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Development of ZatPedia-Edu Media Based on Problem Based Learning in Grade IV Elementary School Sciences Subjects

Auryn Kirana Alfirdausi[1], Dewi Nilam Tyas[2]
Universitas Negeri Semarang
*E-mail: aurynkirana03@students.unnes.ac.id

Abstract

This study aims to develop and test the feasibility and effectiveness of the ZatPedia-Edu interactive learning media based on Problem Based Learning (PBL) in science learning for fourth grade elementary school students. The study was motivated by low student learning outcomes, limited learning media, and suboptimal use of technology in science learning. The research method used was Research and Development (R&D) with the Borg and Gall model, which included the stages of needs analysis, product design, expert validation, testing, and revision. The media was developed using Canva and arranged according to PBL syntax to support problem-based learning. The research was conducted at SDN 4 Jaraksari, Wonosobo Regency, with 27 students as subjects. The data were analyzed using descriptive statistics, a paired sample t-test, and N-Gain analysis. The results showed that the ZatPedia-Edu media was in the highly feasible category with a material expert validation percentage of 93% and a media expert validation percentage of 94%. The effectiveness test showed a significance value of 0.000 < 0.05 with an average N-Gain of 0.7175 (high category). Thus, the ZatPedia-Edu media is effective in improving student learning outcomes in fourth-grade science learning.

Keywords: Interactive Learning Media, Problem-Based Learning, IPAS, Elementary School, Learning Outcomes

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Introduction

Basic education is an important foundation in shaping the character and developing the thinking skills of students. At this level, basic education institutions play a role in equipping students with basic knowledge, attitudes, and skills as a foundation for learning at the next level (Kemendikbudristek, 2024). Therefore, learning in elementary schools needs to be designed to encourage critical thinking, cooperation, and contextual problem-solving skills.

Science and Social Studies (IPAS) learning requires students to understand concepts scientifically and contextually. However, observations in grade IV at SDN 4 Jaraksari, Wonosobo Regency, show that IPAS learning is still dominated by lecture methods, limited teaching aids, and suboptimal use of technology-based media. The questionnaire results show that 47.8% of students stated that IPAS is difficult to understand, 17.3% find it difficult to memorize, and 34.7% consider the material too theoretical. This condition has an impact on low learning outcomes, where 68% of students have not achieved the Learning Objective Achievement Criteria (KKTP) in the material on the Form of Substances and Their Changes.

With the development of technology, digital-based interactive learning media has become an alternative to improve the quality of learning. Previous studies have shown that interactive learning media can increase the motivation, activity, and learning outcomes of elementary school students (Kurniawan, 2024; Mawarni et al., 2024; Alfandi, 2024). In this study, Canva was chosen as the media development platform because it is an online graphic design application that is easy to use for beginners and provides a variety of ready-to-use templates to support the creation of attractive learning media (Kharissidqi & Firmansyah, 2022). However, some of the existing interactive media have not been integrated with a learning model that systematically trains students' problem-solving skills.

The Problem-Based Learning (PBL) model is relevant to be applied in IPAS learning because it places contextual problems as the starting point of learning and encourages students to think critically and actively seek solutions (Djamaluddin, 2019). Therefore, this study developed an interactive learning media called ZatPedia-Edu assisted by Canva based on PBL in IPAS subject for fourth grade elementary school. Canva was chosen based on its ability to present visual, interactive, and contextual learning media, and it has been proven to be feasible and effective in improving science learning outcomes in elementary schools (Zharifah & Ratnaningrum, 2025). This study aims to develop and test the feasibility and effectiveness of ZatPedia -Edu in improving student learning outcomes and is expected to become an innovative alternative in improving the quality of IPAS learning in elementary education.

Methods

The type of research used is Research and Development (R&D) with reference to the Borg and Gall development model. This method is used to produce a specific product and at the same time test the effectiveness of the developed product (Sugiyono, 2016:407). The development model used refers to Borg and Gall because it provides systematic stages that enable the refinement of learning products through a process of validation, testing, and continuous revision (Sa'adah & Wahyu, 2020). This model also provides a systematic framework for developing educational products by involving the following stages: problem exploration, product design, validation, testing, and revision (Jamaludin et al., 2024; Mardatila et al., 2021).

The development procedure consists of ten stages, namely: (1) identification of potential and problems, (2) data collection, (3) product design, (4) expert validation, (5) design revision, (6) small group testing, (7) product revision, (8) usage testing, (9) final revision, and (10) mass production. These stages are carried out systematically to produce valid, practical, and effective learning media.

The product developed is an interactive learning medium called ZatPedia-Edu, supported by Canva and integrated with Problem Based Learning (PBL) syntax. This media is designed to facilitate students in understanding Grade IV science material, particularly the topic of Substances and Their Changes, through the presentation of contextual problems, interactive visuals, and evaluation exercises that encourage critical thinking and problem-solving skills (Djamaluddin, 2019; Arends, 2012).

The research was conducted at SD Negeri 4 Jaraksari, Wonosobo Regency, Central Java, in the even semester of the 2024/2025 academic year. The research subjects consisted of 27 fourth-grade students as the effectiveness test subjects, fourth-grade teachers as supporting subjects, and two expert validators, including an IPAS material expert and a learning media expert.

Data collection techniques include tests and non-tests. Test techniques in the form of pre-tests and post-tests are used to measure improvements in learning outcomes in the cognitive domain (C1–C4) of the material on the Form of Matter and Its Changes, which includes remembering, understanding, applying, and analyzing. The test instruments have been declared valid and reliable, have a good discrimination index, and are designed with representative levels of difficulty in mind, so that they are able to accurately measure learning outcomes. Non-test techniques include interviews, observations, questionnaires, and documentation, which are used to explore learning needs, assess the suitability of media, and determine the responses of teachers and students (Sugiyono, 2016:137; Arikunto, 2018:266).

Qualitative data were analyzed descriptively to describe the initial learning conditions and media development needs. Quantitative data were analyzed using descriptive and inferential statistics. Normality tests were conducted using Shapiro–Wilk, while media effectiveness was analyzed using paired sample t-tests and N-Gain to determine improvements in student learning outcomes (Sugiyono, 2016:111; Lestari & Yudhanegara, 2017:235).

Based on the research objectives and data analysis techniques, a research hypothesis was formulated, namely that the use of ZatPedia-Edu interactive learning media based on Problem Based Learning (PBL) is not effective in improving the learning outcomes of fourth-grade students at SD Negeri 4 Jaraksari, Wonosobo (H0), and that the use of ZatPedia -Edu interactive learning media based on Problem Based Learning (PBL) is effective in improving the learning outcomes of fourth-grade students at SD Negeri 4 Jaraksari, Wonosobo (Ha). All statistical analyses were performed using SPSS version 25.

This study was conducted by upholding the principles of research ethics, including honesty, objectivity, responsibility, and protection of the rights of research subjects. The researchers obtained official permission from the school and maintained data confidentiality in accordance with academic standards (Jailani & Saidin, 2023).

Results and Discussions

1. Result

a. Media Development Design for ZatPedia-Edu

Based on the results of the analysis of learning needs and potential, it was found that IPAS learning in grade IV at SD Negeri 4 Jaraksari still faces obstacles in the form of low learning outcomes, limited teaching aids, and suboptimal use of learning technology. A total of 17 out of 25 students (68%) have not achieved the minimum competency standard of 75, so an interactive learning medium called ZatPedia-Edu based on Problem Based Learning (PBL) was developed using the Canva platform for the material on the Form of Substances and Their Changes.

The main result of this research is the interactive learning media product ZatPedia-Edu based on Problem Based Learning (PBL) developed using the Canva platform. This media is designed to support IPAS learning for fourth grade students on the subject of "The Forms of Matter and Their Changes." The interactive ZatPedia-Edu media contains several main components, including: an attractive and contextual cover page; instructions for using ZatPedia-Edu products; presentation of contextual problems as learning triggers in accordance with PBL syntax; learning materials presented visually and systematically; illustrations, images, videos, and supporting animations; worksheets, practice questions, and interactive quizzes; and a summary of the material as a conclusion.

The development of this media aims to create a more active, enjoyable, and meaningful learning experience so that students do not only receive information passively but are also involved in the problem-solving process in accordance with the characteristics of IPAS learning.



Figure 1. Cover



Figure 2. Instructions for Use



Figure 3. Main Menu



Figure 4. PBL Syntax



Figure 5. Material

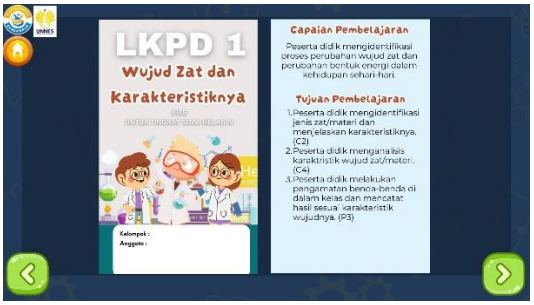


Figure 6. LKPD



Figure 7. Exercise



Figure 8. Conclusion

b. Media Feasibility Test ZatPedia-Edu

The validation of ZatPedia-Edu media was carried out by two experts, namely an IPAS material expert and a learning media expert. The validation aimed to assess the suitability of the media in terms of content, language, presentation, visual appearance, and suitability for learning objectives.

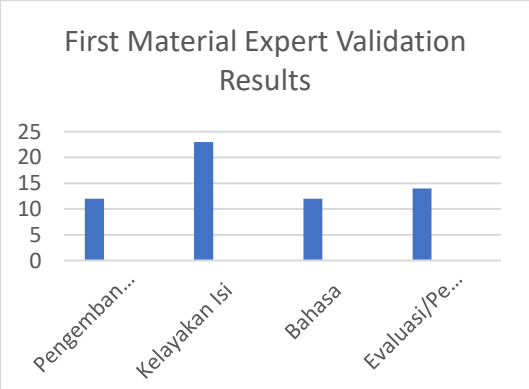


Figure 9. Results of Initial Material Expert Validation

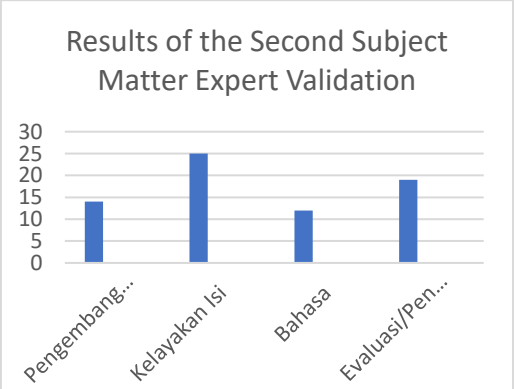


Figure 10. Results of the Second Subject Matter Expert Validation



Figure 11. Media Before Revision



Figure 12. Media After Revision

Table 1.
Results of Expert Validation of the First Material

Total Score	65
Maximum Score	75
Research Results	86,6%
Criteria	Very Worth

Table 2.
Results of Second Subject Matter Expert Validation

Total Score	70
Maximum Score	75
Research Results	93%
Criteria	Very Worth

Based on the subject matter expert validation instrument provided by the researcher, in the first stage a score of 65 out of a maximum score of 75 was obtained with a feasibility percentage of 86.6%, so that the ZatPedia-Edu media was in the feasible category with some improvements. After revisions were made in accordance with the validator's suggestions, re-validation was conducted and a score of 70 out of a maximum score of 75 was obtained, with a feasibility percentage of 93%. These results indicate that the ZatPedia-Edu learning media is in the highly feasible category and can be used in IPAS learning for the material "Forms of Matter and Their Changes".

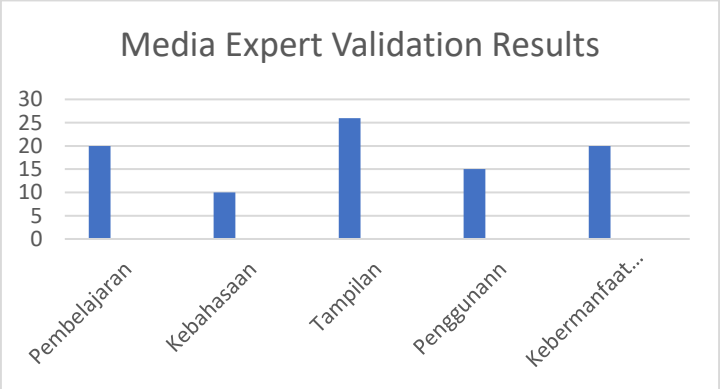


Figure 13. Media Expert Validation Results

Table 3.
Media Expert Validation Results

Total Score	94
Maximum Score	100
Research Results	94%
Criteria	Very Worth

Based on the media expert validation instrument provided by the researcher to the subject matter expert validator, a score of 94 out of a maximum score of 100 was obtained, resulting in a suitability percentage of 94%. These results indicate that the ZatPedia-Edu learning media is highly suitable for use in science education on the subject of the Form of Matter and Its Changes.

c. Media Effectiveness Test for ZatPedia-Edu

The effectiveness of the ZatPedia-Edu media was tested through a small group trial involving 12 students and a large group trial involving 27 students.

Table 4.
Statistical Data Analysis

	N	Minimum	Maximum	Mean	Std. Deviation
Small-Scale Pre-Test	12	30	60	42.83	11.582
Small-Scale Post-Test	12	73	93	84.42	7.179
Large-Scale Pre-Test	27	20	70	43.04	12.635
Large-Scale Post-Test	27	53	97	80.04	12.008
Valid N (listwise)	12				

Based on the descriptive statistics results, there was an increase in student learning outcomes after using the ZatPedia-Edu media in both small-scale and large-scale trials. On a small scale (12 students), the average score increased from 42.83 on the pre-test to 84.42 on the post-test, with a decrease in standard deviation from 11.582 to 7.179. On a large scale (27 students), the average score increased from 43.04 to 80.04, with a relatively stable standard deviation. These results indicate that the ZatPedia-Edu media is effective in improving student learning outcomes and equalizing understanding among students.

Table 5.
Normality Test

		Kolmogrov-Smirnov			Shapiro-Wilk		
Learning Outcomes	Class	Statistics	df	Sig.	Statistics	df	Sig.
	Small-Scale Pre-Test	.193	12	.200*	.879	12	.086
	Small-Scale Post-Test	.224	12	.099	.902	12	.166
	Large-Scale Pre-Test	.131	27	.200*	.971	27	.628
	Large-Scale Post-Test	.141	27	.181	.941	27	.128

Based on the results of normality tests using Kolmogorov-Smirnov and Shapiro-Wilk, the significance value (Sig.) for all pre-test and post-test data on both small and large scales was greater than 0.05. In the small scale pre-test, the Shapiro-Wilk Sig. value was 0.086, in the small scale post-test it was 0.166, in the large scale pre-test it was 0.628, and in the large scale post-test it was 0.128. This shows that all data are normally distributed. Thus, it can be concluded that the student learning outcome data is normally distributed, making it suitable for analysis using parametric statistical tests (paired sample t-test) to examine the effectiveness of the ZatPedia-Edu learning media in improving student learning outcomes.

Table 6.
Paired Sample T-Test

		Paired Differences							
					95% Convidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Small Scale Pre-Test – Small Scale Post-Test	-41.583	5.728	1.654	-45.223	-37.944	-25.148	11	.000
Pair 2	Large-Scale Pre-Test – Large-Scale Post-Test	-37.000	5.724	1.102	-39.265	-34.735	-33.585	26	.000

The results of the Paired Sample t-Test show that the use of ZatPedia-Edu media based on Problem Based Learning (PBL) has a significant effect on improving student learning outcomes. In a small-scale trial (n = 12), a significance value of 0.000 (< 0.05) was obtained with a t-value of −25.148 (df = 11), indicating a significant difference between the pre-test and post-test scores. The improvement in learning outcomes was indicated by an average difference of −41.583 with a 95% confidence interval ranging from −45.223 to −37.944.

In a large-scale trial (n = 27), the analysis results also showed a significant difference between the pre-test and post-test scores, with a significance value of 0.000 (< 0.05) and a t-value of −33.585 (df = 26). The average difference was −37.000 with a 95% confidence interval ranging from −39.265 to −34.735. Thus, the null hypothesis (H0) was rejected and the alternative hypothesis (Ha) was accepted, so it can be concluded that the ZatPedia-Edu learning media is effective in improving student learning outcomes in both small-scale and large-scale trials.

Table 7.
N-Gain Score

	N	Minimum	Maximum	Mean	Std. Deviaton
Ngain-Score	27	.48	.94	.7175	.11637
Ngain_Persen	27	48.05	93.62	71.7484	11.63747
Valid N (listwisw)	27				

Based on descriptive statistical analysis of the N-Gain scores of 27 students, the minimum N-Gain Score was 0.48, the maximum was 0.94, with an average score of 0.7175 (high category) and a standard deviation of 0.11637, indicating an increase in learning outcomes after the application of

learning media. Furthermore, the results of the N-Gain Percent analysis showed an average value of 71.7484% (effective category) with a range of 48.05%–93.62% and a standard deviation of 11.63747. These results indicate that the use of ZatPedia-Edu media based on Problem Based Learning (PBL) is effective in improving student learning outcomes, so the null hypothesis (H0) is rejected and the alternative hypothesis (Ha) is accepted.

2. Discussions

a. Development of ZatPedia-Edu Media

ZatPedia-Edu media pays attention to content quality, depth of material, and its suitability to the applicable curriculum. This is demonstrated through the formulation of clear Learning Outcomes (CP) and Learning Objectives (TP), the suitability of media titles to the material, and the presentation of a complete and coherent Problem Based Learning (PBL) syntax. The material is systematically organized in accordance with learning objectives, contains scientifically accurate concepts, and is adapted to the cognitive development stage of the learners.

From a linguistic perspective, the media uses appropriate sentence structures, communicative language that is easy to understand and suits the characteristics of elementary school students. The evaluation aspect is also taken into consideration through the preparation of questions and exercises that are relevant to the learning objectives, have an appropriate level of difficulty, do not cause ambiguity, and encourage critical thinking skills in line with the PBL approach. In addition, the media display is designed with a neat layout, proportional font and font size selection, attractive color combinations, good visual quality, informative icons, supportive slide transition effects, and clear usage instructions. This media is also designed to be easily accessible and usable, as well as useful in helping students understand concepts, increase their interest in learning, and potentially improve their learning outcomes in Grade IV elementary school science.

The development of ZatPedia-Edu learning media based on Problem Based Learning (PBL) was carried out as an effort to overcome low learning outcomes, limited teaching aids, and the suboptimal use of technology in science learning. This media was designed by combining visual elements, animations, videos, worksheets, interactive quizzes, and contextual problem presentations in accordance with PBL syntax to encourage active student participation. This is in line with the opinions of Akhiruddin (2019) and Arsyad (2019), who emphasize that learning media functions as an information intermediary that can clarify messages, increase attention, and motivate learning. The use of a combination of text, images, animations, and videos is also in line with Mayer's (2009) Multimedia Learning theory and is supported by Daryanto (2016), who states that interactive media is effective in increasing student engagement. The integration of the PBL model in ZatPedia-Edu reinforces the views of Djamaluddin (2019), Arends (2012), and Trianto (2015) that problem-based learning can foster critical thinking, independence, and problem-solving skills through contextual problem-solving activities, making science learning more meaningful and in line with the characteristics of the scientific process.

b. Feasibility of ZatPedia-Edu Media

The points in the material expert's results cover aspects of media development principles, material content feasibility, language, and evaluation/assessment aspects. In terms of media development principles, the assessment covers the clarity and accuracy of Learning Outcomes (CP) and Learning Objectives (TP), the clarity and ease of use of the media, and the consistency of the material presentation. In terms of content suitability, the assessment covers the sequence and systematics of material presentation, the suitability of topics to Learning Outcomes (CP) and Learning Objectives (TP), the suitability of material to learning objectives, the accuracy of concepts according to scientific principles, the suitability of material to the syntax of Problem-Based Learning

(PBL), and the suitability of material presentation to the cognitive development stages of students. The linguistic aspect covers the clarity and accuracy of sentence structure, the ease of language for students to understand, and the suitability of language to the characteristics of elementary school students. Meanwhile, the evaluation/assessment aspect includes the suitability of questions and exercises with learning objectives, the level of difficulty of questions that is proportional to the abilities of students, the clarity of questions so as not to cause double meanings, and the ability of questions to encourage critical thinking skills in accordance with the PBL approach.

The points in the media expert's assessment cover aspects of learning, language, appearance, usage, and usefulness. The learning aspect in ZatPedia-Edu media is assessed based on the suitability of the media title with the material presented, the clarity of the Learning Outcomes (CP) and Learning Objectives (TP), as well as the completeness and consistency of the Problem Based Learning (PBL) learning model syntax supported by the required learning tools. From a linguistic perspective, the assessment covers the use of clear, communicative language that is appropriate for elementary school students. The presentation aspect includes a neat layout, appropriate font and font size selection, attractive color combinations, good visual display quality, and the use of icons and images that support understanding of the material. The usage aspect includes the attractiveness of the transition effects between slides, the ease of application of the media, the availability of clear usage instructions, the media's ability to facilitate the learning process, and ease of access. Meanwhile, the usefulness aspect includes the media's ability to help students understand concepts more easily, its relevance for use in fourth-grade elementary school science learning, its potential to improve learning outcomes, and its role in increasing students' interest in learning.

The results of validation by subject matter experts and media experts show that ZatPedia-Edu media is very suitable for use in science education. The percentage of subject matter experts' suitability increased from 86.6% to 93% after revision, while the results of media expert validation reached 94%, indicating that the media has met the aspects of content, language, presentation, appearance, usage, and usefulness. These findings are in line with Hasan's (2021) opinion that good learning media functions as an intermediary of information, a source of learning, and a motivator for students. In addition, the suitability of the media with CP and TP, the correctness of scientific concepts, and the completeness of PBL syntax indicate that ZatPedia-Edu has met the principles of learning media selection as stated by Akhiruddin (2019), so that this media is suitable for use technically, visually, and pedagogically.

c. Effectiveness of ZatPedia-Edu Media Development

The effectiveness of the ZatPedia-Edu media based on Problem Based Learning (PBL) was demonstrated through the results of a paired sample t-test with a significance value of $0.000 < 0.05$, so that H0 was rejected and Ha was accepted, indicating that this media was effective in improving student learning outcomes. These findings are reinforced by the results of the N-Gain analysis of 27 students with an average score of 0.7175 (high category) and an N-Gain Percentage of 71.7484% (effective category), which shows an increase in learning outcomes from the pre-test to the post-test on the material of Substance Forms and Their Changes.

The effectiveness of the ZatPedia-Edu media based on Problem Based Learning (PBL) is closely related to the characteristics and advantages of the learning design developed, particularly in the preparation of a series of contextual learning activities centered on the students. This media systematically integrates PBL syntax, starting with the presentation of contextual problems that relate the material on the forms of matter and their changes to real phenomena in everyday life, thereby helping learners understand the learning objectives, activate prior knowledge, and build cognitive readiness before entering the problem-solving stage. Next, students are actively involved through worksheet activities, group discussions, and observation of their surroundings, such as

identifying various types of matter and observing changes in matter that are commonly encountered. This series of activities enables students to gradually build their understanding of concepts, relate abstract concepts to concrete experiences, and correct misconceptions that arise in the early stages of learning. These conditions led to a significant increase in learning outcomes from the pre-test to the post-test, resulting in a high N-Gain score and demonstrating the effectiveness of using ZatPedia-Edu media. These findings are in line with the results of research by Widiana and Tyas (2024), which show that the application of the PBL model assisted by interactive media on the subject of Matter and Its Changes is effective in improving student learning outcomes and critical thinking skills.

The results of this study are also in line with Ariani's (2022) opinion and support Kristiantari's (2022) findings, which state that the application of the PBL model assisted by interactive media can improve learning outcomes, scientific literacy, independence, and critical thinking skills of students. Through discussion activities, simple practical work, and interactive exercises, the ZatPedia-Edu media not only improves cognitive aspects but also develops affective and psychomotor aspects in a balanced manner, thereby supporting the achievement of IPAS learning objectives.

In the product evaluation section of the Borg and Gall model, revisions were made based on the results of trials and user feedback. However, ZatPedia-Edu still has limitations in terms of its limited material coverage and dependence on devices and the internet. Therefore, further development is recommended to expand the scope of the material and improve the accessibility of the media so that it can be used optimally in various learning conditions. For future researchers, this media can be developed by adding offline features or variations of learning activities in other IPAS materials, while for teachers, ZatPedia-Edu media can be used as an alternative contextual learning support media by adjusting to the characteristics and needs of students.

Conclusion

Based on the results of the study, it can be concluded that the ZatPedia-Edu learning media based on Problem Based Learning (PBL) is very feasible and effective for use in teaching science and mathematics material on the forms of matter and their changes. The feasibility of the media is demonstrated by the results of validation by subject matter experts and media experts, which are in the very feasible category. The effectiveness of the media was proven through the results of a paired sample t-test with a significance value of 0.000 < 0.05, so that H0 was rejected and Ha was accepted, and reinforced by the results of the N-Gain analysis with an average value of 0.7175 (high category) and N-Gain Percent of 71.7484% (effective category). These results indicate that the use of ZatPedia-Edu media can significantly improve student learning outcomes while supporting the development of critical thinking skills, science process skills, and problem-solving abilities in IPAS learning.

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