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The Development of Interactive 3D Multimedia Based on Problem-Based Learning in *"Denah Tempat Tinggalku"* Material for the Third-Grade Elementary School

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ABSTRAK. *Proses pembelajaran yang seringkali disajikan dengan model konvensional serta kurangnya mengekploitasi media menyebabkan hasil belajar siswa belum mencapai ketuntasan. Penelitian ini bertujuan untuk mendeskripsikan rancang bangun, mengetahui hasil validitas, dan mengetahui efektivitas multimedia interaktif tiga dimensi berbasis* problem based learning *pada muatan IPAS materi denah tempat tinggalku kelas III sekolah dasar. Penelitian ini menggunakan model pengembangan ADDIE yang terdiri dari tahap analisis, desain, pengembangan, implementasi, dan evaluasi. Metode pengumpulan data dilaksanakan melalui metode non-tes berupa kuesioner dan metode tes. Hasil penelitian pengembangan ini meliputi tiga temuan utama. (1), multimedia interaktif tiga dimensi berbasis* problem based learning *berhasil dirancang melalui tahapan model ADDIE, dituangkan dalam* flowchart *dan* storyboard, *serta dihasilkan dalam bentuk produk yang dapat diakses melalui Google Drive. (2), hasil validasi menunjukkan bahwa multimedia yang dikembangkan berada pada kategori sangat valid, dengan skor ahli isi 94,64%, ahli desain instruksional 93,75%, ahli media 93,18%, uji praktisi 94,79%, uji perorangan 96,52%, dan uji kelompok kecil 94,67%. Ketiga, uji efektivitas menggunakan* one-sample t-test *menunjukkan nilai* t_{hitung} *= 4,053 lebih besar daripada* t_{tabel} *= 1,734 pada taraf signifikansi 5%, sehingga multimedia interaktif 3D berbasis problem based learning pada muatan IPAS materi "Denah Tempat Tinggalku" terbukti efektif digunakan dalam pembelajaran siswa sekolah dasar.*

ABSTRACT. The learning process, as often presented in conventional models, and the lack of media, lead to exploitation, resulting in students' learning outcomes not being completed. This study aims to describe the design, determine the validity results, and assess the effectiveness of three-dimensional interactive multimedia based on problem-based learning in the social sciences content of my residence plan for grade III elementary school. This study uses the ADDIE development model, which consists of the stages of analysis, design, development, implementation, and evaluation. Data collection is carried out using non-test methods (questionnaires) and test methods. The results of this development research are (1) the design of three-dimensional interactive multimedia based on problem-based learning developed in accordance with the flowchart and storyboard based on the ADDIE development model flow diagram to produce products that can be accessed via Google Drive. (2) The findings of this development research consist of three main results. First, a three-dimensional interactive multimedia product based on problem-based learning was successfully designed using the ADDIE model, outlined through a flowchart and storyboard, and produced as a digital learning resource accessible via Google Drive. Second, the validation results indicate that the multimedia is highly valid, with expert scores of 94.64% for content, 93.75% for instructional design, 93.18% for media, 94.79% from practitioner review, 96.52% from individual testing, and 94.67% from small-group testing. Third, the effectiveness test using a one-sample t-test shows that the obtained value (t_{count} = 4.053) exceeds the critical value (t_{table} = 1.734) at the 5% significance level, demonstrating that the 3D interactive multimedia based on problem-based learning for the IPAS content "My Residential Layout" is effective for use in elementary school learning.

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1. INTRODUCTION

Learning is an essential process that individuals need to undergo to enhance their potential. Effective learning should be based on interaction between educators and students during the learning process, whether through direct communication or through learning media. The interaction between educators and students would proceed well if educators had first developed a learning strategy. This learning strategy was formulated by considering the learning objectives, learning resources, teaching strategies, learning media, and evaluation methods (Adisel et al., 2022). To achieve success in the learning process, each component is actively influenced and connected with the others. Learning media, as one component of the learning strategy, played a crucial role. Media refers to the tools or means used to facilitate the delivery of messages so that students would be stimulated to understand the information (Gagne, 1970). The media makes the material presented more concrete and helps capture students' attention. Students no longer needed to imagine abstract material. The use of learning media facilitates information transmission, helps overcome obstacles in the learning process, and enhances the motivation of both students and educators, thereby enabling the achievement of learning objectives more effectively (Hasan et al., 2021). In the context of globalization, education continues to evolve alongside students' increasing needs. This development is accompanied by educational technology that facilitates the learning process for both educators and students. Educational technology makes learning more effective and efficient, as evidenced by the shift from conventional to digital learning media. The use of digital learning media is based on their time efficiency in educational activities and the minimal maintenance costs associated with them (Khairunnisa & Ilmi, 2020) The reduced costs for maintaining digital media can be redirected toward creating a greater variety of learning materials. One of the popular media in Indonesian education today is interactive three-dimensional (3D) multimedia.

3D media helps students understand abstract concepts by providing more tangible representations that can be viewed from three perspectives (Marpaung & Pongkendek, 2020). Interactive multimedia serves as a tool for delivering messages through electronic devices, presenting information integrated with text, graphics, audio, and video (Huda & Ardi, 2021). Based on this explanation, 3D interactive multimedia combines two or more media elements, allowing students to feel as though they are engaging in a two-way interaction within the media, with objects viewable from three perspectives. Interactive 3D multimedia is highly suitable for learning. Multimedia, supported by electronic devices, helps students become accustomed to utilizing digital technology in their lives. Interactive multimedia can create compelling learning experiences and enhance student learning outcomes (Asani, 2023). This multimedia uses 3D objects to facilitate the understanding of abstract concepts for third-grade students in the concrete operational stage. The 3D presentation in multimedia can depict objects with three dimensions: length, width, and height, providing a more realistic and detailed representation. This multimedia features three-dimensional elements because 3D graphics not only allow users to view objects from various perspectives but also offer a deeper, more immersive experience. Users can engage with the virtual environment, discovering details beyond what two-dimensional media offers and feeling fully immersed. This, in turn, increases their engagement and understanding of the content presented. Interactive 3D multimedia emphasizes students' active role in operating the media, making it highly compatible with the Merdeka curriculum, which focuses on student-centered learning.

The current Merdeka curriculum combines two interconnected subject areas, making student comprehension of the material more complex (Hasibuan et al., 2023). The subjects of Natural Science (IPA) and Social Science (IPS) are integrated into a single subject, IPAS. IPAS integrates the study of living organisms, inanimate objects, and human interactions, reflecting how elementary students perceive the world as interconnected (Asani, 2023). This combination seeks to simplify interconnected subjects, such as the natural and social sciences, that students encounter in real life. IPAS learning should ideally be presented using student-centered models that can enhance students' interest in learning (Jauhari et al., 2024). High interest in learning IPAS makes it easier for students to understand in-depth material, especially on the "*Denah Tempat Tinggalku*" topic. This material is part of the IPAS curriculum. It discusses a diagram used to indicate the layout of a limited space, such as a house, school, or classroom (Yulianto, 2020). Teaching the material "*Denah Tempat Tinggalku*" using media that meet students' needs will facilitate its delivery and understanding, allowing students to have a good learning experience and results categorized as complete, needing enrichment, or requiring additional challenges. IPAS material can be abstract when relying solely on textbooks, leading students to struggle to understand. Learning based on educator handbooks and suboptimal media use results in suboptimal achievement of learning objectives (Sutrisno et al., 2023). Textbooks that present material only with simple images and text make students feel bored. It is suggested that the teaching of planning material be made engaging and foster students' enthusiasm in the learning process by using concrete, problem-based, and interest-focused activities (Sari & Harjono, 2021). The effective use of interactive media requires systematic steps from the learning model. Employing a model that does not meet students' needs can lead to boredom and hinder student development (Anggraeni et al., 2022). The conventional teacher-centered learning model emphasizes the educator's role in teaching through explanations (Tiastra, 2022). Traditional teaching often limits students' opportunities to think critically, solve problems, and express their opinions. However, critical thinking skills are essential for students in today's era. These skills can be observed through student activity, engagement, and behavior during learning activities (Anggraeni et al., 2022). Critical thinking skills can be enhanced with problem-based learning models (Candra & Rahayu, 2021).

The problem-based learning (PBL) model focuses on developing students' problem-solving skills. According to Tan (2003), the program is designed to enhance the learning process by encouraging critical thinking and connecting lessons to real-life problems. PBL uses real-world issues as a context for student learning, helping to build essential thinking skills and construct key concepts from the subject matter (Sari & Harjono, 2021). The PBL model is effective for learning (Lestari & Winanto, 2022). Combining 3D interactive multimedia with the PBL model is based on the shared characteristics of media and models that prioritize student engagement. PBL linked with interactive multimedia can increase student involvement, support various learning styles, and enable more effective collaboration, creating a more engaging and in-depth learning experience. This learning model can be a solution for developing students' thinking abilities and skills (Febrianti & Rosidah, 2024). Critical thinking and problem-solving skills are particularly suitable for IPAS learning. These abilities help prepare students to make informed decisions in an increasingly complex world (Febrianti & Rosidah, 2024). Critical thinking can be defined as the ability to consider everything using consistent reasoning methods and to reflect on it as a basis for drawing valid conclusions (Saputra, 2020). This skill is crucial in IPAS learning, which relates to natural and social subjects. Students who do not think critically are easily swayed by unverified information. IPAS instruction that trains critical thinking and problem-solving skills enables students to construct their knowledge, ultimately leading to improved learning outcomes.

The hope of achieving learning outcomes categorized as complete and needing enrichment is undoubtedly not easy. Many issues still arise in the learning process, particularly concerning this material. These issues can prevent students' understanding and learning outcomes from reaching their full potential. Educators often present the material "*Denah Tempat Tinggalku*" only verbally, without demonstrating concrete media, causing students to become passive, bored, and struggle to understand the abstract layout of their surroundings (Fitrotiha et al., 2023). Using media and models that do not meet students' needs can make the learning experience feel less engaging and monotonous. Students tend to become bored and disengaged during the learning activities. In line with the results of interviews conducted at SD N Tohpati with the third-grade homeroom teacher, it was found that conventional learning, especially in IPAS, demotivates students. This traditional model relies on images, school layout models, and textbooks during the learning process. Consequently, the 21 third-grade students have not yet achieved the learning objectives and require enrichment.

Based on this description, the researcher aims to develop 3D interactive multimedia for the IPAS curriculum. The 3D interactive multimedia will be developed using a problem-based learning approach to improve students' learning outcomes by engaging them in problem-oriented learning on the topic of "*Denah Tempat Tinggalku*". The 3D interactive multimedia presents objects that can be viewed from three perspectives. Students will engage with the material interactively while also tackling open-ended problems related to the lesson on layouts. They will actively choose problem-solving paths based on predetermined locations. The uniqueness of the objects and the ability to facilitate open-ended problem-solving give this media special characteristics. It is hoped that this media will assist educators in delivering material on layouts, allowing students to have a good learning experience, and for learning outcomes to be categorized as complete or needing enrichment. The researcher proposes a study titled "Development of 3D Interactive Multimedia Based on Problem-Based Learning for IPAS Curriculum on the Topic of *'Denah Tempat Tinggalku'* for Third Grade Elementary School."

2. METHOD

This study employs a research and development (R&D) methodology. Research and development is a method conducted by the researcher, based on their expertise, to produce a product and measure its effectiveness (Sumarni, 2019). The product development follows the ADDIE model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. The ADDIE development model is based on its systematic, flexible, and instructional nature, making it effective for development (Rayanto et al., 2020). Another definition of the ADDIE model is that it is a systematic learning design framework organized into a structured sequence of activities to address learners' needs and characteristics (Pel et al., 2023). The product testing of this research involves several subjects, including three experts: a content specialist, a learning design expert, and a media expert. The expert reviews are used to assess the quality of the developed product before it is given to the research subjects (students). Subsequently, a practitioner trial is conducted with the head of SD N Tohpati and a third-grade homeroom teacher to provide insights into the developed product. The student subjects in this study undergo individual trials with three third-grade students of varying academic achievement. A small-group trial is conducted with nine students representing the target population in third grade at SD N Tohpati. Finally, the effectiveness test of the product involves 19 third-grade students at SD N Tohpati to determine the impact of the developed product.

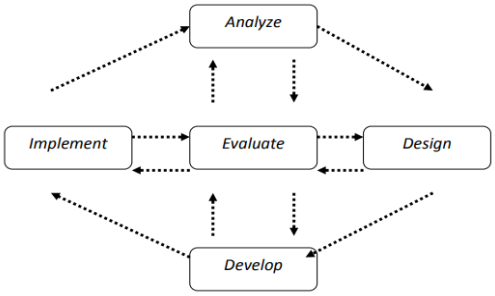

Figure 1. ADDIE Phase

Data collection in this research utilizes closed questionnaires and testing methods. The closed-questionnaire method is used to identify issues in the school setting. The testing method assesses individuals' abilities through a set of questions, resulting in scores. The data collection instruments used in this study include questionnaires and tests consisting of objective questions. The details of the instrument grid are presented in the following Table 1.

Table 1. Instrument Grid for Content Experts

Aspect	Indicator	Item	Item Number
Curriculum	a. Learning outcomes (LO), learning objectives (LO), and the flow of learning objectives (FLO) presented in 3D interactive multimedia are interconnected.	1	3
	b. Learning material presented in 3D interactive multimedia aligns with the flow of learning objectives.	2	
	c. The learning material presented in 3D interactive multimedia aligns with the learning objectives.	3	
Material	a. Suitability of the material to the characteristics of the students	4	6
	b. Completeness of the material	5	
	c. Attractiveness of the material presentation.	6	
	d. Accuracy of the material.	7	
	e. The material is supported by a variety of appropriate media.	8	
	f. The presented material is easy to understand.	9	
Language Features	a. The language used is suitable for the characteristics of the students.	10	3
	b. Accuracy in the use of good and correct vocabulary	11	
	c. Use of appropriate and consistent language	12	
Evaluation	a. Suitability of assessment instruments with learning objectives (TP)	13	2
	b. Balance between assessment instruments and the material presented	14	
	Total		14

Table 2. Instrument Grid for Design Expert

Aspect	Indicator	Item	Item Number
Goals	a. Clarity of learning objectives in 3D interactive multimedia	1	2
	b. Consistency between objectives, materials, and evaluations	2	
Strategy	a. The delivery of material follows an effective learning design	3	4
	b. The delivery of interesting material	4	
	c. The learning activities can motivate students in the learning process	5	
	d. Can provide opportunities for students to learn independently	6	
Evaluation	a. The questions presented are by the flow of learning objectives	7	2
	b. Meet the level of difficulty of the questions	8	
	Total		8

Table 3. Instrument Grid for Learning Media Expert

Aspect	Indicators	Item	Item Number
Techniques	a. Ease of using media	1	5
	b. The media used can help students' understanding	2	
	c. The media presented can provide meaning and learning interaction for students	3	
	d. The media used can motivate students	4	

Aspect	Indicators	Item	Item Number
	e. Can be controlled by students according to their thinking speed	5	
Appearance	a. Use of images and videos that support learning	6	6
	b. Use of appropriate fonts, font sizes, and spacing	7	
	c. The quality of the visual media display is attractive to students	8	
	d. Appropriate and harmonious color composition and combination	9	
	e. Harmonious and balanced screen display	10	
	f. Consistency with the theme	11	
	Total		**11**

Table 4. Instrument Grid for Practitioner, Individual, and Small Group Testing Outline

Aspect	Indicators	Item	Item Number
Learning	a. Can Increase student motivation in learning activities	1	4
	b. Involve students' emotions	2	
	c. allow students to shape their knowledge	3	
	d. Provide real examples in students' lives	4	
Material	a. Easy-to-understand material	5	4
	b. Interesting material	6	
	c. Clarity of material description	7	
	d. Material is useful in students' daily lives.	8	
Media	a. Ease of use of media	9	4
	b. Interesting media	10	
	c. Media can help students understand the material more easily	11	
	d. Media can raise students' learning motivation	12	
	Total		**12**

Table 5. Instrument Grid for Product Effectiveness Questions Testing

Learning Outcomes	Learning Goals	Level Cognitives
Shows the location of the city/district and province of residence on a conventional/digital map.	1. Through observing the material in 3D interactive multimedia, students are able to detail the concept of the floor plan and the cardinal directions correctly.	C4
	2. Through problem-solving activities in 3D interactive multimedia, students are able to analyze the location of objects on the floor plan correctly.	C4
	3. Through group discussion activities, students can examine travel guides from one place to another correctly.	C4 dan C5

The data analysis used in this development research includes quantitative descriptive analysis, qualitative descriptive analysis, and inferential statistics. According to Sugiyono (2020), descriptive statistics is a technique for analyzing statistical data that involves describing or illustrating the data collected. Quantitative research refers to scientific research whose data are expressed as numerical scores. Quantitative descriptive analysis is used to process data obtained from a Likert-scale questionnaire. Qualitative descriptive analysis is the analysis of data in sentences, words, or categories about an object (Agung, 2018). It is used to process data from a questionnaire, including suggestions and comments. The inferential statistical analysis method is a data-processing approach that applies inferential statistical formulas to test a research hypothesis and draw conclusions from the results (Agung, 2018). Inferential statistical analysis measured product effectiveness by conducting normality tests and a one-sample test. The evaluated questionnaire is analyzed using both qualitative and quantitative descriptive methods. The score results obtained are then converted to a five-scale achievement level to decide on the validity of 3D interactive multimedia in Table 6.

Table 6. Conversion Of Achievement Level With A 5-Grade Scale

Achievement (%)	Qualification	Notes
90-100	Excellent	No revision needed
75-89	Good	Minor revision
65-79	Adequate	Adequate revision
55-64	Insufficient	Many aspects revised
1-54	Minimal	Repeated to create the product

3. RESULT AND DISCUSSION

Result

This research produces an interactive 3D multimedia product based on the IPAS curriculum material "*Denah Tempat Tinggalku*." The interactive 3D multimedia being developed is based on problem-based learning, aimed at improving student learning outcomes through problem-oriented instruction on creating a map of their residence. This multimedia presents three-dimensional objects that can be viewed from three perspectives. Students cannot only interact with the material but also solve open-ended problems related to the map. They actively choose problem-solving paths based on predetermined locations. The uniqueness of the objects and the ability to facilitate open problem-solving give this media its distinct characteristics. This approach can provide students with a valuable learning experience, with learning outcomes categorized as mastery or enrichment. The process of developing the interactive 3D multimedia is carried out by following each stage of the ADDIE model, which consists of five phases: (1) analysis, (2) design, (3) development, (4) implementation, and (5) evaluation. According to Tegeh et al., (2014), the ADDIE model is often used to address learning problems by ensuring that learning resources meet learners' needs and characteristics, including the development of interactive 3D multimedia.

The analysis phase is conducted to uncover facts about the implementation of education. This stage aims to identify and gather as much data as possible on gaps and the factors that cause them (Dikananda et al., 2021). Several analyses are performed during this phase, including content analysis, competency analysis, student characteristic analysis, and analysis of facilities that support the learning process. The analysis reveals ongoing issues in IPAS learning, leading many students not to achieve mastery and to require remediation. Based on unstructured interviews with the third-grade teacher at SD N Tohpati, Kadek Ambar S.Pd., it was found that the topic "*Denah Tempat Tinggalku*" is often presented using a conventional model, with only textbooks and images used for supplementation. The reliance on textbooks and images stems from the limited availability of learning media and resources. This situation results in monotonous instruction and low student motivation to learn. Given these issues, there is a need for interactive learning focused on students that can provide a more meaningful educational experience, in this case, through interactive 3D multimedia.

The design phase is conducted to obtain an initial overview of the development of interactive 3D multimedia. This phase involves creating a media concept map, including flowcharts, storyboards, and the ADDIE model flow diagram, which depict the processes, appearances, and steps in product development. The creation of flowcharts and storyboards determines the style, shape, appearance, and material needs for product development (Dikananda et al., 2021). This phase also includes gathering material content and determining the hardware and software to be used. The hardware utilized includes laptops and smartphones, supported by software such as Canva, Struckd 3D, Wordwall, Microsoft PowerPoint, and Google Drive. The assessment of this media is conducted using a questionnaire instrument to gather expert reviews, product trial questionnaires from students, and test instruments to determine effectiveness. The developed design is then evaluated by supervisors regarding the product design. The flowchart and storyboard for the interactive 3D multimedia are Figure 2.

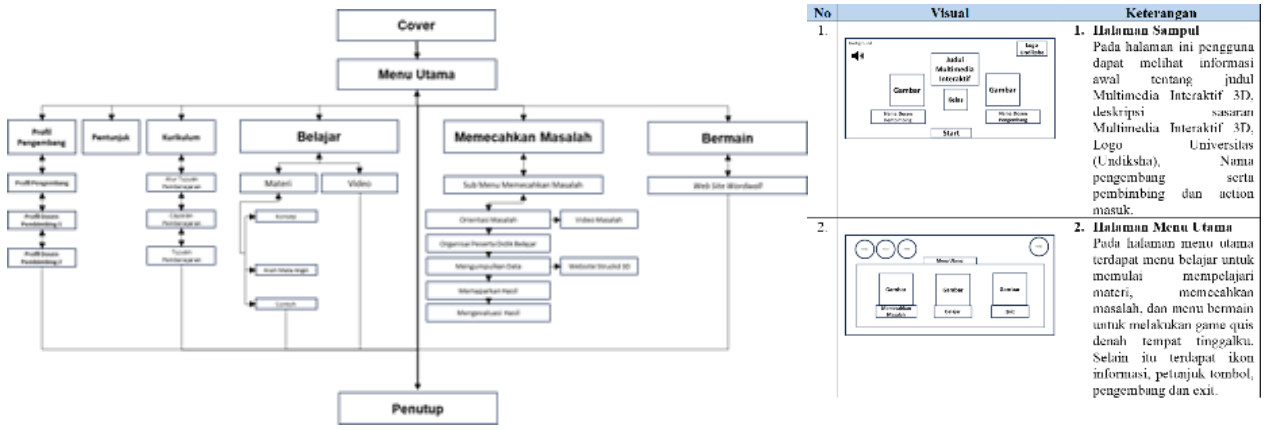

Figure 2. Flowchart and Storyboard

The development phase involves creating an interactive 3D multimedia product based on the approved design. The developed interactive 3D multimedia integrates various elements into a cohesive whole, including text, images, videos, audio, animations, and quizzes, to accommodate different learning styles for the material on the map of their residence. Canva creates this multimedia for slides, Wordwall for quizzes, and Struckd 3D for the problem-solving map. It is packaged in PowerPoint and published on Google Drive for user access. It is packaged in multimedia format through Microsoft PowerPoint and published on Google Drive, allowing users to download the media via a shared Google Drive link. Moreover, the interactive 3D multimedia is developed based on problem-based learning, training students to think critically and solve problems.

Figure 3. Media Design

In this multimedia development phase, an instrument test is conducted with experts, followed by product validity testing with specialists, including learning content experts, instructional design experts, and media experts, to obtain valid interactive multimedia based on their reviews and feedback. Next, the interactive 3D multimedia is implemented with students after the media is declared valid by the experts. This phase includes three testing stages: practitioner testing, individual testing, and small group testing. Practitioner testing involves the school principal and the third-grade teacher at SD N Tohpati. Individual testing involves three students, while small-group testing involves nine students with varying abilities (high, medium, and low). After collecting assessments from individual and small group tests, an effectiveness test is conducted. Effectiveness measures the success of a specific method or effort in achieving the intended goals (Fahruddin et al., 2022). This effectiveness test analyzes student learning outcomes using a post-test, which yielded an 86% score. The post-test is administered after one session of interactive 3D multimedia learning. The post-test results are then analyzed using a one-sample t-test to determine the product's effectiveness.

The evaluation phase assesses the success of interactive 3D multimedia development. This phase consists of two stages: formative evaluation and summative evaluation. Formative evaluation aims to refine the product at each stage of the ADDIE model, using experts' feedback. Moreover, summative evaluation is conducted at the end to assess the effectiveness of the developed product in achieving student learning outcomes. Based on this, it can be concluded that the interactive 3D multimedia, based on problem-based learning for the IPAS material "*Denah Tempat Tinggalku*" for third-grade elementary students, was developed according to the flowchart, storyboard, and ADDIE model flow diagram, resulting in multimedia accessible via Google Drive. The validity of the interactive 3D multimedia product based on problem-based learning can be assessed through expert evaluations and student trials. Expert validation includes assessments from learning content, instructional design, and media experts. Product testing consists of practitioner trials and student trials (individual and small-group testing). This development research employs a non-test method (questionnaires) to collect data on the product's feasibility. The following explains the results of expert validation and student trials, as presented in Table 7.

Table 7. Result of Expert Validation

No	Test Subject	Result %	Qualifications
1	Subject Matter Expert	94.64	Excellent
2	Instructional Design Expert	93.75	Excellent
3	Learning Media Expert	93.18	Excellent
4	Practitioner Trial	94.79	Excellent
5	Individual Trial	96.52	Excellent
6	Small Group Trial	94.67	Excellent

Based on validation by experts, practitioners, and students, interactive 3D multimedia based on problem-based learning has demonstrated strong validity, making it suitable for the learning process. The effectiveness test of interactive 3D multimedia products based on problem-based learning was conducted using a test method involving all 19 students in grade III at SD N Tohpati. This test method is given to measure student learning outcomes. The study employed a standard multiple-choice test comprising 20 items with four answer options. The items were evaluated for validity, reliability, difficulty level, and differentiating power. Learning outcome data in the effectiveness test were collected in a single stage, namely the post-test. The post-test was used to assess students' knowledge after using interactive multimedia. The post-test yielded an average student score of 91.842%, indicating that it was above the KKTP of 86%. The post-test data were then analyzed using the normality test and the one-sample t-test. The results of the Shapiro-Wilk normality test are shown below. The data analysis showed that the Shapiro-Wilk value for the post-test was 0.914. This value is greater than 0.05 or 0.901, indicating that the data are usually distributed. After the data were deemed normal, they were analyzed using the one-sample t-test, yielding a t_{value} of 4.053. The value calculated is then compared with the price at a significance level of 5% with dk = n - 1 = 19 - 1 = 18, and the t_{value} is 4.053. The results show that $t_{count} = 4.053 > t_{table} = 1.734$, so H_0 is rejected and H_1 is accepted. The results of the effectiveness test indicate that interactive 3D

multimedia, based on problem-based learning of the content of the science material, for the layout of my residence, is effectively applied to elementary school students.

Discussion

Multimedia is a learning medium that can facilitate learning by providing resources such as text, images, audio, and user interactivity via electronic devices (Faridawaty, 2022; Gunawan & Ritonga, 2020; Zafari & Iskandar, 2024). This multimedia is developed to provide a varied learning medium that accommodates students' different learning styles. This approach encourages students to engage in interactive, problem-oriented learning (Jauhari et al., 2024). Students gain meaningful learning experiences by understanding the "Denah Tempat Tinggalku" concept both theoretically and in real-world applications. Interactive 3D multimedia combines various media components into a cohesive unit: text, audio, images, animations, and videos, enhancing students' motivation to learn. The developed product has also undergone several tests and improvements based on feedback from experts and students, making it suitable for use in the learning process. This multimedia was developed using a flowchart and a storyboard, following the ADDIE model, to produce content accessible via Google Drive. The ADDIE stages implemented in this research include the analysis phase. In this phase, facts regarding the implementation of learning activities in the field were collected. This stage involved several analyses: content analysis, competency analysis, student characteristic analysis, and analysis of facilities supporting the learning process. The results indicated that, despite IPAS learning, many issues persisted in the learning process, leading to a significant number of students not achieving mastery and requiring remedial action. Subsequently, the design phase was conducted to obtain an initial overview of the development of interactive 3D multimedia according to students' learning needs. This phase involved creating media concept maps, such as flowcharts, storyboards, and ADDIE model flow diagrams, that depict the flow, appearance, and steps of product development. This stage also involved gathering material content and determining the necessary resources, such as hardware and software. The hardware used is a laptop and a smartphone, supported by Canva, Struckd 3D, Wordwall, Microsoft PowerPoint, and Google Drive.

The development stage was carried out to create an interactive 3D multimedia product based on the approved design. Subsequently, instrument testing was conducted with experts, as well as product validity testing with specialists in content, instructional design, and media, to gather reviews and feedback, resulting in valid interactive multimedia. The subject matter expert's evaluation yielded an excellent rating, while the instructional design expert's evaluation also received an excellent rating. The media expert's evaluation scored a good rating. Therefore, the development of interactive 3D multimedia is excellent and valid for implementation with students. The implementation stage of the interactive 3D multimedia was carried out with students after expert validation. This phase involved testing the interactive 3D multimedia across three stages: practitioner trials, individual trials, and small-group trials. The practitioner trial involved the school principal and the third-grade teacher at SD N Tohpati. The individual trial included three students, while the small group trial involved nine students with varying abilities: high, medium, and low. After obtaining assessments from the individual and small group trials, effectiveness testing was conducted. This effectiveness test analyzed student learning outcomes using a post-test, achieving an 86% score. The post-test results were then analyzed using a one-sample t-test to conclude the product's effectiveness. Based on the effectiveness test results, the interactive 3D multimedia based on problem-based learning is effective for elementary school students. Finally, the evaluation stage was conducted to assess the success of the interactive 3D multimedia development. This stage consists of two parts: formative evaluation and summative evaluation. The formative evaluation aims to refine the product at each stage of the ADDIE model, using experts' feedback. The summative evaluation is conducted at the end to determine the effectiveness of the developed product based on student learning outcomes.

This multimedia is deemed suitable for use in the learning process based on experts' reviews and aligns with trials conducted by practitioners and students. The interactive multimedia received an excellent qualification based on assessments from content experts. The use of a problem-based learning (PBL) approach in education is fundamentally rooted in its systematic nature. This approach also ensures that media use is more organized and is rated excellent by instructional design experts. The inclusion of 3D objects in the media significantly enhances its quality. Students find it easier to understand the material when objects can be viewed from three different perspectives. The novelty of these objects qualifies the interactive multimedia as very good. As a new learning element, 3D interactive multimedia has received very positive responses from both practitioners and students. Overall, this multimedia encourages students and makes learning more enjoyable. Practitioners and students have rated the interactive multimedia as excellent.

The effectiveness test of the 3D interactive multimedia based on problem-based learning for the IPAS topic "Denah Tempat Tinggalku" demonstrates that it is effectively applicable to elementary school students. This research is highly relevant to previous studies by Ajeng et al., (2021) on the development of interactive multimedia in Google Slides and by Zafari & Iskandar (2024). On the development of interactive multimedia, both of which used the ADDIE model. Both studies yielded similar results, indicating that the developed media were deemed suitable for use as learning media. Furthermore, Rahmawati et al., (2023), also conducted relevant research on the development of 3D animation media to enhance learning outcomes and character values among students. This study found that the media were categorized as "very feasible" for use as learning media. Lastly, research conducted by Dewi & Sujana (2022) is also relevant, focusing on the development of e-comics based on problem-based learning and concluding that the media is suitable for application in learning activities.

The development of interactive 3D multimedia based on problem-based learning has its unique features. This is evidenced by the integration of the Struckd 3D website, which allows for more realistic visual representations of objects. The use of a problem-based learning approach makes the learning process more systematic and aligns with constructivist theory. Additionally, this multimedia facilitates various learning methods that enhance student understanding. The inclusion of games on the Wordwall website further enriches the user experience, making it more enjoyable and engaging. The novelty of the objects featured makes the interactive multimedia highly qualified. As a new approach in education, this interactive 3D multimedia has received very positive responses from both practitioners and students. Overall, it has made students more enthusiastic to learn. Practitioners and students have rated interactive multimedia very highly. The implementation of interactive 3D multimedia for the IPAS lesson on "*Denah Tempat Tinggalku*" demonstrated its effectiveness in enhancing student motivation and learning achievement.

4. CONCLUSION

The design of a three-dimensional, interactive multimedia product based on problem-based learning was developed using a flowchart and storyboard, following the ADDIE development model, to produce products accessible via Google Drive. The validity of three-dimensional interactive multimedia is stated to be very valid based on the results of the assessment of learning content experts of 94.64% which is qualified as very good, the assessment of instructional design experts of 93.75% which is qualified as very good, the assessment of learning media experts of 93.18% which is qualified as very good, practitioner trials of 94.79% which is qualified as very good, individual trials of 96.52% which is qualified as very good, and small group trials of 94.67% which is qualified as very good, The effectiveness test using the one sample t-test formula obtained a tcount value = 4.053 while the ttable value at a significance level of 5% and dk = n - 1 = 19 - 1 = 18 obtained a t_{table} value = 1.734. The results show that $t_{count} > t_{table}$, so that H_0 is rejected and H_1 is accepted. An interactive 3D multimedia experience based on problem-based learning of IPA content in the floor plan of my residence is effectively applied to elementary school students.

Students are encouraged to use interactive 3D multimedia based on problem-based learning as a supportive tool for third-grade IPAS lessons. Multimedia is packaged in ways that make students more interested and provide a more meaningful learning experience through its application. Furthermore, teachers and principals are advised to use interactive 3D multimedia based on problem-based learning, especially in the IPA content of the floor plan of my residence for grade III elementary school. Other researchers are advised to use the results of this study as a reference to enrich their knowledge and develop more innovative, interactive 3D multimedia based on problem-based learning in the future.

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