*Asian Journal of Assessment in Teaching and Learning*
*Vol 13, Issue 1, 2023 (71-81) /eISSN* ***2821-2916***

# Development of IPAS Learning Modules Based on Problem-Based Learning on Ecosystem Material for Elementary School Students

**Endah Tri Noviani, Erik Aditia Ismaya*, Khamdun**
Faculty of Teacher Training and Education, Universitas Muria Kudus,
Central Java, Indonesia

*Corresponding author: erik.aditia@umk.ac.id

**Received:** 20 May 2023; **Revised:** 12 June 2023;
**Accepted:** 16 June 2023; **Published:** 30 June 2023

**To link to this article:** https://doi.org/10.37134/ajatel.vol13.1.9.2023

## *Abstract*

This study aimed to achieve the following objectives: (1) determine the necessity for an Independent Curriculum Science (IPAS) learning module in Sale District, Rembang Regency; (2) design a Problem-Based Learning (PBL) module for Science focused on Ecosystem Material for 5th-grade students in the same district; (3) assess the feasibility of the PBL-based IPAS learning module on Ecosystem Material for these students; and (4) evaluate the efficacy of the PBL Science module in enhancing learning outcomes for 5th-grade students in Sale District. The research employed a development approach based on Borg and Gall's methodology, with modifications to meet the project's specific needs. This included stages such as preliminary research, planning, initial product development, field trials, revisions, and final tests. Data collection utilized a combination of quantitative techniques (testing and validation) and qualitative methods (observation, interviews, questionnaires). Both qualitative and quantitative analyses were conducted. The findings indicated a significant need for the Problem-Based Learning science module. The development process involved detailed planning, execution, and evaluation phases. The module's feasibility was validated by experts, and its effectiveness was confirmed through statistical analysis, specifically a t-test using SPSS. The results demonstrated a significant difference in performance between the control and experimental groups, confirming the module's efficacy. Therefore, it was concluded that the Problem-Based Learning-based Science module is suitable for integration into the Independent Curriculum Science education for 5th-grade students.

***Keywords:*** *Modules, IPAS, Problem-Based Learning*

## INTRODUCTION

The curriculum is a planned and implemented educational program aimed at achieving educational goals. It encompasses all learning designed for individuals or groups, within or outside of school (Chiu & Chai, 2020). Ortega-Auquilla et al. (2019) defines curriculum as a comprehensive effort by schools to guide students toward predetermined learning outcomes (Guskey, 2013). According to Law No. 20 of 2003, the curriculum is a set of plans and arrangements regarding goals, content, teaching materials, and methods used as guidelines for organizing learning activities to achieve national educational goals (Wachidi et al., 2020). The curriculum serves as a reference to deliver education according to students' needs and development. Changes in Indonesia's curriculum is often driven by shifts in political, social, cultural, economic, and technological contexts (Hadiz, 2010).

Since Indonesia's independence, the curriculum has undergone several changes, culminating in the current introduction of the "Kurikulum Merdeka" (Lestari & Qamariah, 2023). The Programme for International Student Assessment (PISA) revealed that 70% of 15-year-old students lack basic reading

and math skills. PISA scores have not significantly improved over the past decade, indicating declining learning quality due to socioeconomic disparities. The COVID-19 pandemic has worsened the situation by suspending face-to-face learning, prompting the government to simplify the curriculum in emergency conditions.

The Kurikulum Merdeka was developed as a flexible framework focusing on essential content to enhance student character and competence post-COVID-19 (Anggreini & Harjono, 2020). It features three key characteristics: project-based learning to develop soft skills and align with Pancasila student profiles; emphasis on essential literacy and numeracy skills; and flexibility for differentiated, contextually relevant teaching, supported by diverse teaching materials (Dudley, 2023). To foster diverse learning, instructional materials like learning modules are employed. Modules allow independent or guided learning, enhancing education quality and achieving learning objectives. Notably, the Kurikulum Merdeka differs from the previous 2013 curriculum by maintaining separate subjects while integrating science and social studies into "IPAS." Both curricula promote student-centered, meaningful learning, allowing students to explore concepts independently (Septiyani, 2023).

To achieve meaningful learning, a suitable teaching model is required. The syntax of a teaching model should focus on each learning objective to improve student outcomes (Sari et al., 2023). A teaching model serves as a systematic framework for organizing learning experiences to achieve educational goals. The model should fulfill four criteria: operational steps, a social system, action principles, and support systems. Models that align with Kurikulum Merdeka include Problem Based Learning (PBL), Project Based Learning (PjBL), Discovery Learning, and Inquiry Learning (Khomsah & Fajrie, 2023). The Problem Based Learning model involves students in solving real-world problems using scientific methods, enhancing knowledge and problem-solving skills. Previous research, such as Krsmanovic (2021) and Mushlihuddin et al. (2018), shows the efficacy of Problem Based Learning in enhancing student learning outcomes.

Students' creative thinking abilities in science emerge when problems serve as triggers. Through problem-solving in science learning, students learn to think creatively. To train creative thinking skills, students need problems to solve (Setyawati et al., 2020). Practicing critical thinking helps students differentiate between good and bad information, make decisions, and take responsibility for the information they obtain. The advantage of using the PBL model is that it encourages open thinking, active learning, and expression of opinions, facilitating successful problem solving.

Observations and interviews at SD Negeri Jinanten and SD Negeri Joho, indicate that Kurikulum Merdeka's learning outcomes have not been maximized. Many teachers are not fully acquainted with its implementation. Daily test results reveal low scores, with many students falling below the Minimum Mastery Criteria (KKM). Teaching lacks variety and student engagement, and available teaching materials are inadequate. Thus, educators need to develop supplementary materials like learning modules to enhance learning outcomes. Based on these observations, this study aims to identify the Effectiveness of Problem Based Learning-Based IPAS Learning Modules on Ecosystem Material to Improve Learning Outcomes of Grade 5 Students in Sale District, Rembang Regency. The research question of this study is:

1) What is the need for an IPAS learning module in the Merdeka Curriculum?
2) How is the design of a PBL-based IPAS learning module for the Ecosystem topic?
3) How is the feasibility of implementing the module in grade 5?
4) How effective is the module?

## METHODOLOGY

The research was conducted at SD Negeri Jinanten and SD Negeri Joho in Sale Subdistrict, Rembang Regency. The study employed a research and development approach to create an IPAS learning module based on Problem-Based Learning (PBL) for fifth-grade students following the 10-step general design by Gall et al. (2007) as shows in Figure 1. The research design included the following development steps: introduction and initial data collection, planning, initial product development, initial field testing, main product revision, main field testing, operational product revision, operational field testing, final product revision, and dissemination and implementation. The experimental group consisted of 19 fifth-

grade students from SD Negeri Jinanten, while the control group included 15 fifth-grade students from SD Negeri Joho. The research procedures involved studying literature, conducting field observations, and gathering data.

Data collection techniques included pre-tests and post-tests, expert validation, observations, interviews with students and teachers, and questionnaires. Data analysis comprised both quantitative and qualitative techniques. Quantitative data were analyzed using descriptive analysis, while qualitative data were derived from expert validation and observations. The effectiveness of the module was assessed by analyzing the normalized gain (n-gain) of pre-test and post-test scores and comparing the results using independent sample t-tests.

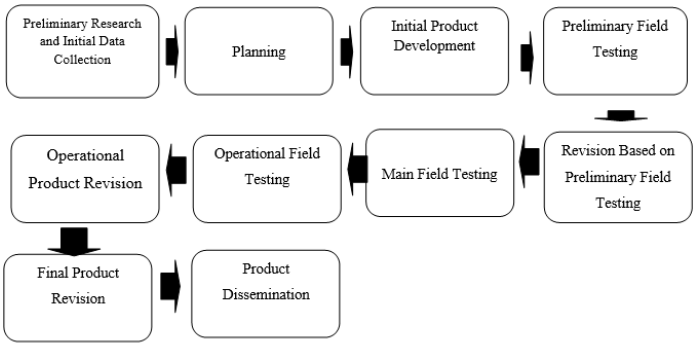



**Figure 1** The procedure steps according to Gall et al. (2007)

## FINDINGS

1. Field Trial

Following the limited trial, a comprehensive field trial was conducted at Jinanten and Joho Public Elementary Schools to evaluate the efficacy of the IPAS learning module rooted in Problem-Based Learning. Before commencing the field trial, prerequisites such as normality and homogeneity tests were administered to ensure the validity of the data. The results from these tests indicated that the data were both normally distributed and homogenous, allowing for a reliable comparison of learning outcomes. The field trial's findings demonstrated a significant improvement in students' learning outcomes, as evidenced by increased post-test scores compared to pre-test scores. The effectiveness of the IPAS module was further supported by a notable increase in student engagement and participation during the learning process. This improvement aligns with previous studies by Pramana et al. (2020), which underscore the benefits of Problem-Based Learning in enhancing educational outcomes. The positive results from the field trial suggest that the IPAS learning module is an effective tool for improving 5th-grade students' understanding of ecosystem concepts, making it a valuable addition to the Merdeka Curriculum.

2. Normality Test

Normality Test was performed to assess whether the collected data followed a normal distribution. This test was conducted using SPSS software. For the Control Group, the Shapiro-Wilk test statistic and significance levels (sig.) were utilized for the analysis, as shown in Table 1. The criteria for determining normal distribution are as follows: a significance value (sig.) greater than 0.05 indicates a normal distribution, while a significance value less than 0.05 indicates a non-normal distribution. In the Control Group, both the pretest and posttest values showed significance (sig.) values of 0.086 and 0.931, respectively, both of which are greater than 0.05, indicating a normal distribution. Similarly, for the Experimental Group, as presented in Table 2, the pretest and posttest data were subjected to the same analysis, confirming that both datasets followed a normal distribution.

**Table 1** Normality Test Results for the Control Group

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | **Statistic** | **df** | **Sig.** | **Statistic** | **df** | **Sig.** |
| Pre-test | 0.237 | 15 | 0.023 | 0.897 | 15 | 0.086 |
| Post-test | 0.131 | 15 | 0.200* | 0.976 | 15 | 0.931 |
| *. This is a lower bound of the true significance. | | | | | | |
| a. Lilliefors Significance Correction | | | | | | |

The sig. values for the Shapiro-Wilk test were 0.138 for the pretest and 0.952 for the posttest, both exceeding the 0.05 threshold, thereby suggesting normal distribution for the pretest and posttest scores in the Experimental Group as well.

**Table 2** Normality test results for the experimental group

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | **Statistic** | **df** | **Sig.** | **Statistic** | **df** | **Sig.** |
| Pre-test | 0.179 | 19 | 0.109 | 0.925 | 19 | 0.138 |
| Post-test | 0.104 | 19 | 0.200* | 0.981 | 19 | 0.952 |
| *. This is a lower bound of the true significance. | | | | | | |
| a. Lilliefors Significance Correction | | | | | | |

3. Homogeneity Test

The Homogeneity Test was conducted to determine whether there were differences in variance between the control and experimental groups. This test was executed using SPSS software. For the Control Group, the Levene statistic, degrees of freedom (df1 and df2), and the significance level (sig.) were examined. The criterion for determining homogeneity of variance is as follows: if the significance level (sig.) is greater than 0.05, the variance is considered homogenous; if the significance level is less than 0.05, the variance is considered non-homogenous. Based on Table 3, the Levene statistic's significance (sig.) value is 0.872, which is greater than 0.05. This indicates that the data in the control group exhibits homogenous variance.

**Table 3** Homogeneity test results for the control group

| Score | | | |
|---|---|---|---|
| **Levene Statistic** | **df1** | **df2** | **Sig.** |
| 0.027 | 1 | 28 | 0.872 |

Similarly, for the Experimental Group, as presented in Table 4, the Levene statistic, degrees of freedom (df1 and df2), and significance (sig.) value were analyzed to assess the homogeneity of variance. The significance (sig.) value for the Levene statistic was found to be 0.303, which exceeds the 0.05 threshold. As a result, it can be concluded that the data in the experimental group also exhibits homogenous variance.

**Table 4** Homogeneity test results for the experimental group

| Scores | | | |
|---|---|---|---|
| **Levene Statistic** | **df1** | **df2** | **Sig.** |
| 1.092 | 1 | 36 | 0.303 |

4. N-Gain Score Test

The N-Gain Score Test aimed to evaluate the improvement in learning outcomes before and after instructional activities. Utilizing SPSS software, the test presented pretest and posttest scores, the difference between these scores, the gap between 100 and the pretest scores, the N-Gain Score, and the N-Gain Percentage for participants in both the Control and Experimental Groups. The Control Group

exhibited an average N-Gain Score of 30.77%, categorized as "Not Effective," with individual N-Gain Scores ranging from 8.82% to 56.52%. Conversely, the Experimental Group displayed an average N-Gain Score of 68.14%, labeled "Moderately Effective," with individual N-Gain Scores ranging from 25.93% to 100%. These results indicate that the Experimental Group experienced a more substantial improvement in learning outcomes compared to the Control Group. Table 5 shows the N-gain score test results.

**Table 5.** N-Gain score test results

| Group | Pretest | Posttest | Post-Pre | 100-Pre | N-Gain Score | N-Gain Percentage |
|---|---|---|---|---|---|---|
| 1 | 50 | 74 | 24 | 50 | 0.48 | 48.00 |
| 1 | 52 | 60 | 8 | 48 | 0.17 | 16.67 |
| 1 | 56 | 77 | 21 | 44 | 0.48 | 47.73 |
| 1 | 64 | 76 | 12 | 36 | 0.33 | 33.33 |
| 1 | 56 | 72 | 16 | 44 | 0.36 | 36.36 |
| 1 | 55 | 70 | 15 | 45 | 0.33 | 33.33 |
| 1 | 60 | 72 | 12 | 40 | 0.30 | 30.00 |
| 1 | 54 | 72 | 18 | 46 | 0.39 | 39.13 |
| 1 | 65 | 65 | 0 | 35 | 0.00 | 00.00 |
| 1 | 55 | 69 | 14 | 45 | 0.31 | 31.11 |
| 1 | 54 | 73 | 19 | 46 | 0.41 | 41.30 |
| 1 | 53 | 66 | 13 | 47 | 0.28 | 27.66 |
| 1 | 54 | 80 | 26 | 46 | 0.57 | 56.52 |
| 1 | 59 | 71 | 12 | 41 | 0.29 | 29.27 |
| 1 | 63 | 66 | 3 | 34 | 0.90 | 80.82 |
| 2 | 74 | 86 | 12 | 26 | 0.46 | 46.15 |
| 2 | 69 | 91 | 22 | 31 | 0.71 | 70.97 |
| 2 | 78 | 89 | 11 | 22 | 0.50 | 50.00 |
| 2 | 60 | 83 | 23 | 40 | 0.58 | 57.50 |
| 2 | 74 | 92 | 18 | 26 | 0.69 | 69.23 |
| 2 | 77 | 88 | 11 | 23 | 0.48 | 47.83 |
| 2 | 66 | 94 | 28 | 34 | 0.82 | 82.35 |
| 2 | 78 | 100 | 22 | 22 | 1.00 | 100.0 |
| 2 | 73 | 80 | 7 | 27 | 0.26 | 25.93 |
| 2 | 76 | 92 | 16 | 24 | 0.67 | 66.67 |
| 2 | 65 | 96 | 31 | 35 | 0.89 | 88.57 |
| 2 | 74 | 85 | 11 | 26 | 0.42 | 42.31 |
| 2 | 62 | 89 | 27 | 38 | 0.71 | 71.05 |
| 2 | 69 | 98 | 29 | 31 | 0.94 | 93.55 |
| 2 | 75 | 92 | 17 | 25 | 0.68 | 68.00 |
| 2 | 70 | 96 | 26 | 30 | 0.87 | 86.67 |
| 2 | 77 | 96 | 19 | 23 | 0.83 | 82.61 |
| 2 | 63 | 91 | 28 | 37 | 0.76 | 75.68 |
| 2 | 67 | 90 | 23 | 33 | 0.70 | 69.70 |

Note: Group 1 = Control Group; Group 2 = Experimental Group

5. N-Gain Score T-Test

The N-Gain Score T-Test was conducted to compare mean scores betweesn the control and experimental groups. The criterion for determining normal distribution is if the significance (sig.) value is greater than 0.05, the data is considered normally distributed; if the sig. value is less than 0.05, the data is not normally distributed. Based on Table 6, the sig. value for the Shapiro-Wilk test is 0.137 for the N-Gain score in the control group and 0.779 for the N-Gain score in the experimental group. Therefore, it can be concluded that the N-Gain scores in both the control and experimental groups are normally distributed, as the sig. values are greater than 0.05.

**Table 6.** N-Gain normality test results

| | Group | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|---|
| | | Statistic | df | Sig. | Statistic | df | Sig. |
| NGain_Percentage | Control Class | 0.229 | 15 | 0.034 | 0.910 | 15 | 0.137 |
| | Experimental Group | 0.154 | 19 | 0.200* | 0.970 | 19 | 0.779 |

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

6. T-Test

Based on this perspective, it can be concluded that the t-test is employed to examine the differences between two groups, namely the control group and the experimental group. The hypotheses are as follows:

Ho: There is no significant difference in scores between the control and experimental groups.
Ha: There is a significant difference in scores between the control and experimental groups.

Table 7 displays the t-test results, including Levene's test for equality of variances and the t-test for equality of means, under the assumptions of equal variances assumed and equal variances not assumed. The significance criterion for the t-test in this study is to reject Ho when the significance value is less than 0.05. According to the table, the obtained significance value is 0.000, and the t-value is -5.863. Since 0.000 is less than 0.05, Ho is rejected, leading to the conclusion that there is a significant difference between the control group and the experimental group. These analyses were conducted using SPSS Version 23. It can be concluding the findings substantiate the effectiveness of the IPAS learning module for 5th-grade students, employing a Problem-Based Learning approach. The module demonstrated promising potential in enhancing learning outcomes, as indicated by increased N-Gain scores and statistically significant differences between the control and experimental classes.

**Table 7** Independent sample t-test results

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | 95% Confidence Interval of the Difference | |
| | | | | | | | | | Lower | Upper |
| NGain_Persen | Equal variances assumed | 0.472 | 0.497 | -5.863 | 32 | 0.000 | -37.37177 | 6.37412 | -50.35543 | -24.38810 |
| | Equal variances not assumed | | | -5.940 | 31.416 | 0.000 | -37.37177 | 6.29154 | -50.19656 | -24.54698 |

## DISCUSSION

1. Analysis of IPAS Learning Module Needs Based on Problem Based Learning

The study identified a critical need for supplementary teaching resources to enhance teacher-led education at SD Negeri Jinanten and SD Negeri Joho, promoting interactive and student-centered learning environments. Therefore, the research introduced an IPAS module utilizing Problem-Based Learning (PBL) for 5th graders, offering an alternative approach for both educators and students to

foster dynamic and engaging learning experiences. Initial findings revealed that teachers had a limited understanding of the Merdeka Curriculum's application in IPAS education, leading to inadequate teaching strategies. The demand for an IPAS PBL-based module arose due to the scarcity of materials and over-reliance on government textbooks, which resulted in passive learning and diminished student enthusiasm. The lack of engaging tools and minimal use of technology further exacerbated these challenges in IPAS education. The introduction of the IPAS PBL-based module aimed to address these issues by facilitating individual and group-based learning while supporting teachers. This aligns with previous research by Phasa (2020), Widayanti and Nur'aini (2020) and Palobo et al. (2018), which emphasized the effectiveness of problem-based learning models in promoting independent and active group learning.

The introduction of an IPAS module based on Problem-Based Learning (PBL) received positive feedback from both educators and students. Observations and interviews indicated that students found the IPAS subject challenging due to its theoretical nature, lack of engaging materials, and minimal technological integration. The proposed IPAS module, grounded in PBL and enhanced with internet-based technology, aims to rejuvenate the learning process, reflecting Sammel's view of knowledge as a dynamic and ongoing effort to uncover truths and apply them to life.

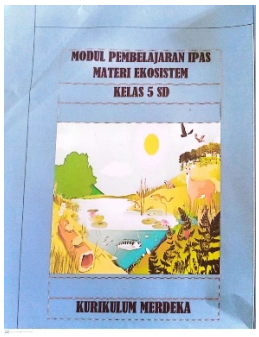
2. Design of IPAS Learning Module Based on Problem Based Learning

The design process for developing an IPAS learning module based on Problem-Based Learning (PBL) encompasses three stages: planning, implementation, and evaluation. In the planning phase, the researcher conducts an analysis of Learning Outcomes (LO), Learning Objectives (LO), Learning Objective Flow (LOF), and subject matter, culminating in the creation of a teaching module plan (RPP). The implementation stage involves the actual creation of the module, including both its design and content compilation. Following the creation of the module, expert validation is carried out to refine the module by incorporating feedback and suggestions from validators. The final step in the design process is the evaluation phase, which assesses the module's effectiveness. This three-stage design process ensures the thorough development and enhancement of the IPAS PBL-based learning module.

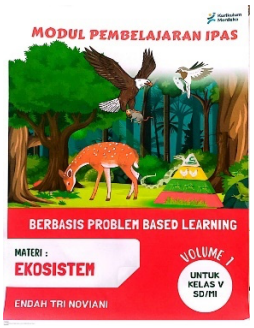
The design and development of the IPAS module focused on the ecosystem topic for 5th-grade students. This module addresses the identified challenges in IPAS education, incorporating interactive and engaging materials to foster student interest and understanding. Expert validation confirmed the module's feasibility, with high ratings for content accuracy, instructional design, and overall appeal. Upon completion of revisions, the IPAS Learning Module based on PBL will be published by a publisher with an ISBN, ensuring official copyright protection. The design adheres to the Merdeka Curriculum, aiming to actively engage students while providing guidance for teachers. The researcher integrates creativity and technology, following Gredler's principles of real-world design testing. The development process is consistent with instructional design models like ADDIE, ensuring effective implementation. The module's content comprises various sections, with learning activities tailored to ecosystem topics. The evaluation phase includes a post-test to assess cognitive outcomes. Figure 2 shows the initial and final design of IPAS learning module based on problem-based learning.

3. Feasibility of IPAS Learning Module Based on Problem Based Learning

The validation of the IPAS learning module based on Problem-Based Learning (PBL) involved assessments from media experts, subject matter experts, language experts, and educational practitioners. The expert validation results were as follows: 89.3% from media experts (categorized as valid), 81.25% from subject matter experts (valid), 82.69% from language experts (valid), and 85% from educational practitioners (valid). Following validation, the researcher incorporated feedback from the validators to refine the learning module. Additionally, assessments were gathered from both students and teachers. Teacher evaluations scored 86%, categorizing the module as "very good." Furthermore, the overall student assessment score for the PBL-based IPAS module was 3.91, also indicating a "very good" rating. Based on the validation results from experts and practitioners, as well as feedback from students and teachers, it can be concluded that the IPAS learning module based on Problem-Based Learning, focusing on the ecosystem topic for 5th-grade students, is suitable for enhancing learning outcomes in primary education.



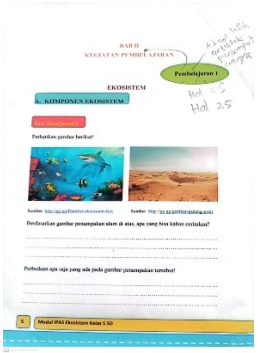

Front Cover
(Before Revision)




Front Cover
(After Revision)

Unavailable Back Page
(Before Revision)


Back Page
(After Revision)



Content
(Before Revision)


Content
(After Revision)

**Figure 2** Initial and final design of ipas learning module based on problem-based learning

## 4. Effectiveness of IPAS Learning Module Based on Problem Based Learning

Prior to conducting the research, prerequisite tests for normality and homogeneity were administered. The normality test results showed Shapiro-Wilk values of 0.086 for the pretest and 0.931 for the posttest in the control group, and 0.138 for the pretest and 0.952 for the posttest in the experimental group, indicating normally distributed data (sig. > 0.05). The homogeneity test yielded Levene's statistic values of 0.872 for the control group and 0.303 for the experimental group, signifying homogenous variances (sig. > 0.05). The effectiveness of the IPAS learning module based on Problem-Based Learning (PBL), focusing on the ecosystem topic, was assessed using a t-test between the control and experimental groups. The criterion for the t-test was that Ho would be rejected if the significance value was less than 0.05. The t-test revealed a significance value of 0.000 with a t-score of -5.863. Since 0.000 < 0.05, Ho was rejected, indicating a significant difference between the control and experimental groups.

This result demonstrates that the development of the IPAS module using PBL is effective within the Merdeka Curriculum, enhancing learning outcomes for 5th-grade students. The experimental group outperformed the control group, substantiating the module's success in improving learning outcomes. These findings corroborate research by Datreni (2022) on the efficacy of PBL-based modules for enhancing learning. Moreover, the module encourages active student participation and enthusiasm, aligning with Arends' assertion that Problem-Based Learning fosters independent exploration and boosts confidence. The module's usage promotes student engagement and motivation compared to conventional methods. These observations resonate with conclusions by Irwan and Mansurdin (2020) and Anugraheni (2018), who found that PBL cultivates student independence and active learning. Further research emphasizes PBL's ability to motivate students, incite curiosity, and create enjoyable learning experiences (Nasrul, 2018).

In the pursuit of enhancing the learning module's effectiveness, feedback from validators was incorporated, and the study progressed to limited product trials. These trials involved five 5th-grade students at Jinanten Public Elementary School. Utilizing the IPAS learning module grounded in Problem-Based Learning, students' learning outcomes were examined. Results indicated an average N-

Gain increase of 0.57, signifying a moderate level of improvement. This finding suggests that the IPAS module has the potential to elevate 5th-grade students' learning outcomes. This trend aligns with prior research by Pudjawan et al. (2020), which also highlighted the effectiveness of Problem-Based Learning modules in fostering better learning outcomes.

Effectiveness analysis demonstrated significant improvements in student learning outcomes. Quantitative data from pre-tests and post-tests were analyzed using descriptive statistics and independent sample t-tests. The results showed a significant increase in the experimental group's scores compared to the control group, indicating the module's positive impact on student performance. In conclusion, the IPAS module based on PBL is both feasible and effective for enhancing the learning outcomes of Grade 5 students in the Sale sub-district. Its development and implementation address the current shortcomings in IPAS education, offering a dynamic and engaging learning experience aligned with the Merdeka Curriculum. Table 8 shows the recapitulation of limited testing.

**Table 8** Recapitulation of limited testing

| Average Pre-test Score | Average Post-test Score | Maximum Score | N-Gain |
|---|---|---|---|
| 52.00 | 79.00 | 100 | 0.57 |

## CONCLUSION

The study revealed a strong demand for this module, identified through a needs analysis involving observations, interviews, and questionnaires with teachers and students. The Problem-Based Learning approach was highlighted as essential for enhancing IPAS education and improving learning outcomes. The module's design followed structured phases of planning, development, and evaluation. These phases included activities such as analyzing Learning Objectives (LO), designing the Flow of Learning Objectives (FLO), creating the module's content, and conducting assessments. The module underwent rigorous validation by media, subject matter, language experts, and educational practitioners, all of whom rated it as valid. The effectiveness of the module was confirmed through statistical analysis, demonstrating its positive impact on IPAS learning within the Merdeka Curriculum. The significant improvement in learning outcomes for the experimental group compared to the control group underscores the module's success in fostering a more engaging and effective learning environment. The researcher recommends that educators commit to creating engaging, student-centered learning environments. The IPAS module grounded in Problem-Based Learning proves to be a valuable resource for both educators and students. Future research should aim to enhance depth by incorporating a broader range of references, thereby improving the overall quality and applicability of research outcomes.

## ACKNOWLEDGEMENT

The author extends sincere gratitude to SDN Jinanten and SDN Joho, Rembang Regency, Indonesia, for their participation in this study. The author also wishes to express deep appreciation to the postgraduate lecturers at Muria Kudus University for their invaluable guidance and constructive analysis of the research results.

## FUNDING

The authors declare that no financial support was received for the research, authorship, and publication of this article.

## DATA AVAILABILITY STATEMENT

Data will be made available on request.

## CONFLICT OF INTEREST

The authors declare no conflict of interest.

## REFERENCES


Anggreini, G., & Harjono, N. (2020). Komparasi Model Pembelajaran Problem Based Learning dan Teams Game Tournament ditinjau dari Kemampuan Berpikir Kreatif Siswa Sekolah Dasar. *Jurnal Basicedu*, *4*(4), 985-994. https://doi.org/10.31004/basicedu.v4i4.486

Anugraheni, I. (2018). Meta Analisis Model Pembelajaran Problem Based Learning dalam Meningkatkan Keterampilan Berpikir Kritis di Sekolah Dasar. *Polyglot: Jurnal Ilmiah*, *14(1)*, 9–18. https://doi.org/http://dx.doi.org/10.19166/pji.v14i1.789

Chiu, T. K., & Chai, C. S. (2020). Sustainable curriculum planning for artificial intelligence education: A self-determination theory perspective. *Sustainability*, *12*(14), 5568. https://doi.org/https://doi.org/10.3390/su12145568

Datreni, N. L. (2022). Model Pembelajaran Problem Based Learning Meningkatkan Hasil Belajar Matematika Siswa Kelas III Sekolah Dasar. *Journal of Education Action Research*, *6(3)*, 369–375. https://doi.org/https://doi.org/10.23887/jear.v6i3.49468

Dudley, P. (2013). Teacher learning in Lesson Study: What interaction-level discourse analysis revealed about how teachers utilised imagination, tacit knowledge of teaching and fresh evidence of pupils learning, to develop practice knowledge and so enhance their pupils' learning. *Teaching and Teacher Education*, *34*, 107-121. https://doi.org/10.1016/j.tate.2013.04.006

Gall, M. D., Gall, J. P., & Borg, W. R. (2007). Educational research: an introduction (8. utg.). *AE Burvikovs, Red.) USA: Pearson*.

Guskey, T. A. (2013). Defning Student Achievement. In *International guide to student achievement* (pp. 3-6). Routledge.

Hadiz, V. (2010). *Localising power in post-authoritarian Indonesia: A Southeast Asia perspective*. Stanford University Press.

Irwan, V. P., & Mansurdin, M. (2020). Penerapan Model Problem Based Learning Dalam Peningkatan Hasil Belajar Tematik Terpadu Di Sekolah Dasar. *Jurnal Pendidikan Tambusai*, *4*(3), 2097-2107.

Khomsah, S. N., & Fajrie, N. (2023). Penggunaan Pembelajaran Contextual Teaching and Learning (CTL) pada Pembelajaran Matematika Siswa Kelas III di SDN Karangwono 01 Pati. *Journal on Education*, *5*(3), 5925-5929. https://doi.org/10.31004/joe.v5i3.1355

Krsmanovic, M. (2021). Course redesign: implementing project-based learning to improve students' self-efficacy. *Journal of the Scholarship of Teaching and Learning*, *21*(2), 93-106. https://doi.org/10.14434/josotl.v21i2.28723

Lestari, M., & Qamariah, Z. (2023). Major steps in curiculum merdeka design for learning english. *Jurnal Ilmiah Multidisiplin*, *2*(04), 96-102. https://doi.org/10.56127/jukim.v2i04.810

Mushlihuddin, R., Nurafifah, & Irvan. (2018, January). The effectiveness of problem-based learning on students' problem solving ability in vector analysis course. In *Journal of Physics: Conference Series* (Vol. 948, p. 012028). IOP Publishing. https://doi.org/10.1088/1742-6596/948/1/012028

Nasrul, S. (2018). Pengembangan bahan ajar tematik terpadu berbasis model problem based learning di kelas iv sekolah dasar. *Jurnal Inovasi Pendidikan dan Pembelajaran Sekolah Dasar*, *2*(1), 81-92.

Ortega-Auquilla, D., Fajardo-Pacheco, I., Cabrera-Vintimilla, J., & Siguenza-Garzón, P. (2019). A comprehensive overview on the fundamentals of curriculum development: understanding key interrelated theoretical aspects. *Revista Boletín Redipe*, *8*(11), 148-168. https://doi.org/10.36260/rbr.v8i11.866

Palobo, M., Sianturi, M., Marlissa, I., Purwanty, R., Dadi, O., & Saparuddin, A. (2018, October). Analysis of teachers' difficulties on developing curriculum 2013 lesson plans. In *1st International Conference on Social Sciences (ICSS 2018)* (pp. 1319-1324). Atlantis Press. https://doi.org/10.2991/icss-18.2018.278

Phasa, K. C. (2020). Meta analisis pengaruh model pembelajaran problem based learning terhadap kemampuan berpikir kritis dalam pembelajaran matematika. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, *4(2)*, 711–723. https://doi.org/https://doi.org/10.31004/cendekia.v4i2.296

Pramana, M. W. A., Jampel, I. N., & Pudjawan, K. (2020). Meningkatkan hasil belajar biologi melalui e-modul berbasis problem-based learning. *Jurnal Edutech Undiksha*, *8*(2), 17-32. https://doi.org/10.23887/jeu.v8i2.28921

Sari, I. N., Ardianti, S. D., & Khamdun, K. (2023). Pengaruh model pembelajaran problem based learning berbantuan media PSA (panggung siklus air) terhadap kemampuan berpikir kritis siswa. *Attadrib: Jurnal Pendidikan Guru Madrasah Ibtidaiyah*, *6*(2), 302–310. https://doi.org/10.54069/attadrib.v6i2.539

Septiyani, I. (2023). Teachers'challenges in implementing an independent learning curriculum in science and social studies for primary iv students. *Jurnal Cakrawala Pendas*, *9(3)*, 463–474. https://doi.org/https://doi.org/10.31949/jcp.v9i3.5118

Setyawati, D. H. L., Fakhriyah, F., & Khamdun, K. (2020). Peningkatan berpikir kritis siswa sekolah dasar dengan menerapkan model contextual teaching and learning berbantuan media lempar karet pengetahuan. *Pendas: Jurnal Ilmiah Pendidikan Dasar*, *5*(2), 130-139. https://doi.org/10.23969/jp.v5i2.3426

Wachidi, W., Rodgers, A., & Tumanov, D. Y. (2020). Professional competence understanding level of elementary school in implementing curriculum 2013. *International Journal of Educational Review*, *2*(1), 99-105. https://doi.org/https://doi.org/10.33369/ijer.v2i1.10642

Widayanti, R., & Nur'aini, K. D. (2020). Penerapan model pembelajaran problem based learning untuk meningkatkan prestasi belajar matematika dan aktivitas siswa. *Mathema: Jurnal Pendidikan Matematika*, *2(1)*, 12–23. https://doi.org/https://doi.org/10.33365/jm.v2i1.480