecturers' resources and students from Universitas PGRI Silampari, Indonesia.

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