Development of Interactive Multimedia for Sciences Based on Problem-Based Learning in Grade V of Elementary School

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Abstract: The background of this study is the low involvement and learning outcomes of students in science and natural sciences learning, as well as the limited use of contextual digital learning media in elementary schools. This study aims to develop interactive multimedia based on Problem Based Learning (PBL) that is effective, practical, and feasible to use in science and natural sciences learning in grade V of SD Negeri 43 Sangkir. This type of research is research and development (R&D) with the ADDIE development model. The research sample involved 1 teacher and 23 grade V students. Data analysis techniques include expert validation, practicality test, and effectiveness test. The validation results show that the instruments, media, language, and materials are of very good quality, with an average score above 4.5 and a feasibility percentage above 90%. The practicality test by the teacher showed an average score of 4.60 (93%), small group of students 4.90 (98%), and large group of students 4.48 (94.6%), all of which are categorized as very practical. The effectiveness test showed an increase in the average score from 63.5 (pretest) to 82.3 (posttest), with a gain of 18.8 points. In conclusion, this PBL-based IPAS interactive multimedia has proven to be valid, practical, and effective in improving students' understanding and critical thinking skills. This product is suitable for use as an innovative digital-based learning media at the elementary school level.

Keywords: Critical thinking; Interactive multimedia; Problem based learning; Science

Introduction

21st century education requires students to have high-level thinking skills such as critical thinking (Mu'minah, 2021), creative (Saimon et al., 2023), collaborative, and communicative (4C) (Sartini et al., 2022). The importance of developing higher-level, social, and moral thinking skills in response to increasingly complex global challenges (Pratomo et al., 2017; Sartini et al., 2022). Therefore, the modern education system must be able to develop students who not only master conceptual knowledge, but also be able to think reflectively, solutively, and ethically (Cleland et al., 2023).

The Merdeka Curriculum as Indonesia's national education framework is designed to answer these needs (Arisanti, 2022; Purba et al., 2023). This curriculum demands contextual, active, and student-centered learning with 21st century competency strengthening, especially in terms of critical thinking and problem-solving (Putra et al., 2020). In its implementation, this curriculum encourages teachers to develop project-based, problem-based, and digital technology-based learning to improve the quality of student learning processes and outcomes (Petko et al., 2023).

One of the relevant subjects in strengthening critical thinking skills is Natural and Social Sciences (IPAS) (Putri et al., 2025). IPAS is an integration between science and social studies that emphasizes observation,

exploration, and contextual problem-solving skills in the environment around students (Fanani et al., 2025). In accordance with Piaget's theory of cognitive development (Piaget, 2010), elementary school-age children are in the concrete operational stage, so they can more easily understand things that are real and visual (Mukti et al., 2014). Therefore, social studies learning needs to be presented through a contextual, interactive, and visual-based approach (Cleland et al., 2023).

However, in reality, social studies learning in elementary schools still faces various obstacles. The results of the initial documentation and observation study at SD Negeri 43 Sangkir, Lubuk Basung District, on July 22, 2024, show that the majority of grade V students have not reached the Learning Goal Achievement Criteria (KKTP). Teachers still use lecture methods (Dhivya et al., 2023) and conventional media such as textbooks (Hu et al., 2021) and PowerPoint (Kassa et al., 2024), without any efforts to integrate interactive technology (Raja et al., 2025). This has an impact on low motivation to learn and active involvement of students in the learning process.

A survey conducted on students showed that 70% found it easier to understand IPAS material if it was delivered through visual and interactive media, while 55% thought textbooks were too complicated because the language was less interesting. Interestingly, 100% of students at the school have access to smart devices such as smartphones or tablets. This shows that there is a great opportunity to utilize digital technology as a more relevant and interesting learning medium for elementary school students.

Based on these problems, the solution that can be offered is the development of digital-based science learning media that adopts a learning model that encourages exploration (Sanudin et al., 2023; Taqiyyah et al., 2023), problem-solving, and collaboration (Nugroho et al., 2022). One of the appropriate approaches is Problem Based Learning (PBL) (Heriwan et al., 2020; Sari et al., 2020). PBL emphasizes on providing contextual problems as a learning stimulus, which then encourages students to find solutions independently or with groups (Dias-Oliveira et al., 2024; Servos et al., 2023). This model not only encourages active engagement, but also hones students' critical and creative thinking skills (Schiavio et al., 2021).

To support the implementation of PBL in science learning, visual-based digital media is important (Sudarto et al., 2024). One potential platform is Canva, which allows teachers to create interactive learning media with text, image, video elements (Sunami et al., 2021), animation (Utami et al., 2024), and QR-Code integration (Anggraeni et al., 2022; Rahmah et al., 2023; Widanti et al., 2024). The use of Canva is in line with the visual and digital-native characteristics of elementary

school students, and supports the presentation of contextual and engaging content.

Previous research has shown that the use of Canva in learning media has proven to be effective (Hapsari et al., 2021). Canva is able to improve students' understanding of concepts and learning motivation (Alfian et al., 2024; Hasanah et al., 2024). Furthermore, PBL-based interactive multimedia is able to increase student involvement, curiosity, and learning outcomes (Zulfa et al., 2023). This shows that the integration between the PBL model and Canva media has great potential in addressing the challenges of learning IPAS in elementary schools.

The novelty of this research lies in the development of Problem-Based Learning-based IPAS learning media using the Canva platform (Sulasmi, 2022), which has not been widely developed at the elementary school level. This media is designed not only to deliver material in an informative manner, but also to stimulate exploration and problem-solving through fun, contextual, and visual learning experiences (Aldonia et al., 2023; Alobaid, 2020). This research offers a new approach that combines innovative learning models with digital technology that suits the characteristics of today's learners (Abdulrahaman et al., 2020; Aghasafari et al., 2025).

Based on this background, this study aims to develop Problem-Based Learning-based IPAS learning media using Canva to improve the critical thinking skills of grade V elementary school students. This research is important to be carried out as an effort to improve the quality of learning that is more interactive, contextual, and adaptive to technology and the needs of the 21st century curriculum.

Method

This type of research is a research and development (R&D) that aims to develop Multimedia IPAS Learning based on Problem Based Learning for grade V elementary school students. R&D research is a research method that aims to produce a product and test its effectiveness (Creswell, 2017; Sugiyono, 2020). This development procedure uses the ADDIE development model, which consists of five main stages, namely: analysis, design, development, implementation, and evaluation (Branch, 2009; Lu et al., 2022).

This development procedure uses the ADDIE development model, which consists of five main stages, namely: analysis, design, development, implementation, and evaluation (Hess et al., 2016). This model consists of five stages, namely Analysis, Design, Development, Implementation, and Evaluation (Romualdi et al., 2023). The ADDIE model was chosen because the development process is sequential and interactive, so that the results

of the evaluation at each stage can be used to improve and improve the development at the next stage. The five stages can be seen in figure 1.
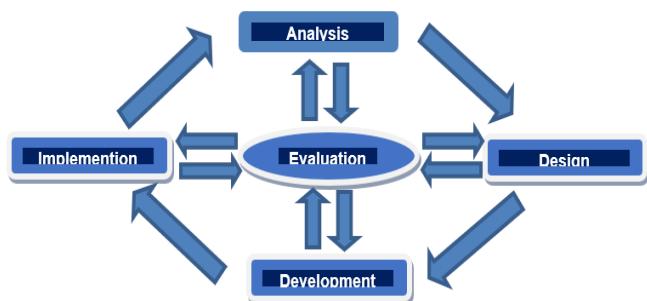
Figure 1. ADDIE model

This paper focuses on the development of multimedia learning of science for grade V elementary school students with a Problem Based Learning approach. This multimedia is created using the lectora application and is developed based on the steps in the ADDIE model. The procedure for its development is presented in figure 2.
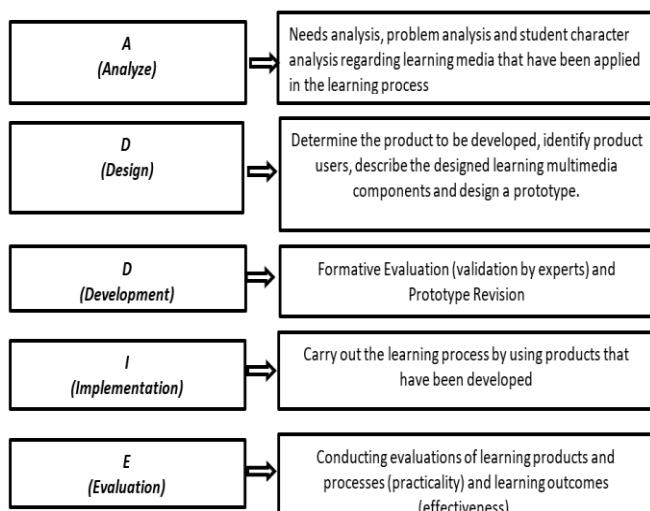

Figure 2. ADDIE development model design

The results of the instrument validation showed that the assessment instrument developed had very good quality, with an average score of 4.60 or equivalent to a feasibility percentage of 92%. The aspects assessed included the clarity of the filling instructions, the suitability of the indicators to the objectives of developing interactive multimedia, readability, and the relevance of the indicators to the Problem Based Learning model and strengthening science and 21st century skills. The highest score was in the readability and understanding of the question items and the relevance of the indicators to strengthening science, which was 4.80. This shows that the instrument has been able to clearly describe the objectives and aspects to be

achieved in developing multimedia that is contextual and relevant to students' needs. The data from the instrument validity test results are presented in table 1.

Table 1. Instrument Validation Results

Aspect	Criteria	Average
Instrument	Clarity of filling instructions	4.20
	Compliance of indicators with the objectives of interactive multimedia development	4.60
	Readability and understandability of items	4.80
	Relevance of indicators to the Problem Based Learning (PBL) model	4.60
	The relationship between indicators with strengthening science and 21st century skills	4.80
Amount		23.0
Average		4.60
Percentage		92%

In the media aspect, the validation results showed an average score of 4.60 with a percentage of 92%, which is also included in the "Very Good" category. The criteria tested include visual quality and aesthetics of the display, consistency and function of multimedia links including QR-Code, logical and interactive navigation between chapters, and compliance with the principles of Problem Based Learning. This validation confirms that the media developed is able to provide an interesting and effective learning experience for fifth grade elementary school students, as well as support critical thinking and problem solving processes. The data from the media validity test results are presented in table 2.

Table 2. Media Validation Results

Aspect	Criteria	Average
Media	Visual display quality and aesthetics	4.70
	Consistency and functionality of multimedia links	4.60
	Ease of LKPD navigation (structured, logical)	4.50
	Suitability of media design with the principles of Problem Based Learning	4.60
Amount		18.40
Average		4.60
Percentage		92%

The language aspect of interactive multimedia IPAS shows a very high level of validity with an average score of 4.63 and a percentage of eligibility of 93%. The validator assessed that the use of language was in accordance with the cognitive level of fifth grade elementary school students, had clarity in terms of sentence structure and spelling, and was consistent in the use of terms relevant to IPAS and Problem Based

Learning. Communicative language that is in accordance with the world of students is the main strength in supporting their understanding and involvement in learning. The data from the language validity test are presented in table 3.

Table 3. Language Validation Results

Aspect	Criteria	Average
Language	The suitability of language use to the level of thinking of grade V students	4.70
	Clarity of sentences, spelling, and grammatical structure	4.60
	Consistency in the use of the terms IPAS and Problem Based Learning	4.60
Amount		13.90
Average		4.63
Percentage		93%

The material aspect obtained an average score of 4.58 with a percentage of 91.6%, included in the "Very Good" category. The assessment was carried out on six important criteria such as the suitability of the material to the Merdeka Curriculum, integration of the Problem Based Learning approach, relevant real contexts, encouragement of critical thinking skills, relationships between concepts, and strengthening character values. These results indicate that the content developed is not only in accordance with curriculum standards, but also encourages meaningful and collaborative learning in depth, in accordance with the spirit of the curriculum and the needs of 21st century learning. The data from the material validity test results are presented in table 4.

Table 4. Material validation results

Aspect	Criteria	Average
Material	Suitability of IPAS material with the curriculum	4.60
	Integration of activities with the Problem Based Learning approach	4.70
	Relevance of content to real context and strengthening of scientific literacy	4.60
	Drive towards collaborative thinking skills	4.50
	Strengthening inter-conceptual relationships and contextual problem solving	4.60
	Emphasis on character values and meaningful learning	4.50
Amount		27.50
Average		4.58
Percentage		91%

Result and Discussion

Practicality test of interactive multimedia of Science based on Problem Based Learning that was developed showed that the product is very practical to use in learning in Class V of SD Negeri 43 Sangkir. The assessment by educators showed a high average score in the aspects of ease of use (4.60), time efficiency and support for PBL objectives (4.80), and benefits in increasing student involvement (4.60). Overall, this multimedia obtained a total score of 14.00 or 93%, which is included in the category of "Very Practical". This shows that this multimedia makes it easier for teachers to manage problem-based learning and supports the achievement of learning objectives effectively. Referring to the practicality criteria category, the results of the practicality of educator responses are included in the "Very Practical" category. The results in table 5.

Table 5. Educator Practicality Test Results

Aspect	Criteria	Average
Practicality	Ease of using multimedia in learning	4.60
	Time efficiency and support for PBL goals	4.80
	Benefits in increasing student engagement	4.60
Amount		14.0
Percentage		93%

In the small group practicality test involving three students (AA, BB, and CC), an average score of 4.90 was obtained with a practicality percentage of 98%. These results indicate that the learning media is very easy to use by students individually. The three students were able to follow instructions, access the QR-Code, and complete learning activities smoothly. The high score reflects that this LKPD has succeeded in presenting materials and instructions that are in accordance with the characteristics of elementary school students. The results of the small group practicality test can be seen in Table 6.

Table 6. Practicality Test Results in Small Groups

Aspect	Name	Average
Small Group Test	AA	4.90
	BB	4.90
	CC	4.90
Average		4.90
Percentage		98%

The results of the practicality test on a large group involving 23 students of Grade V of SD Negeri 43 Sangkir showed an average score of 4.48 with a practicality percentage reaching 94.6%. This assessment shows that the majority of students feel helped and comfortable using multimedia in science learning. With various interactive features and digital content support through QR-Code, students can more easily access information, solve the problems presented, and be actively involved in the learning process. These results strengthen the conclusion that this interactive

multimedia is not only suitable for individual use, but also effective on a wider class scale. The results of the large group practicality test can be seen in Table 7.

Table 7. Practicality Test Results in Large Groups

Aspect	Name	Average
	Student 1	4.45
	Student 2	4.30
	Student 3	4.40
	Student 4	4.60
	Student 5	4.50
	Student 6	4.48
	Student 7	4.38
Large Group Test	Student 8	4.35
	Student 9	4.42
	Student 10	4.30
	Student 11	4.28
	Student 12	4.25
	Student 13	4.35
	Student 14	4.40
	Student 15	4.60
	Student 16	4.38
	Student 17	4.50
	Student 18	4.55
	Student 18	4.45
	Student 19	4.45
	Student 20	4.70
	Student 21	4.72
	Student 22	4.68
	Student 23	4.66
Average		4.48
Percentage		94.6%

The results of the effectiveness test of the use of interactive multimedia for science and natural sciences based on Problem Based Learning for fifth-grade students of SD Negeri 43 Sangkir. The data show a significant increase in the average pretest and posttest scores of students. The average pretest score was 62.5 while the average posttest score increased to 78.4. The average percentage of student achievement also increased from 62.5% in the pretest to 78.4% in the posttest. These results indicate that the use of interactive multimedia based on Problem Based Learning is effective in improving students' understanding of science concepts and critical thinking skills. The consistent increase in scores for most students confirms that this learning media is able to facilitate a more active and meaningful learning process, as well as help students solve problems systematically in accordance with the Problem Based Learning approach. Data on the pre-test and post-test results of grade V students can be seen in Table 8.

The development of interactive multimedia for IPAS based on Problem-Based Learning (PBL) in Grade V of elementary school has produced a product with a very good level of quality. The validation results for instruments, media, language, and learning content showed average expert scores above 4.5 and feasibility percentages exceeding 90%. This demonstrates that the developed media meets both academic and pedagogical standards, criteria that good learning media must be readable and linguistically appropriate to support student comprehension (Muhammadi et al., 2023).

Table 8. Student Effectiveness Test Results

Name	Pre-test	Post test	Gain Score
Student 1	65	80	15
Student 2	50	65	15
Student 3	55	75	20
Student 4	30	50	20
Student 5	50	65	15
Student 6	75	90	15
Student 7	60	80	20
Student 8	55	75	20
Student 9	40	60	20
Student 10	35	55	20
Student 11	45	70	25
Student 12	55	75	20
Student 13	35	60	25
Student 14	70	80	10
Student 15	50	70	20
Student 16	50	75	25
Student 17	55	75	20
Student 18	70	85	15
Student 18	80	90	10
Student 19	65	80	15
Student 20	60	75	15
Student 21	55	70	15
Student 22	50	68	18
Student 23	1460	1893	433
Amount	63.5	82.3	18.8
Average	63.5%	82.3%	+18.8%
Percentage	65	80	15

The relevance of the material to the Merdeka Curriculum and its integration with the PBL approach reflects the principles of contextual learning (Baharuddin, 2021). This ensures that the multimedia not only conveys content accurately but also connects learning with real-life situations. Furthermore, the design encourages the development of 21st-century skills (Dewi et al., 2024), such as critical thinking and collaboration, making the learning process more meaningful and student-centered.

Practicality tests conducted with teachers and students in both small and large groups produced very high ratings. Teachers appreciated the ease of use, time efficiency, and improved student engagement. PBL-based interactive media can enhance student motivation and active participation (Rahmadani et al., 2020). Likewise, students showed fluency in using the multimedia, indicating its accessibility and adaptability across different learning contexts, effective learning

media should support various learning styles and provide engaging experiences (Alaagib et al., 2019).

The effectiveness of the developed media was confirmed through a significant improvement in student learning outcomes. The average score increased from 63.5 in the pretest to 82.3 in the posttest, reflecting a gain of 18.8 points or nearly 20%. Interactive multimedia can improve conceptual understanding and critical thinking (Annisa et al., 2023). Through the PBL approach, students actively engage in problem-solving, fostering deeper and more applicable learning (Sarie, 2022).

In conclusion, the PBL-based interactive multimedia developed for IPAS at SD Negeri 43 Sangkir is valid, practical, and effective. It not only facilitates systematic and engaging content delivery by teachers but also empowers students to become active and critical learners. Integration of technology with contextual approaches can enhance both the learning process and outcomes (Cleland et al., 2023). Therefore, this multimedia serves as an innovative solution for 21st-century science learning tailored to the needs of today's elementary students.

Conclusion

The development of interactive multimedia for IPAS based on Problem-Based Learning (PBL) in Grade V of elementary school has resulted in a product that is valid, practical, and effective. Validation results indicate very good quality in terms of instruments, media, language, and content, with average expert scores above 4.5 and feasibility percentages over 90%. Practicality tests also show excellent results, with scores of 4.60 (93%) from teachers, 4.90 (98%) from small group students, and 4.48 (94.6%) from large group students, all categorized as very practical. The effectiveness test revealed a significant improvement in learning outcomes, with the average score increasing from 63.5 (pretest) to 82.3 (posttest), reflecting a gain of 18.8 points. These findings conclude that the developed PBL-based interactive multimedia is suitable for use as an innovative digital learning tool to enhance students' understanding and critical thinking skills in elementary science education.

Author Contributions
Conceptualization, D.A and F.Y.J; methodology, R.Y and F.Y.J; validation, D.A and F.Y.J.; formal analysis, Z.Z; investigation, D.A and F.Y.J; resources, D.A and F.Y.J.; data curation, D.A and F.Y.J: writing—original draft preparation, D.A and F.Y.J; writing—review and editing, R and Z.Z: visualization, D.A

and F.Y.J All authors have read and agreed to the published version of the manuscript.

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