DEVELOPMENT OF TEACHING MODULE PROBLEM-BASED LEARNING MODEL TO IMPROVE LEARNING OUTCOMES OF ELEMENTARY SCHOOL IPAS IN JEMBER

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ABSTRACT
This research aims to develop Teaching Modules based on Problem-Based Learning (PBL) that can improve the learning outcomes of elementary school students in learning Natural and Social Sciences (IPAS). The background of this research is based on the low learning outcomes of elementary school students, as shown in literacy studies such as PISA and interviews with teachers. The method used is Research and Development (R&D) with the Plomp model, which includes five stages: analysis, design, development, implementation, and evaluation. The research involved 104 fourth grade students from SDN Yosorati 03, SDN Rowotengah 01, and SDN Rowotengah 02. The research instruments included validation sheets, teacher response questionnaires, and pretest-posttest questions to measure the validity, practicality, and effectiveness of the module. The results showed that this PBL-based Teaching Module was declared valid with an average score of 92% from three validators. In addition, the effectiveness of the module was assessed to be in the medium category with an average N-gain score of 0.69. This research provides an important contribution in the development of more effective teaching materials to improve students' thinking skills in IPAS learning, which is very relevant to the demands of the 21st century.
Keywords: *Learning Outcomes, Problem Based Learning, teaching Modul*

INTRODUCTION

Natural and Social Sciences, also known as science, refers to knowledge that is logically and systematically organized based on human experience and observation of the natural environment through the scientific process. This scientific process involves a series of steps starting with observation, investigation, hypothesis formulation, and testing of ideas. An understanding of science is very important because it is the foundation in developing a systematic and critical way of thinking about natural phenomena. In the context of education, IPAS plays an important role in training high-level reasoning skills, known as Learning Outcomes. According to Saido , science education aims to help students develop the ability to think reflectively, reason critically, and be skilled in solving problems through the scientific method. Thus, this ability is very relevant to face challenges in real life.

The concept of Learning Outcomes, as proposed by Ennis, is defined as the ability to reason reflectively and critically with the aim of making correct decisions on things believed or done. also emphasizes the importance of thinking responsibly, so that decisions made become more appropriate and accountable. In this case, IPAS education is expected to train students to

think rationally in solving problems, as well as develop skills to make reflective and logical decisions.

To achieve this goal, teaching modules become an important tool in the learning process. Teaching modules are learning materials that are systematically designed and include various important components such as learning objectives, materials, methods, and evaluation. This module aims to assist teachers and students in the learning process, both independently and with guidance. With the teaching module, it is expected that students can achieve certain competencies in the curriculum, including critical thinking and reasoning skills which are the main objectives of science education.

However, although science education in Indonesia aims to develop higher-order thinking skills, various studies show that the ability of Indonesian students in the field of IPAS is still relatively low. Based on the TIMSS 2015 survey results, Indonesia ranked 44th out of 47 participating countries with an average score of 397 . This confirms that the ability of students in science is still far from satisfactory. In addition, the 2018 PISA survey also showed similar results, where Indonesia ranked 70th out of 78 countries in the science literacy category, with a score of 396, far below the global average of 500.

This data illustrates a fundamental problem in the development of critical reasoning abilities and scientific skills among Indonesian students. The large number of studies focusing on the development of Learning Outcomes at the primary school level indicates that science education has not been fully effective in building high-level reasoning skills. This calls for reform in the approach to science education, with a stronger emphasis on the use of appropriate scientific methods, as well as the development of teaching modules that are more effective in facilitating critical and reflective reasoning skills. Thus, IPAS education in Indonesia should focus not only on improving knowledge, but also on developing thinking skills that will help students solve real-life problems rationally and responsibly.

Based on interviews with several teachers in the field, such as those at SDN Yosorati 03 and SDN Rowotengah 01 in Sumberbaru sub-district, it appears that the development of Teaching Modules at the fourth grade level has not been optimal. Despite efforts to develop such modules, there are still many shortcomings in terms of implementation and achievement of the expected learning objectives. Teachers admit that they find it difficult to train and improve students' Higher Order Thinking Skills (HOTS) through the development of Teaching Modules that suit their learning needs. One of the main challenges faced is the limited learning models applied and the reliance on third-party published Teaching Modules that are not necessarily in accordance with the specific context and competencies in each school.

The Teaching Modules used in these schools are often not the result of teachers' own development, but products published by external parties, so they do not support the learning needs of students. In terms of material, the Teaching Modules do not provide adequate learning experiences, especially in terms of encouraging students to learn independently. The knowledge presented in the Teaching Module is limited to the available text, without providing space for learners to dig deeper or think critically. In addition, the physical appearance of the Teaching Module is also unattractive, with opaque paper and monotonous black and white illustrations, so that learners' interest in reading decreases. This limitation in appearance is exacerbated by the types of questions that focus a lot on multiple choice and short descriptions, which are less effective in training students' reasoning skills.

As a result of using Teaching Modules that are less interesting and less supportive of the development of critical thinking skills, learners get little benefit. They are not sufficiently trained to deal with problems that require high-level reasoning skills. In fact, HOTS skills are very important to face challenges in science learning and daily life. Therefore, it is necessary to find alternative learning approaches that can be more effective in training and improving students' HOTS.

One solution that can be considered is the utilization of problem-based learning (PBL) approach in the development of Teaching Modules. This approach offers opportunities for learners to be actively involved in the learning process through solving real problems. Thus, PBL can encourage learners to think critically, perform reasoning, and develop deeper analysis skills. PBL-based Teaching Modules will provide opportunities for learners to not only understand the material theoretically, but also apply it in a real context, so that they can improve their learning outcomes and reasoning skills. The implementation of this approach can be one of the important steps to improve the quality of education in schools, especially in an effort to develop high-level thinking skills that are needed in this modern era.

Based on various studies, the development of Teaching Modules based on Problem-Based Learning (PBL) has proven effective in improving students' critical reasoning skills and learning outcomes. found that the use of PBL Teaching Modules supported by interactive videos assisted by Google Site was able to stimulate students' critical thinking skills. This finding is reinforced by which shows a significant increase in the ability of students' learning outcomes when using PBL-based Teaching Modules, with high improvement criteria. also found that the application of PBL Teaching Modules produced an N-gain of 0.47, which was categorized as effective in improving learning outcomes.

The PBL approach not only improves learning outcomes, but also develops an active, critical, and independent attitude in students. found that the application of the PBL model with the help of web-based Wordwall media succeeded in making students more active, think critically, and independently. In addition, emphasized that the PBL-based mind map strategy is also very effective in developing Teaching Modules in mathematics learning in elementary schools, showing the broad potential of this approach in various subjects.

The effectiveness of PBL in improving learning outcomes is also supported by the study of , which showed an N-gain of 0.758, indicating that this approach is very effective. Another study by showed that the use of Google Classroom in the development of PBL-based Teaching Modules had a significant positive effect on students' learning outcomes. also reported an increase in learning outcomes with moderate criteria when using Android-based Teaching Modules with the PBL model.

Research by confirmed that the development of PBL-based Teaching Modules is not only valid and effective, but also practical as teaching materials used in the learning process. This module is able to train students' critical thinking skills, as well as improve their understanding of the material in a more in-depth and applicable way. With all these findings, it is clear that PBL is one of the most effective approaches in developing Teaching Modules, especially in encouraging learners to be more critical, independent, and ready to face various challenges in learning and daily life.

METHODS

This research is a development research known as Research and Development (R&D). This method is used to create products and measure their effectiveness . The purpose of using this R&D method is to produce Teaching Modules that can improve student learning outcomes. The development model used is ADDIE, which includes five stages: Analysis, Design, Development, Implementation, and Evaluation. This research involved three teachers, three principals, and all fourth grade students from three elementary schools, namely SDN Yosorati 03, SDN Rowotengah 01, and SDN Rowotengah 02, with a total research sample of 104 students.

The first stage in this research is needs analysis, where interviews with teachers and students are conducted to identify problems and needs that can be addressed through the development of Teaching Modules. In addition, curriculum analysis was conducted to determine learning materials based on Core Competencies, Basic Competencies, and learning objectives. In the design stage, researchers developed Problem-Based Learning (PBL)-based

Teaching Modules with input from supervisors, which were designed to support learning objectives and facilitate learning activities.

The development stage involved expert validation of the syllabus, pretest-posttest questions, and Teaching Module by three validators: material experts, media experts, and education experts. After validation, revisions were made to improve the Teaching Module prototype. The implementation stage began with a limited test at SDN Rowotengah 02, followed by a broad test at SDN Yosorati 03 and SDN Rowotengah 01. The results of these two tests were used to improve the product. In the evaluation stage, the feasibility of the product is assessed based on the results of the field test, which finally produces the final Teaching Module that is ready to be used in learning.

RESULTS AND DISCUSSION

Results

1. *Analysis Stage*

Based on the results of interviews with several resource persons as well as literature studies and observations in two elementary schools in Gugus 2, Sumberbaru sub-district, several main problems in learning were found. First, student learning outcomes are not optimal and difficult to improve during the learning process. Second, teachers do not utilize various relevant sources of information to support learning. In addition, there is no Teaching Module specifically designed to help improve student understanding. Therefore, it is necessary to develop Teaching Modules based on Problem-Based Learning (PBL) which are expected to help improve students' ability to learn more effectively.

Regarding the curriculum and materials, schools in Sumberbaru Sub-district implement the Merdeka Curriculum. The government authorizes each education unit to develop the curriculum according to the needs and conditions in the field. This flexibility opens up opportunities to create Teaching Modules that are more in line with the needs of students and teachers in the school.

2. *Design Stage*

Teaching Modules are prepared as a guide for teachers in organizing teaching and learning activities. Therefore, the planning of the Teaching Module must be in line with Problem-Based Learning (PBL) based learning activities. In this case, the Teaching Module design refers to the school syllabus and learning steps are arranged based on PBL syntax, which emphasizes learning through problem solving.

At the design stage, the initial design of the PBL-based Teaching Module was prepared based on the results of the needs analysis. The first step in this design is to find relevant references as a guide, both for the material and in the preparation of tests. This reference becomes the basis in designing the Teaching Module to match the learning objectives to be achieved. The second step is to compile a test that serves as a measuring tool for student competency achievement, where this test must be aligned with existing learning indicators.

The third step in the design stage is to create a draft or prototype of the PBL-based Teaching Module in document format. This draft includes several important parts. The cover page contains the title of the Teaching Module in accordance with the learning material, namely the reproduction of living things, as well as the identity of the author and supervisor. In addition, there is an introduction and instructions for using the Teaching

Module which contains guidelines to make its use easier. Furthermore, there are Basic Competencies to be achieved and introductory material that helps students understand the material to be learned. An activity sheet organized following the PBL syntax is also included, with three activities designed to train students' thinking skills in solving problems

3. Development Stage

At the development stage, several instruments were developed to support the validation and assessment of the effectiveness of the Teaching Module. The instruments made include: Teaching Module validation sheet, educator response questionnaire sheet, pretest-posttest questions for students, and pretest-posttest question validation sheet. This validation sheet plays an important role in ensuring the quality and feasibility of the product developed before use. The more valid the product is, the higher the quality and feasible to be applied in research.

a. Teaching Module Validation Sheet: This instrument was used to assess the feasibility of the Teaching Module when the research was conducted. The validation sheet includes five main aspects, namely the format, purpose, content, time, and language of the Teaching Module. The assessment of these five aspects aims to ensure that the Teaching Module can be used effectively in learning.
b. Teaching Module Validation Sheet (Details): Before the Teaching Module is used in research, its feasibility must be assessed first. This validation sheet focuses on three main components: the content or material, the way of presentation, and the language of the Teaching Module. These components determine how well the Teaching Module conveys the material to the learners.
c. Educator Response Questionnaire Sheet: This instrument was used to collect data regarding the practicality of the Teaching Module from the perspective of educators. Educators' responses to the Teaching Module were assessed through three main aspects, namely the content, presentation, and language of the Teaching Module. This instrument helps assess the extent to which the Teaching Module facilitates educators in teaching.
d. Learner Pretest-Posttest Problem: The pretest-posttest question serves as an instrument to assess the effectiveness of the Teaching Module. This question consists of ten questions designed to measure the achievement of learning objectives in accordance with the Teaching Module indicators based on the Ennis version.
e. Pretest-Posttest Question Validation Sheet: This instrument is used to assess the feasibility of the pretest-posttest questions. This validation sheet includes several aspects, such as question material, question construction, language, scoring rubric, and question time allocation. This validation ensures that the pretest-posttest questions can be used properly to accurately evaluate students' abilities.

The following researchers will describe the validation results of 3 validators including material, media and language validators

Tabel 2. Result of material expert

ASPECT	Indicator	Score	Smt	VALPRO (%)
Content and Material	Puposes	12	12	100
	Material	33	36	91,67
	Text	15	16	93,75
Total Score		**60**	**64**	**93,75**
Presentation	Presentation technique	18	20	90
	Supporting technique	11	12	91,67
Todal Score		**29**	**32**	**90,63**
Score		**89**	**96**	
Final Score				**92,71**

Based on the data in table 2, the material expert validator gave a real score of 89 out of a maximum score of 96 if converted to 92.71% and rounded up to 93%. Based on the assessment of the material expert validator after being converted and entered into the validity criteria scale that the author refers to, the Teaching Module is classified in the "good / appropriate" category.

The validation of the Teaching Module by media experts validated seven including: the size of the Teaching Module, layout, content illustration, didactic requirements, construction requirements, technical / design requirements which include writing, images, coloring, appearance, Teaching Module, and interaction aspects of the Teaching Module. A summary of the results of validation by media experts on the Teaching Module is shown below:

Tabel 3. The Result of Media Expert

Indicator	Srt	Smt	VALPRO (%)
Teaching Module Size	4	4	100
Teaching Module Layout	7	8	87,5
Illustration of Teaching Module Content	4	4	100
Didactic Requirements	14	16	87,5
Construction Requirements	11	12	91,67
Technical Requirements / Teaching Module Design	29	32	90,63
Teaching Module Interaction	15	16	93,75
MEDIA EXPERT VALIDATION RESULTS	**84**	**92**	**91,3**

Based on table 3, the media expert validator gave a score of 84 out of 92 maximum scores that could be achieved, if converted to 91.3% and rounded up to 91%. This value according to the criteria scale is classified in the "good or feasible" category.

The validation of the Teaching Module by linguists validates five aspects, namely: aspects of language straightforwardness, the use of interactive dialogical language, in accordance with the development of students, in accordance with language rules, using terms, icons or symbols. The results of validation by linguists on the Teaching Module are presented below:

Table 4. Result of Linguist Expert

Indicator	Srt	Smt	VALPRO (%)
Directness	11	12	91,67
Use of interactive dialogical language	7	8	87,5
Appropriateness to learner development	7	8	87,5
Conformity with language rules	8	8	100
Use of icon or symbol terms	7	8	87,5
LINGUIST VALIDATION RESULTS	**40**	**44**	**90,91**

Based on table 4.7, the linguist validator gave a score of 40 out of 44 maximum scores and if converted to 90.91% and rounded up to 91%. This value in the validation criteria scale is in the good or feasible category.

4. Implementation Stage

At this stage, the development product is applied to students through learning activities. This application process is carried out in two stages of field try out, namely limited test and broad test, to evaluate the effectiveness of the Teaching Module developed.

The limited test was conducted on fourth grade students of SDN Rowotengah 02, Sumberbaru District, Jember Regency. This test was carried out starting on March 11, 2023 by involving 30 students as test subjects. During the limited test, the researcher was accompanied by three observers who were tasked with observing and assessing the implementation of learning using the Teaching Module. At the end of the meeting, the teachers involved were also asked to provide feedback regarding the use of the Teaching Module in the learning process.

In this limited test, data collection was carried out through pretest and posttest to measure the improvement of student learning outcomes. In addition, other data collected included an assessment of the implementation of the Teaching Module in learning as well as educators' and students' responses to its use. The pretest and posttest scores obtained from students were then processed and analyzed to see the effectiveness of the Teaching Module in improving learning outcomes. Data in the form of pretest and posttest scores were processed and then analyzed and the results are shown in the following table:

Table 5. The result of N-Gain Teaching Modules at SDN Rowotengah 02

Analisis	**Elementary clarification**		**Basic Support**		**Inference**		**Advanced clarification**		**Strategy and tactics**		**Modul Ajar**	
	Pretes	*Postes*	*Pretes*	*Postes*	*Pretes*	*Postes*	*Pretes*	*Postes*	*Pretes*	*Postes*	*Pretes*	*Postes*
Min	0,0	62,5	12,5	37,5	0,0	25	0,0	62,5	0,0	25	10,0	52,5
Maks	87,5	100	87,5	100	37,5	100	87,5	100	25,0	87,5	55,0	95
Average	39,2	86,3	49,2	82,9	9,17	69,2	24,6	89,2	7,5	61,7	25,9	77,8
N-gain	0,77		0,66		0,66		0,86		0,59		0,70	

Category	High	Medium	Medium	High	Medium	High

Based on the table, the N-gain of the Teaching Module indicators ranges from 0.59 to 0.86. If the value of the Teaching Module indicators is converted, strategy and tactic, inference, and basic support are in the medium category. Elementary clarification and advanced clarification are in the high category. The average N-Gain of the Teaching Module is 0.70 and after converting the criteria into a high category, this means that the effectiveness of using this PBL-based Teaching Module is in the high category.The value of the implementation of the Teaching Module in learning, the value of the educator's response to the use of the Teaching Module and the results of student interviews are used to determine the practicality of the Teaching Module.

The broad test was conducted on March 16, 2023. The broad trial was conducted at SDN Yosorati 03 and SDN Rowotengah 01, Sumberbaru District, Jember Regency. The broad test subjects at SDN Yosorati 03 involved 42 children and at SDN Rowotengah 01 as many as 32 children. The implementation of the broad test at each institution was carried out three times a meeting.

Data from the broad test at Yosorati 03 State Elementary School and Rowotengah 01 State Elementary School. Rowotengah 01 Kec. Sumberbaru Kab.Jember in the form of pretest-posttest data, the results of the implementation of the Teaching Module in learning, the results of teacher responses and student responses to the use of Teaching Modules. Data from the results of the extensive test carried out are presented as follows:

Table 6. Results of N-Gain Analysis of Teaching Modules at SDN Yosorati 03

Analisis	**Elementary clarification**		**Basic Support**		**Inference**		**Advanced clarification**		**Strategy and tactics**		**Modul Ajar**	
	Pretes	*Postes*	*Pretes*	*Postes*	*Pretes*	*Postes*	*Pretes*	*Postes*	*Pretes*	*Postes*	*Pretes*	*Postes*
Min	0	37,5	25	37,5	0	25,0	0	37,5	0	25,0	5	52,5
Maks	100	100	100	100	75,0	100	87,5	100	37,5	100	72,5	100
Average	58,6	83,3	65,8	88,1	13,4	61,6	23,8	85,1	8,6	64,3	34,0	76,5
N-gain	**0,60**		**0,65**		**0,56**		**0,80**		**0,61**		**0,64**	
Category	Medium		Mediium		Medium		High		Medium		Medium	

Based on the data above, the N-gain of the Teaching Module indicators ranges from 0.56 to 0.80. The value is converted into a scale of criteria then elementary clarification, basic support, inference, and strategy and tactic, into the medium category. advanced clarification is in the high category.

Overall, the Teaching Module N-Gain value obtained was 0.64. This value is converted into a criterion scale into a medium category, this means that the effectiveness of using PBL-based Teaching Modules at SDN Yosorati 03 is in the medium category.

Table 7. N-Gain Analysis Results of Teaching Modules at SDN Rowotengah 01

Analisis	Elementary clarification		Basic Support		Inference		Advanced clarification		Strategy and tactics		Modul Ajar	
	Pretes	*Postes*	*Pretes*	*Postes*	*Pretes*	*Postes*	*Pretes*	*Postes*	*Pretes*	*Postes*	*Pretes*	*Postes*
Min	0,0	25,0	0,0	37,5	0,0	12,5	0,0	37,5	0,0	25,0	5,0	40,0
Maks	87,5	100,0	62,5	100,0	75,0	100,0	37,5	100,0	12,5	100,0	40,0	100,0
Average	55,5	85,2	19,9	83,6	23,0	64,8	5,9	83,6	0,4	72,7	20,9	78,0
N-gain	**0,67**		**0,80**		**0,54**		**0,83**		**0,73**		**0,72**	
Category	Medium		High		Medium		High		High		High	

Based on the data above, the Teaching Module indicator N-Gain value is in the range between 0.54 to 0.83. The value is converted into a scale of criteria then elementary clarification and inference into the medium category. Basic support, advanced clarification and strategy and tactic are categorized as high. Overall the Teaching Module N-Gain value obtained was 0.72. The value is converted into a scale of criteria into a high category, thus the effectiveness of using PBL-based Teaching Modules at Rowotengah 01 State Elementary School is in the high category.

Discussion

This study aims to develop a teaching module based on Problem-Based Learning (PBL) that can improve student learning outcomes in elementary schools in Sumberbaru District. Based on the results of the needs analysis, several main problems were found in the learning process, such as low student learning outcomes and the lack of variety of information sources used by teachers. This research is in line with several previous studies that also highlight the importance of using innovative learning approaches such as PBL in improving students' understanding and involvement in the learning process.

The teaching modules developed refer to the Merdeka curriculum, which allows curriculum adjustments according to student needs. This adjustment allows the development of teaching modules that are more relevant to the learning context at school. In previous research, the Merdeka Curriculum has been shown to provide flexibility in the preparation of teaching modules that are more adaptive, especially in the use of PBL approaches that are effective in improving students' critical thinking skills.

At the design stage, the teaching module is structured with reference to the PBL syntax, which emphasizes learning through problem solving. This is in line with a study by , which states that PBL helps students develop analytical skills and critical thinking abilities. Preparation of competency tests relevant to learning indicators is also an important step in supporting the achievement of learning objectives.

The validation results show that the teaching module developed has been assessed as feasible by material, media, and language experts. Validation by material experts gave a score of 92.71%, which is in the category of “good/worthy.” This result is supported by other studies which show that PBL-based modules generally have a high level of validity because they are able to facilitate students' understanding of learning materials.

From the media aspect, the validation results showed a score of 91.3%, which is also included in the “feasible” category. Previous research by revealed that well-designed media play an important role in facilitating interaction between students and learning materials, especially in the context of PBL.

Meanwhile, validation from linguists showed a result of 90.91%, which supports that this module uses language that is developmentally appropriate and easy to understand. This is in line with the findings of which shows the importance of using appropriate language in learning modules so that students can more easily understand the material presented.

The implementation stage of the teaching module showed positive results. Based on the limited and extensive trials, the average N-gain was in the moderate to high category, indicating a significant increase in student learning outcomes after using the PBL-based module. These results are in line with previous research by , which showed that the PBL approach can effectively improve students' concept understanding and critical thinking skills.

This study successfully demonstrated that the development of PBL-based teaching modules can improve learning effectiveness and student learning outcomes, supporting the findings in previous studies which revealed that PBL is an effective learning method for improving analysis and problem-solving skills .

CONCLUSION

Based on the results of research and development of Teaching Modules based on Problem-Based Learning (PBL) to improve the learning outcomes of elementary school students on grade IV IPAS material, several things can be concluded. First, the validity test results show that the teaching module is classified as “valid,” with an average assessment from the validator reaching 92%, so this module is declared feasible for use in learning. Second, the results of the effectiveness test of the PBL-based teaching module are stated to have an effectiveness classified as “medium,” based on the limited test and the broad test with an average N-Gain value of 0.69. This shows that the PBL-based teaching module is quite effective in improving the learning outcomes of elementary school students on IPAS material.

CONFLICT OF INTEREST

A conflict of interest statement must also be included in the manuscript before the "Acknowledgements" sections and should summarize all aspects of any conflicts of interest.

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