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Development of problem-based learning based on multimedia to improve learning outcomes

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ABSTRACT

Implementing the integrated science and social studies subject (IPAS) faces several challenges, including limited teacher understanding of the integrative concept and inadequate learning resources. This study aims to develop interactive multimedia based on Problem-Based Learning (PBL) to improve IPAS learning outcomes in V-grade elementary school students. This study used the 4D development model (Define, Design, Develop, Disseminate). During validation, the developed multimedia was rated highly feasible by media, design, and content experts. Practicality testing showed a usage categorized as very practical. Effectiveness testing indicated that of students experienced a high level of improvement, while some of them showed moderate gains based on N-gain scores. The multimedia enhanced students' conceptual understanding, critical thinking, creativity, and active engagement in learning. Its development was aligned with constructivist principles and Vygotsky's Zone of Proximal Development (ZPD), emphasizing scaffolding to support student progress. This study recommends interactive multimedia based on Problem-Based Learning (PBL) as an innovative approach to social studies instruction under the Kurikulum Merdeka. It supports the development of 21st-century competencies in students through meaningful and engaging learning experiences that bridge knowledge and real-world application.

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ABSTRAK

Implementasi mata pelajaran Ilmu Pengetahuan Alam dan Sosial (IPAS) menghadapi berbagai tantangan, seperti keterbatasan pemahaman guru terhadap konsep integratif dan kurangnya sumber belajar yang memadai. Penelitian ini bertujuan untuk mengembangkan multimedia interaktif berbasis Problem Based Learning (PBL) guna meningkatkan hasil belajar IPAS pada peserta didik kelas V sekolah dasar. Penelitian ini menggunakan model pengembangan 4D (Define, Design, Develop, Disseminate). Pada tahap validasi, multimedia yang dikembangkan dinilai sangat layak oleh ahli media, desain, dan materi. Uji praktikalitas menunjukkan tingkat penggunaan dikategorikan sangat praktis. Uji efektivitas menunjukkan peserta didik mengalami peningkatan hasil belajar dalam kategori tinggi, sedangkan beberapa berada pada kategori sedang berdasarkan skor N-gain. Multimedia ini mampu meningkatkan pemahaman konsep, keterampilan berpikir kritis, kreativitas, serta keterlibatan aktif peserta didik dalam pembelajaran. Pengembangannya selaras dengan prinsip konstruktivistik dan konsep Zone of Proximal Development (ZPD) dari Vygotsky, yang menekankan pentingnya scaffolding untuk mendukung perkembangan peserta didik. Penelitian ini merekomendasikan penggunaan multimedia interaktif berbasis Problem-Based Learning (PBL) sebagai inovasi pembelajaran IPS dalam Kurikulum Merdeka. Pendekatan ini mendukung pengembangan kompetensi abad ke-21 melalui pengalaman belajar yang bermakna dan relevan dengan kehidupan nyata.

Kata Kunci: *hasil belajar; ilmu pengetahuan sosial; multimedia interaktif; pembelajaran berbasis masalah*

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INTRODUCTION

The vital role of education in realizing Indonesia's national ideals, as stated in the fourth paragraph of the Preamble to the 1945 Constitution, is to create an intelligent national life. Quality education serves as a fundamental basis for achieving the nation's aspirations toward justice, prosperity, and welfare. Education at the elementary school level contributes significantly to building the initial foundation of knowledge and capabilities within the community's human resources (Pujiarti *et al*., 2024). Human resources are considered of high quality when they possess a combination of skills, knowledge, and attitudes necessary to contribute effectively across various sectors of life. The Indonesian government, through the Ministry of Education, Culture, Research, and Technology (Kemendikbudristek), has undertaken various efforts by planning the implementation of the Kurikulum Merdeka.

The Kurikulum Merdeka is designed as an adaptive framework for learning reform in the era of the industrial revolution. In addition, this curriculum focuses on the development of students' character and skills (Suryati *et al*., 2023). Two subjects were introduced in the Kurikulum Merdeka in 2022: Natural Sciences (IPA) and Social Sciences (IPS). The subject of Natural and Social Sciences (IPAS) is the result of an integration of these two disciplines. This integration aims to create a more holistic learning approach, aligned with the concrete and integrated thinking characteristics of elementary school students. By combining natural and social aspects, IPAS is designed to help students understand the interconnection between natural phenomena and social life around them, thereby encouraging the development of integrated critical thinking and problem-solving competencies (Nailu & Haeruddin, 2025).

The implementation of the IPAS subject currently faces various obstacles, such as limited teacher understanding of this integrative concept, the lack of adequate learning resources, and the need for more intensive training for educators. Nevertheless, IPAS offers significant opportunities to enrich students' learning experiences by connecting learning materials with real-life contexts, thereby enhancing the relevance and meaning of learning for students. One important topic in IPAS learning aimed at fostering a sense of love and pride in students' places of origin is the material titled "My Proud Region" (*Daerahku Kebanggaanku*). Studying this material is important because students are not only introduced to the cultural richness of their surroundings but are also trained to understand that each region has its own unique and valuable potential (Viqri *et al*., 2024).

In the context of the Kurikulum Merdeka, this material supports the strengthening of the Pancasila Student Profile, particularly in the aspects of collaboration, global diversity, and creativity. The material "My Proud Region" (*Daerahku Kebanggaanku*) can be interpreted as a process of introduction, understanding, and appreciation of local diversity, including customs, traditional clothing, regional foods, traditional houses, and regional arts. Social Studies (IPS) learning in elementary schools faces various significant challenges (Lathifah *et al*., 2023). One of the main issues is the low student learning outcomes due to monotonous and non-interactive teaching methods, which often lead to boredom and reduced active class participation (Khotimah *et al*., 2024). This is exacerbated by teachers' limitations in developing engaging learning resources and media, as well as the lack of adequate training to enhance their pedagogical skills (Isnaeni & Radia, 2021).

The integration of local wisdom values into Social Studies (IPS) material remains limited, due to teachers' lack of understanding of the concept and the scarcity of relevant teaching materials. This condition hinders efforts to instill character values and local culture in students. Another issue is the misconceptions that occur in students' understanding of IPS material, especially on topics such as globalization and cultural diversity. The material is often oversimplified or not aligned with the actual context, making it difficult for students to relate the lessons to the social realities around them. Limited instructional time, lack of resources, and minimal evaluation and monitoring from relevant authorities further exacerbate this

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situation. In addition, teachers face challenges in developing students' social literacy, which is essential for fostering a deep understanding of societal dynamics. The lack of supporting facilities and training in the use of digital technology serves as an additional barrier in this effort (Anggraeny *et al*., 2020). From the perspective of Lev Vygotsky's theory of the zone of proximal development (ZPD), the material "My Proud Region" (*Daerahku Kebanggaanku*) provides space for teachers to act as scaffolders—learning companions who assist students in surpassing the limits of their independent abilities through appropriate support (Cholid, 2024).

When students are given problem-based projects that are challenging yet within their developmental range, teachers can provide support through questioning, modeling, or group work to deepen their understanding. Learning becomes not merely a process of information transfer, but also an active social process in which students learn through peer and teacher interaction within a real cultural context. The Kurikulum Merdeka emphasizes differentiated and student-centered learning, which requires teachers to design learning activities that align with students' needs, interests, and backgrounds (Hamzah *et al*., 2022). The use of interactive media based on Canva enables teachers to design adaptive and contextual learning content, with visually engaging presentations that are flexible and can be tailored to local culture and students' learning styles (Hamzah *et al*., 2022).

Several previous studies have demonstrated the effectiveness of Problem-based Learning (PBL) in improving learning outcomes, yet have not specifically developed digital media tailored to the characteristics of elementary school students (Halimah *et al*., 2023; Tonge *et al*., 2023). Other studies have focused solely on the use of multimedia in conventional learning without directly linking it to PBL strategies and the theory of the Zone of Proximal Development (ZPD) (Kurniawan *et al*., 2024). Unlike previous studies, this research develops an interactive multimedia product that is systematically designed through the 4D development model (define, design, develop, disseminate) to foster critical and collaborative thinking skills, as well as enhancing students' conceptual understanding of the material "My Proud Region" (*Daerahku Kebanggaanku*). This study contributes to the development of media that is not only feasible and practical but also capable of facilitating students' cognitive and social development through activity designs aligned with their ZPD range. These findings are expected to support the strengthening of digital learning practices that are adaptive, contextual, and problem-based, while also enriching references for media development oriented toward the characteristics of learners at the elementary education level.

This study presents scientific novelty in the development of interactive learning media based on Problem-Based Learning (PBL) integrated with the social constructivist approach and the concept of the Zone of Proximal Development (ZPD) within the context of Social Studies (IPS) learning in elementary schools. The development of interactive media based on PBL serves as an innovative strategy to enhance the effectiveness of the learning process. This media is designed not only as a means of delivering information but also as a stimulus for critical thinking through contextual problem scenarios and visually engaging content. The integration of PBL into this media enables students to go beyond passively receiving material, encouraging them instead to actively solve challenges, engage in group discussions, and present solutions based on data and their observations. This interactive media not only addresses the need for contextual and engaging learning resources but also aligns with the principles of ZPD, allowing teachers to provide graduated support following students' developmental levels.

The development of effective learning media that meet the needs of elementary school students is an urgent challenge in the field of education. The application of interactive multimedia based on Problem-Based Learning (PBL) is one potential approach to addressing the challenge of developing adaptive learning media, with a focus on active student engagement in solving contextual problems. This study aims not only to improve cognitive learning outcomes but also to stimulate critical, collaborative, and reflective thinking skills. The theoretical foundation of this research refers to social constructivist theory,

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particularly Lev Vygotsky's concept of the Zone of Proximal Development (ZPD), which emphasizes the importance of gradual support in helping students reach their optimal learning potential. Therefore, this study was conducted to analyze the effectiveness of developing interactive multimedia based on PBL designed using the 4D approach, as well as to examine its contribution to enhancing the quality of Social Studies (IPS) learning in elementary schools from the perspective of constructivist theory.

LITERATURE REVIEW

Social Studies (IPS)

Social Studies (IPS) learning in elementary schools has the essential purpose of serving as a means to shape citizens who are active, critical, and responsible in social life. The aim of Social Studies learning is to help students understand social realities comprehensively and systematically by integrating various branches of social sciences. The integration of technology in Social Studies learning has also been proven to enhance student engagement, enrich learning experiences, and facilitate better conceptual understanding (Utami & Asidiqi, 2023). In addition, Social Studies learning must be adapted to the cognitive development characteristics of students, who are still in the stage of concrete thinking, making contextual approaches highly important (Lestari *et al*., 2024). Learning that emphasizes direct experiences and the relevance of material to students' daily lives can help them understand and apply social values (Syaumi & Dewi, 2022). Character education can also be integrated into Social Studies learning by embedding character values into lesson plans, so that academic goals and character development can be achieved simultaneously (Masriani, 2021). Furthermore, the importance of integrating local, national, and universal cultural values in Social Studies learning aims to shape students' character to be responsible and socially aware.

The implementation of Social Studies (IPS) learning in elementary schools will be more effective if it is linked to the PBL learning model and the ZPD theory, as both are capable of facilitating active and meaningful learning processes. The PBL model has been proven to improve learning outcomes and student engagement in Social Studies lessons by providing space for students to explore real-world problems collaboratively (Widyaswati *et al*., 2022). This approach also strengthens higher-order thinking skills, comprehension, and encourages students to become more independent and capable of working in groups (Hartatik, 2023). Technological support in the application of PBL can enhance students' collaborative skills and learning outcomes within the context of dynamic social learning. Systematic studies have concluded that the PBL model consistently improves elementary school students' critical thinking and problem-solving skills in the context of Social Studies learning (Mustofiyah & Muhibbin, 2024). The effectiveness of this model is also reinforced by findings that its implementation significantly improves critical thinking skills in understanding complex social issues (Darmawati & Mustadi, 2023). The PBL approach, when aligned with Vygotsky's ZPD theory, allows teachers to bridge students' actual and potential abilities through social interaction, collaboration, and structured scaffolding, making the learning process deeper and more personal (Olivares, 2024).

Constructivist Learning Theory

The constructivist theory developed by Lev Vygotsky emphasizes that learning is a social process that is greatly influenced by interaction with the environment, culture, and language, in which students actively construct their knowledge through collaboration and dialogue with more competent individuals, such as teachers and peers. One of the fundamental concepts of this theory is the ZPD, which refers to the distance between a student's ability to complete a task independently and the ability they can achieve with assistance from others (Wastyanti, 2021). Vygotsky explains that the ZPD is the gap between the actual

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developmental level—referring to one's ability to complete tasks independently—and the potential developmental level, which refers to the ability one can reach when guided by an adult or collaborating with more capable peers (Ma'mun *et al*., 2024). The ZPD emphasizes that the most effective learning occurs when students face challenges slightly beyond their current abilities but still attainable with the help of others. ZPD places social interaction as a bridge between what students already know and what they can learn through guidance. Vygotsky highlights that the teacher's role is crucial in identifying and providing appropriate support so that students can develop optimally (Suardipa, 2020).

ZPD in modern education serves as the foundation for designing adaptive, collaborative, and responsive learning strategies tailored to individual differences in ability (Suardipa, 2020). The role of the teacher becomes crucial as a facilitator who provides scaffolding, which is gradual support given to students until they are able to become cognitively independent (Hidayat, 2023). Language is also considered the primary tool for transmitting culture and shaping students' thinking structures, as knowledge can be effectively internalized through language (Budiyanti *et al*., 2023). Additionally, cultural context shapes how students understand and relate their experiences to the material being studied (Ferreira *et al*., 2023). In practice, Vygotsky's constructivist theory has proven effective when applied in project-based and collaborative learning, as it significantly increases student engagement and learning outcomes (Salsabila & Muqowim, 2024). This approach also aligns with the needs for differentiated instruction in elementary schools, as it allows teachers to adjust learning strategies based on the unique characteristics of each student (Rahayu *et al*., 2025). The application of ZPD strongly supports the use of technology as an aid in designing interactive and innovative learning scenarios that can enhance creativity and student participation in the context of modern education (Wibowo *et al*., 2024).

Interactive Multimedia

Interactive multimedia is a combination of various elements such as text, images, animation, video, and sound arranged integratively in a single digital learning media that enables users to be actively engaged. This media can increase learning interest and create more contextual and meaningful learning experiences for students, especially at the elementary school level (Hopeman *et al*., 2022). Interactive multimedia designed based on a contextual learning approach effectively helps students understand abstract materials. The use of this interactive media also has a significant impact on improving students' learning outcomes in thematic learning. Multimedia innovation has also proven very beneficial in addressing the challenges of distance learning during the COVID-19 pandemic. Even in higher education contexts, interactive multimedia shows a major contribution to enhancing the effectiveness of computer-based learning. The use of Canva-based interactive media in IPAS learning becomes a strategic choice because it offers high flexibility and visual appeal, thus improving elementary students' learning outcomes. Canva provides various design features that allow teachers to create interactive, informative, and easy-to-understand teaching materials, such as infographics, animated slides, and interactive quizzes that support the PBL approach (Agustin *et al*., 2024). Canva-based interactive media effectively facilitates students in understanding abstract concepts through concrete and attractive visualizations, in line with the cognitive characteristics of students who are still in the concrete operational stage (Nisa *et al*., 2023). Additionally, Canva is accessible online and collaboratively, facilitating the integration of group project assignments that require social interaction, cooperation, and creativity (Dahliani, 2023).

Problem Based Learning (PBL) Model

The PBL learning model is a teaching approach that places real-world problems as the starting point of the learning process to develop critical thinking and problem-solving skills (Dewi *et al*., 2024). PBL has been proven effective in improving students' learning outcomes as well as their ability to solve problems

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independently. This approach focuses learning on solving real-life problems relevant to daily life, aiming to develop cognitive and social learning skills (Dita *et al*., 2021). PBL also provides opportunities for students to learn critical thinking and acquire knowledge through direct experience in solving problems (Mareti & Hadiyanti, 2021). By using real-life problems as context, students can become more engaged in learning and develop analytical thinking skills. This model encourages collaboration among students, where they work together in groups to find solutions to the problems faced (Ogunsola *et al*., 2021). Based on social constructivist theory, PBL centers on students and emphasizes social interaction in the learning process (Purba & Azis, 2022). This learning process also strengthens students' independence by facilitating them to develop knowledge and skills through gradual problem-solving (Sekarwangi *et al*., 2021).

METHODS

This study uses the 4-D development model (define, design, develop, disseminate) developed by Thisupayaajan, Semmel, and Semmel in 1974, which includes four main stages, namely define, design, develop, and disseminate. This model was chosen because it provides a systematic approach in the process of developing effective and valid learning media for application in the context of primary education. This research falls under the category of Research and Development (R&D), focusing on the development of an educational product in the form of interactive multimedia based on PBL, as well as testing the feasibility and effectiveness of the product in the learning process. The subjects of this study were fifth-grade students at UPT SD Negeri 065009 Medan in the 2024/2025 academic year, who were the target of media implementation as part of the validation and product trial. The development model used in this study follows the 4-D stages, starting with the define phase by conducting a needs analysis through a preliminary study at UPT SD Negeri 065009 Medan, aimed at identifying problems and designing the basis for media development. The design phase was carried out to design the content, navigation, and visual and interactive elements based on PBL. Next, the development phase included prototype creation, expert validation, and product revision based on feedback. Finally, the dissemination phase was conducted through practical testing to assess the use and effectiveness of the product in improving the quality of social studies learning in primary schools.

The research design used is a pretest-posttest single-group design, in which students are given treatment in the form of learning using interactive multimedia based on PBL, followed by measurements before and after the treatment to determine the impact of its use on learning outcomes. This treatment aims to integrate the PBL approach in Social Studies learning through interactive and engaging media, thereby increasing student involvement and understanding. Data collection was conducted using various techniques, including interviews with the principal and classroom teachers to understand the needs and readiness for implementation, distribution of questionnaires to teachers and students to assess responses to the developed media, as well as observation and documentation of learning activities. Additionally, cognitive tests were administered before and after the learning process to evaluate the improvement in students' learning outcomes on the material "My Proud Region," serving as an indicator of the success of the developed media. Analysis of the cognitive test data was performed quantitatively by calculating the normalized gain (N-Gain) using Microsoft Excel. The N-Gain formula was used to measure learning improvement based on pretest and posttest scores. The results were categorized into three classifications: high (≥ 0.70), moderate (0.30–0.69), and low (< 0.30). This approach was chosen because it is practical and relevant for evaluating the effectiveness of learning at the elementary school level.

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RESULTS AND DISCUSSION

This section presents the findings of the research obtained from the development and implementation process of PBL-based interactive media designed to support social studies learning in elementary schools. The discussion is conducted critically and systematically by comparing the results of this study with relevant theories and findings from previous research. The objective is to examine the effectiveness of the developed media in enhancing conceptual understanding, critical thinking skills, and active student engagement in the learning process. Additionally, this section analyzes how the PBL approach and constructivist theory—particularly Vygotsky's Zone of Proximal Development (ZPD)—are concretely implemented within the context of social studies learning through interactive multimedia. The development process began with the definition stage, aimed at formulating learning needs, identifying problems, and analyzing student characteristics as well as field conditions.

Define Stage

The needs analysis revealed that the development of this media is expected to contribute to improving student learning outcomes, particularly in the topic "My Proud Region". These initial findings underscore the urgency of developing interactive multimedia that can effectively address the learning needs at the elementary school level.

Table 1. Learning outcomes of fifth-grade students in 2023/2024

Students Total	Percentage	Explanation
21	84%	Not finished
4	16%	finished

Source: Fifth-grade homeroom teacher of UPT SD Negeri 065009 Medan

The results of data analysis presented in **Table 1** show that the level of student mastery in social studies is still low, with 84% of students categorized as not achieving mastery and only 16% reaching mastery. These findings strengthen the picture that social studies learning, especially at UPT SD Negeri 065009 Medan, has not yet optimized students' conceptual understanding, so a more contextual and active approach is needed to improve learning outcomes comprehensively. The application of the PBL model in the material "My Proud Region" encourages students to identify problems or cultural potentials in their environment. This process encourages active student engagement in seeking information, discussing and working collaboratively, and then formulating creative solutions in the form of projects such as cultural documentation, local exhibitions, or traditional art performances. The teacher needs analysis revealed that the implementation of social studies learning, particularly on the topic "My Proud Region," has not gone as expected. All teacher respondents stated that the current learning process is still far from expectations, indicating serious challenges in its classroom implementation. In line with that, the analysis of students' needs showed that the majority of students feel bored when learning occurs without the support of media. This condition underlines the importance of using instructional media to increase students' interest and active participation in the learning process.

Curriculum analysis was conducted to select the material "My Proud Region" as the focus for the development of interactive multimedia. This material aims to enable students to recognize the diversity of national cultures, understand the concept of cultural heritage, and analyze and identify cultural heritage in their respective regions. In addition, analysis of student characteristics showed that students' attitudes toward Social Studies learning tended to be less enthusiastic, influenced by monotonous teaching methods and the limited use of media. The lack of visual and narrative stimulation further emphasizes the need for more interactive and engaging learning media innovation. Based on the results of the analysis in

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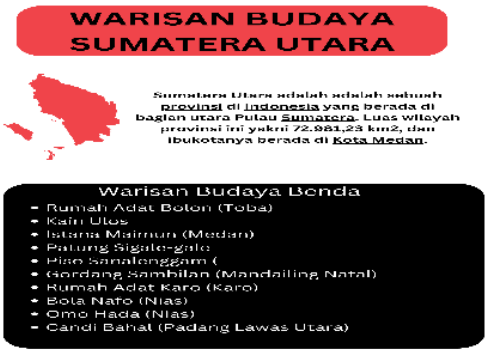
the define stage, a strong foundation was obtained regarding the needs, characteristics of students, and the material to be developed. The next process enters the design stage, which focuses on systematic planning for the design of interactive multimedia based on PBL to align with the predetermined learning objectives.

Design Stage

The results of the needs analysis and characteristics of the students served as the basis for entering the design stage, which focuses on designing interactive learning media based on PBL following the instructional objectives. The selection of multimedia was made based on the needs analysis and curriculum that had been identified in the previous stage. Preliminary studies showed that the material "My Proud Region" is relatively difficult to teach and understand. Until now, teachers have relied on textbooks as the primary source to deliver the material, but observations indicated that this method is less engaging for most students. Therefore, there is a need for more varied and interactive learning media to increase student engagement and understanding.

Menu awal multimedia

Menu petunjuk guru



Materials menu

Games menu

Figure 1. Initial design of interactive multimedia based on PBL
Source: *Research 2025*

Based on the information obtained during the analysis stage and the storyboard design as presented in **Figure 1**, the initial product of interactive multimedia based on PBL was then developed. The interactive multimedia based on PBL was created using the Canva application. The following is the appearance of the developed interactive multimedia product that applies the phases of the PBL learning model. The product design, which is the third stage of the 4-D development model, is grounded in Vygotsky's constructivist learning theory through the concept of the Zone of Proximal Development (ZPD). This interactive multimedia features several levels of game difficulty arranged progressively, allowing students to face challenges with minimal support from teachers or peers. The product is designed to be compatible

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with mobile devices such as tablets and smartphones, supporting the principle of flexible learning. This ease of access enables students to learn not only at school but also at home, expanding learning opportunities beyond formal class hours. This approach aligns with constructivist principles, where students can control their own learning process, encouraging independent exploration and reflection.

Development Stage

The process of compiling the learning media was carried out systematically by involving validation from experts to ensure that the developed media meets the quality standards appropriate to the learning needs. This validation used feasibility instruments designed to assess three main domains: the media construction aspect, multimedia acceptability, and the feasibility of content or material. Each domain includes several assessment indicators arranged in the form of items with specific criteria to measure the extent to which the media quality meets pedagogical elements, technological aspects, and the substance of the material. The assessment was conducted quantitatively based on the total scores obtained from each domain, which were then used as the basis for revising and refining the learning media.

Table 2. Feasibility Instrument Assessment from Experts

No	Domain	Aspect	Item (n)	Result ($\sum x$)	Total $x = \frac{\Sigma x}{n}$
1	Media construction	• Guidelines and information • Program performance • Systematics, aesthetics, and design principles	38	160	4.41 Very worthy
2	Multimedia acceptance	• Guidelines and information • Multimedia materials • Evaluation • Media design and facilities	31	130	4.19 Very worthy
3	Content	• Guides and information • Multimedia content/materials • Evaluation	24	91	3.79 Worthy

Source: Research 2025

Table 2 presents the results of the feasibility validation of the interactive learning media based on PBL conducted by three experts focusing on different domains: media construction, multimedia acceptability, and content or material. In the media construction domain, the assessment was carried out by a media expert emphasizing three main aspects: guidance and information, program performance, and systematics, aesthetics, and design principles. A total of 38 items were used in this evaluation process, resulting in a total score of 160 and an average score of 4.41, which falls into the very feasible category. In the multimedia acceptability domain, validation was conducted by a design expert who evaluated four aspects: guidance and information, multimedia material, evaluation, and media design and facilities. This domain's assessment involved 34 items, producing a total score of 130 with an average score of 4.19, also categorized as very feasible. Meanwhile, in the content/material domain, validation was done by a

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subject matter expert focusing on guidance and information, multimedia content/material, and evaluation. The evaluation process used 24 items and achieved a total score of 91 with an average rating of 3.79, indicating that the media falls within the feasible category. Based on these results, it can be concluded that the developed learning media meet the feasibility criteria for use in IPS learning at the elementary school level. The next stage in the instrument development is empirical testing of item validity based on student response data.

The validity calculation process was conducted by analyzing the correlation between the score of each test item and the total score obtained by the students. The analysis results showed that all 30 test items were declared valid, as the correlation coefficient values for each item exceeded the r-table value of 0.404 at a significance level of 0.05, indicating a significant relationship between the test items and the overall score. Based on the results of the validity, reliability, difficulty level, and discrimination power analyses, it can be concluded that the developed test instrument has excellent quality for use in the study. All test items met the validity criteria, with a reliability value reaching 0.880, which indicates a high internal consistency. The difficulty levels were proportionally distributed, with most items categorized as moderate, allowing the instrument to measure students' abilities representatively. The discrimination power of the items ranged from good to very good, demonstrating the items' ability to distinguish between high-ability and low-ability students. All analyses were conducted systematically using Excel software, which provided accurate and reliable results. Therefore, this instrument is deemed feasible and valid to be used as a measurement tool for students' abilities in administering pretests and posttests in PBL-based IPS learning.

Dissemination Stage

The practicality assessment of the product's usage also involved the students as the primary users to directly measure the media's usability. Based on the practicality test results involving 25 students at UPT SD Negeri 065009 Medan, the aspect of "Guidance and Information" achieved an average percentage of 89.2%, categorized as "very practical," while the "Appearance and Program" aspect reached an average of 91.0%, also categorized as "very practical." The overall average from these two aspects indicates that the interactive multimedia based on PBL is considered highly practical for use in teaching Social Studies on the topic "My Proud Region" for fifth-grade students.

Table 3. Results of Practical Trials for Teachers

No	Aspect	Persentage	Criteria
1	Guidelines and information	89.6%	Very practical
2	Appearance and program	90.4%	Very practical

Source: Research 2025

Based on the results of the practicality test presented in **Table 3**, the "Guidance and Information" aspect obtained an average percentage of 89.6%, categorized as "very practical," while the "Appearance and Program" aspect reached an average of 90.4%, also classified as "very practical." The overall average of these two aspects indicates that the interactive multimedia product based on PBL, developed for Social Studies learning with the material "My Proud Region," has a very high level of practicality. This product is deemed suitable for use in Social Studies learning for Grade V at UPT SD Negeri 065009 Medan in the 2024/2025 academic year, serving as an innovative tool capable of enhancing both the effectiveness of learning and the active involvement of students.

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These findings reinforce that the developed product not only meets the quality criteria from the educators' perspective but also successfully provides ease of use, clear information, and an appealing interface for the students, making it suitable for implementation in the elementary school learning process. The use of interactive multimedia based on PBL in Social Studies learning shows a significant improvement in students' learning outcomes. Of the 25 students tested, 18 students, or 72%, achieved an N-gain score of ≥ 0.70, which falls into the high improvement category. Meanwhile, 7 students, or 28%, attained N-gain scores between 0.30 and 0.69, categorized as moderate improvement. These results indicate that the majority of students experienced enhanced contextual understanding and improved learning outcomes after participating in learning using the interactive multimedia-based approach.

Discussion

This chapter not only discusses the results obtained but also connects these findings with relevant literature to provide a deeper understanding of the impact and potential development of interactive media within the context of elementary education. The research results indicate that the development of interactive multimedia based on PBL effectively enhances the quality of Social Studies learning in elementary schools. The practicality level of the media, as assessed by both teachers and students, falls within the "very practical" category for both the "Guidance and Information" and "Appearance and Program" aspects. This demonstrates that the developed media is not only technically feasible but also successfully meets the learning needs of students, which demand interactivity, active engagement, and appealing visualization. These findings align with previous studies stating that the implementation of the PBL model in Social Studies learning improves students' learning outcomes and encourages active participation in the learning process (Widyaswati *et al*., 2022). Other research supports that the PBL model effectively develops students' critical thinking and problem-solving skills, which are essential aspects of Social Studies learning (Mustofiyah & Muhibbin, 2024). Furthermore, these results are reinforced by studies concluding that the systematic use of problem-based approaches enhances students' analytical abilities in understanding social dynamics (Darmawati & Mustadi, 2023).

The alignment between this study's findings and previous research demonstrates the consistent effectiveness of the problem-based learning (PBL) approach in enhancing the quality of social studies education at the elementary school level. The use of interactive multimedia based on PBL positively influences students' learning outcomes by providing a more contextual and meaningful learning experience through visual presentations and problem-based interactions that encourage critical thinking, discussion, and collaboration. Furthermore, this media application aligns with the principles of the Zone of Proximal Development (ZPD), where students are given relevant challenges supported by appropriate guidance through digital media. Consequently, learning becomes more adaptive to students' cognitive development needs while also increasing their motivation, interest, and achievement in social studies. The findings indicate that implementing interactive PBL multimedia is consistent with Vygotsky's social constructivist theory, where students actively construct understanding through exploration, collaboration, and reflection within problem-solving contexts relevant to their lives. The learning is designed within the ZPD range, where students face challenges slightly beyond their current capabilities and overcome them with scaffolding support from teachers or peers (Hidayat, 2023; Wastyanti, 2021). This strategy contributes to improvements in critical thinking skills, conceptual mastery, and social interaction, reflecting meaningful learning within the ZPD framework (Ma'mun *et al*., 2024).

The presence of interactive media strengthens differentiated learning practices by adapting to students' individual learning styles and needs (Rahayu *et al*., 2025; Rosyiddin *et al*., 2023), as well as facilitating the internalization of culture and language within the thinking process (Budiyanti *et al*., 2023; Ferreira *et al*., 2023). The developed learning media have been proven to support academic achievement while simultaneously promoting students' cognitive and social development, in line with the essence of

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Vygotsky's constructivist theory. The implementation of the 4D development model (define, design, develop, disseminate) in this study proved effective in producing interactive PBL-based media for social studies learning in elementary schools. Each stage was carried out systematically, from analyzing student needs to testing the practicality of the product, with results showing that the media was rated as highly practical by both teachers and students. The main advantage of this model lies in its structured workflow, grounded in real field needs, and ongoing validation processes to enhance product quality. Nevertheless, challenges remain, such as the long time requirements and limitations in providing supporting technology and teachers' technical skills. Overall, this development process positively impacts the quality of the resulting media, as evidenced by its feasibility, usability, and effectiveness in increasing student engagement and learning outcomes. The interactive PBL-based media produced contributes significantly to creating innovative, engaging, and meaningful social studies learning through a disciplined development approach.

CONCLUSION

This study produced interactive PBL-based learning media on the social studies topic "My Proud Region" for grade V at UPT SD Negeri 065009 Medan using the 4-D development model (define, design, develop, disseminate). The media was declared feasible and highly practical based on expert validation and practicality testing. Its implementation increased student engagement, supported the construction of understanding, and facilitated cognitive and social development in line with constructivist principles and the ZPD approach. The use of this media should be optimized in social studies learning, while future development can focus on expanding content and visual design. Further research is recommended to involve more subjects and examine non-cognitive aspects to strengthen the generalizability of the findings.

AUTHOR'S NOTE

The author declares that there are no conflicts of interest related to the publication of this article. The author also affirms that the data and content of the article are free from plagiarism.

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