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Interactive Learning Multimedia Based on Problem-Based Learning Models in Fifth-Grade Science Content

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ABSTRAK

Kurangnya penggunaan media pembelajaran yang kreatif dan interaktif berdampak pada rendahnya hasil belajar peserta didik. Penelitian ini bertujuan untuk mengembangkan multimedia pembelajaran interaktif berbasis model pembelajaran problem based learning pada muatan IPA kelas V. Penelitian ini tergolong kedalam jenis penelitian pengembangan dengan model ADDIE. Subjek penelitian ini yakni 1 ahli isi mata pelajaran, 1 ahli desain pembelajaran, 1 ahli media pembelajaran, 3 siswa untuk uji perorangan, dan 9 siswa untuk uji kelompok kecil. Metode pengumpulan data yaitu metode kuesioner/angket dan metode tes. Instrumen yang digunakan untuk mengumpulkan data yaitu kuesioner. Teknik yang digunakan untuk menganalisis data yaitu analisis deskriptif kuantitatif dan analisis statistik inferensial (Uji-t). Hasil uji validitas produk media menunjukkan bahwa uji ahli bidang studi atau mata pelaajaran memperoleh presentasi 98,6% (sangat baik). Ahli desain pembelajaran yaitu 92% (sangat baik). Ahli media pembelajaran yaitu 95% (sangat baik). Uji coba perorangan memperoleh presentase 91,3% (sangat baik) dan uji coba kelompok kecil 90% (sangat baik). Selain itu multimedia pembelajaran interaktif berbasis problem based learning pada muatan IPA menunjukkan terdapat pengaruh penggunaan multimedia pembelajaran interaktif berbasis problem based learning terhadap hasil belajar siswa. Disimpulkan bahwa multimedia secara signifikan dapat meningkat hasil belajar siswa kelas V SD.

ABSTRACT

The lack of creative and interactive learning media impacts students' low learning outcomes. This study aims to develop interactive learning multimedia based on problem-based learning models in science content class V. This research belongs to the type of development research with the ADDIE model. The subjects of this study were one subject matter expert, one instructional design expert, one instructional media expert, three students for the individual test, and nine students for the small group test. The data collection method is the questionnaire/questionnaire method and the test method. The instrument used to collect data is a questionnaire. The data analysis techniques are quantitative descriptive and inferential statistical analyses (t-test). The results of the media product validity test showed that the subject matter expert test obtained a presentation of 98.6% (very good). Learning design expert is 92% (very good). Learning media expert is 95% (very good). Individual trials obtained a percentage of 91.3% (very good), and small group trials 90% (very good). In addition, problem-based learning-based interactive multimedia learning on science content shows an effect of problem-based learning-based interactive multimedia on student learning outcomes. It was concluded that multimedia could significantly increase the learning outcomes of fifth-grade elementary school students.

1. INTRODUCTION

The development of science from time to time supports the creation of new technologies that mark the progress of the times. Now, developing technology has entered the digital stage. Including in Indonesia, every field has started to utilize technology to facilitate work, including the education sector (Lestari, 2020; Mazidah., et.al, 2018). The use of technology is no stranger to globalization. Including in the world of education, as the birthplace of technology, it is only natural that education also utilizes technology to facilitate the implementation of learning (Anjalina et al., 2019; Dwiqi et al., 2020). It is where the term educational technology began to emerge. Educational Technology is the study and practice of ethics to facilitate learning and improve performance by creating, utilizing, and managing appropriate technological processes and resources (Arifin et al., 2021; Panjaitan et al., 2020). The main goal is facilitating learning (effective, efficient, and interesting/joyful) and improving performance (Lauc et al., 2020; Ridwan et al., 2023). The process of educational technology is abstract, which implies that educational technology is a complex and integrated process involving people, ideas, procedures, equipment, and organizations to analyze problems, find ways to

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solve problems, implement, assess, and manage problem-solving that covers all aspects of human learning (Agustian & Salsabila, 2021; Heo & Toomey, 2020).

Educational technology emerged from a problem in the education system (Agustian & Salsabila, 2021). In education, especially at the SD/MI level, students are currently required to play an active role in the learning process, and teachers are not the only source of learning. The mode of communication in learning is no longer a one-way mode that takes the teacher as the only source of learning, but the teacher acts as a guide in the learning process, using all resources to make learning effective and efficient (Anggraeni et al., 2021; Rohman et al., 2021; Wedayanti & Wiarta, 2022). To support this aspect, one of them is the use of technology-based learning media in learning. However, it is even better if it is supported by the teacher's ability to produce learning media independently. Learning media can be made from any material, depending on the teacher's creativity. Using innovative media will increase student motivation to learn and influence student learning outcomes (Rahmadani & Taufina, 2020; Wulandari et al., 2022). The selection of appropriate learning media will make students not bored and motivated to learn (Nugroho & Surjono, 2019; Yama et al., 2018). In addition, the media is also useful for increasing knowledge and can foster student enthusiasm for learning (Prehanto et al., 2021; Wijaya et al., 2021). Using media, students can write, speak and imagine according to their thinking abilities so that the learning process can run more effectively and efficiently (Hidayah & Fahmi, 2020; Negara & Putra, 2021). The presence of learning media will certainly improve learning quality and maximize learning objectives' achievement.

It's just that the reality on the ground shows that the application of digital technology media in schools still needs to be improved. It aligns with the observations and interviews conducted in class FIVE at SD Negeri 1 Banjar Tegal. The observations and interviews show that the school already has learning facilities such as computers, LCDs, and other facilities supporting learning. Still, it's just that their use could be more optimal, and they need more time to develop learning media. In addition, information was obtained that the data on the average value of student learning, especially on science content, can be said that student learning outcomes are still low and students have not been able to master the material thoroughly, especially on theme 5 ecosystem, sub-theme 1 ecosystem component.

Furthermore, the results of the interviews show that student learning outcomes in science content are still not optimal or below the minimum completeness criteria (KKM) set by the school, namely 70 with a class average of 59.52% and all students in class LIMA totaling 32 students. 11 students completed, while 21 students did not complete. The low learning outcomes are caused by several factors, including the lack of learning media that can support science learning materials, the low interest in reading students towards textbooks so that students prefer to study with audio-visual media displays, and the absence of interactive multimedia learning that has been developed. If left continuously, these problems will certainly impact not achieving learning objectives and decrease the quality of education.

Referring to these problems, it is necessary to develop a media that can help students understand the concept of abstract material to be more concrete, make learning more interesting and interactive, and follow current conditions, namely in interactive learning multimedia. Interactive learning multimedia is a form of text, audio, and graphic transmission at the same time defined as a computer-based interactive communication system capable of creating, storing, presenting, and re-accessing information in the form of text, graphics, sound, video, or animation, enabling storing, processing and reproduce sound and video sources in digital format (Geni et al., 2020; Miftah, 2018; Ridwan et al., 2023). Learning multimedia must be developed by students' characteristics and by existing technological developments containing videos, photos, and text to facilitate learning (Astri et al., 2022; Wulandari et al., 2022). In addition, interactive multimedia can be equipped with a controller that can be operated by the user so that the user can choose what he wants for the next process (Juniari & Putra, 2021; Nuraini et al., 2021). Interactive learning multimedia is designed to help make it easier for students in the learning process, wherein the learning process materials delivered by the teacher are supported by strengthening images, sounds, videos, and animations contained in multimedia to clarify material that is difficult for students to understand (Abdur & Jampel, 2020; Geni et al., 2020; Nata & Putra, 2021).

The application of interactive multimedia will be more effective if the Problem-Based Learning learning model accompanies it because it uses problems around students at the beginning of the learning process. Students in groups analyze these problems to train students to think critically and have the skills to solve problems so that students can gain an understanding of the subject matter and students social abilities, which can also be developed as a whole in integrated thematic learning in elementary schools (Khoirunnisa et al., 2020; Styowati & Utami, 2022; Umbara et al., 2020). Previous studies revealed differences in science learning outcomes before multimedia learning (Rati, 2022). The results of other studies reveal that PBL interactive multimedia meets the criteria of validity and practicality in learning (Kuncahyono & Sudarmiatin, 2019). Subsequent findings also mention significant differences in science learning outcomes between students who study by following the conventional learning model and students who learn using the PBL model in grade five of elementary school (Margarita, 2018). Based on some of these research results, applying PBL-based interactive

multimedia is feasible for science learning. In previous research, no research specifically discusses interactive multimedia learning based on problem-based learning models in fifth-grade science content at SD No. 1 Banjar Tegal. So this research is focused on the study of developing interactive learning multimedia based on problem-based learning models in fifth-grade science content.

2. METHOD

This research belongs to the type of development research which was developed using the ADDIE model. The ADDIE development model consists of five development stages, including the design stage, the development stage, the implementation stage, and the evaluation stage. The subjects involved in this study were one subject matter expert, one instructional design expert, one instructional media expert, three students for individual trials, and nine students for small group trials. Data collection in the study was carried out using a questionnaire/questionnaire and test method. This development research used a questionnaire/questionnaire and test instrument. The questionnaire was used to collect data on the results of reviews from educational technology experts, the results of reviews from content experts in the subject or subject areas, learning design experts, and learning media experts, as well as individual trials and small group trials. At the same time, the objective test instrument is used in collecting data to test the effectiveness of student learning outcomes to get scores on learning outcomes in the pre-test and post-test activities. The research instrument grids are presented in Tables 1, Tables 2, Tables 3, and Tables 4.

Table 1. Subject Content Experts

No	Aspect	Indicator	Number of Items	Total Items
1	Curriculum	The suitability of the material with the core competencies	1	3
		The suitability of the material with basic competence	2	
		Material suitability with indicators	3	
2	Method	Completeness of the material presented	4	6
		The accuracy of the presentation of material in multimedia	5	
		The suitability of the example with the material presented	6	
		Compatibility of images in multimedia with material	7	
		Suitability of animation in multimedia with the material	8	
		Presentation of material can motivate students	9	
3	Language	Appropriate use of language in multimedia	10	1
4	Evaluation	Suitability of questions with learning objectives	11	3
		The suitability of the questions with the material	12	
		Ease of difficulty level questions on multimedia	13	
		Total		**13**

Table 2. Learning Design Expert

No	Aspect	Indicator	Number of Items	Total Items
1	Theme Accuracy	The suitability of the material with the learning objectives	1	2
		The suitability of the material with the chosen theme	2	
2	Methodology (how to present the material)	Methodology (how to present the material)	3	3
		Clarity of learning methods	4	
		The presentation of the material presented varies	5	
3	Appearance	Determination of the use of color	6	3
		Determination of the use of font sizes	7	
		Define button and image layout	8	
4	Interactivity	Interesting learning motivation	9	2
		Relevance of questions to the material	10	
5	Question quality	Questions are easy to understand	11	2
		Difficulty level of questions	12	

No	Aspect	Indicator	Number of Items	Total Items
6	Method	Appropriateness of apperceptions/illustrations is presented in the form of students' real problem orientation	13	3
		Clarification of examples of cases/events included	14	
		Multimedia invites students to investigate learning phenomena	15	
		Total		15

Table 3. Learning Media Expert

No	Aspect	Indicator	Number of Items	Total Items
1.	Text Aspect	Text clarity (text readability)	1	4
		Text rendering accuracy	2	
		Text size accuracy	3	
		Text type suitability	4	
2	Image Aspect	Image layout suitability	5	5
		Image quality	6	
		Background suitability	7	
		Color balance	8	
		Image attractiveness	9	
3	Animation Aspect	Animation video quality	10	3
		Animation fun.	11	
		Suitability of the animation with the material presented	12	
4	Audio Aspect	Clarity of sound/music sound	13	4
		Appropriate use of background music	14	
		Appropriate use of sound effects	15	
		Clarity of the voice of the narrator (voice actor)	16	
5	Packaging Aspect	The attractiveness of multimedia covers	17	2
		Compatibility cover with multimedia content	18	
6	Accessibility Aspect	Ease of access/use of learning multimedia	19	2
		Smooth interactive links	20	
		Total		**20**

Table 4. Individual Test and Small Group Test

No	Aspect	Indicator	Number of Items	Total Items
1	Material	Ease of understanding the material	1	5
		The accuracy of the language used	2	
		Compatibility of examples with material	3	
		Learning multimedia can increase student motivation	4	
		Learning multimedia facilitates the learning process	5	
2	Animation	Animation video quality in multimedia	6	2
		Interesting Animation	7	
3	Picture	Interesting Animation	8	2
		Image quality	9	
4	Audios	Sound/sound quality	10	2
		Backsound attractiveness (background music)	11	
5	Media	The attractiveness of the multimedia display	12	3
		Color attractiveness	13	
		Text clarity (readability level)	14	
6	Evaluation	The questions presented follow the material	15	2
		Clarity of instructions for working on questions with tests	16	
7	Aksesbilitas	Ease of using media	17	2
		Explanation of instructions for use	18	
		Total		**18**

The data obtained in the study were then analyzed using quantitative descriptive analysis methods and inferential statistical analysis methods. This quantitative descriptive analysis method is a way of processing data by systematically compiling figures and presentations regarding an object under study to obtain general conclusions. While the inferential statistical analysis method is a statistic used to analyze sample information, the results will be generalized/inferential to the population where the sample was taken. A scale of 5 gives meaning to decision-making, as in Table 5.

Table 5. Conversion of Achievement Levels with a Scale of 5

Achievement Level %	Qualification	Description
90-100	Very good	No need to revise
80-89	Good	Slightly revised
65-79	Enough	Adequately revised
55-64	Not enough	Many things were revised
0-54	Very less	Repeated product creation

3. RESULT AND DISCUSSION

Result

The results of this development research contain the process of developing interactive learning multimedia and the results of the validity of interactive learning multimedia. The process of developing interactive learning multimedia uses the stages of the ADDIE development model, which consists of five stages: the analysis stage, the design stage, the development stage, the implementation stage, and the evaluation stage. An overview of the ADDIE development stages can be seen in Figure 1.

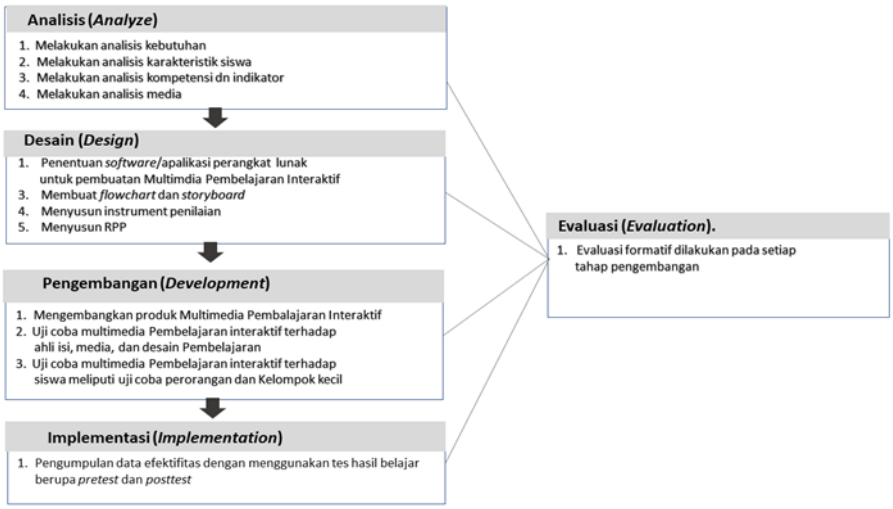

Figure 1. Stages of the ADDIE Model

The first stage is the analysis stage (analyze). At this stage, three things were analyzed: needs analysis, basic competency analysis and indicators, and media analysis. The needs analysis was done based on interviews, observations, and document recording. Based on this, information can be obtained regarding the low learning outcomes in science learning, especially among fifth-grade students at SDN 1 Banjar Tegal. The low learning outcomes are caused by several factors, including the lack of learning media that can support science learning materials, the low interest in reading students towards textbooks so that students prefer to study with audio-visual media displays, and the absence of interactive multimedia learning that has been developed. The analysis of basic competencies and indicators, namely analyzing the relationship between ecosystem components and food webs in the surrounding environment and indicators, which include, among others: explaining the meaning of ecosystems, understanding types of ecosystems, identifying ecosystem components, and identifying animal groups based on their food. The media analysis results were conducted to find out the various learning media that exist or are used and to analyze the criteria or prerequisites for good learning media. Several aspects of media validity and practicality must be met to produce good-quality learning media.

The second stage, namely the design stage (design). At this stage, it is carried out in the manufacture of interactive learning multimedia, namely: selecting and determining the software/software used to create

interactive learning multimedia, creating interactive learning multimedia flowcharts and storyboards, compiling interactive learning multimedia assessment instruments, compiling lesson plans (RPP). The results of the interactive learning multimedia development process can be seen in Figure 2.

Figure 2. The Results of the Interactive Learning Multimedia Development Process

The third stage, namely the development stage. This stage is to collect product validity data to determine the level of product validity based on expert opinion. The validity was measured by conducting product trials, including subject content expert trials, learning media experts, instructional design experts, individual trials, and small group trials. The fourth stage, namely the implementation (implementation). This stage is to collect product validity data to determine the level of product validity based on expert opinion. The validity was measured by conducting product trials, including subject content expert trials, learning media experts, instructional design experts, individual trials, and small group trials.

The fifth stage, namely evaluation (evaluation). At this stage, it is carried out to provide product users feedback so that the evaluation results make revisions or needs the product still needs to fulfill. The results of the validity of the development of interactive learning multimedia were determined based on the results of reviews from experts (experts in the field of study or subjects, learning design experts, and learning media experts) and product trials (individual and small group trials). Based on the results of the validity test of learning multimedia products conducted by experts in the field of study or subjects, a presentation of 98.6% was obtained, with very good qualifications. Instructional design experts get a percentage of 92%, with very good qualifications. Learning media experts get a percentage of 95%, with very good qualifications. Individual trials obtained a percentage of 91.3%. Very well qualified. Small group trials obtained a percentage of 90%, with very good qualifications. From the results of the validation of interactive learning multimedia products, suggestions, input, and comments are received, which will then be used as a reference for consideration in revising the product for the sake of the perfection of developing interactive learning multimedia products.

Discussion

Multimedia interactive learning based on the problem-based learning model has very good qualifications and is suitable for use as a learning resource. Several things influence eligibility. First, in the design process, the development model uses the ADDIE development model, which is easy to understand, and the stages are structured to be applied easily and quickly (Cahyadi, 2019; Widyastuti & Susiana, 2019). The development of interactive learning multimedia using the ADDIE model is effective for creating valid and quality products and is suitable for use in the learning process (Aulia & Aina, 2016; Soesilo & Munthe, 2020). Following the review of various aspects related to the design using the ADDIE model, which goes through the various stages expected by this model, it can be shown that this interactive learning multimedia can motivate students to study the material so they can understand the material presented easily (Almelhi, 2021; Sugihartini & Yudiana, 2018). Interactive multimedia development using the ADDIE model can minimize errors in the development process.

Second, interactive multimedia development is feasible to be applied in the learning process because it makes it easier for students to understand learning material in terms of the contents of the lesson content, relevance, correctness of the material, and the choice of language in delivery as a whole. The advantage of this interactive multimedia from the material aspect lies in the suitability of the content and the way of presenting the learning material according to the characteristics of the students. Adjustment to student characteristics aims to make it easier for students to understand the material presented (Agustian & Salsabila, 2021; Juniari & Putra, 2021). Interactive multimedia developed according to student characteristics effectively improves science learning outcomes (Dewi & Haryanto, 2019; Nugroho & Surjono, 2019; Yama et al., 2018). Third, multimedia

learning is feasible to be applied in the learning process because it can increase students' interest in learning. Very good qualifications in the design aspect were obtained based on the advantages of interactive multimedia in facilitating students to study independently and generating student learning motivation. In the developed interactive learning multimedia, complex science subject matter is packaged through illustrations and animations that are interesting and contextual to the environment of elementary school students. Packaging material in this way will not require students to read the material presented in reading texts monotonously, preventing them from feeling bored and bored (Hidayah & Fahmi, 2020; Negara & Putra, 2021).

Fourth, multimedia can improve learning situations, make learning more interesting, and motivate students (Arifin et al., 2021; Kusumawati et al., 2021; Panjaitan et al., 2020). Interactive multimedia learning can help students in learning so that students are more motivated to learn (Juniari & Putra, 2021; Nuraini et al., 2021; Putra, 2021). In addition, multimedia can also help the effectiveness of the learning process and the delivery of learning content messages to increase student learning interest. Learning should increase student motivation. A learning media must stimulate students' memory of the material that has been studied (Shalikhah, 2017). The multimedia application will make it easier for students to understand learning material because multimedia can improve the learning atmosphere. It impacts increasing student learning outcomes (Geni et al., 2020; Miftah, 2018; Ridwan et al., 2023). Using appropriate multimedia in learning activities can create quality learning by solving student problems (Lestari, 2018; Suartama, 2019).

The results obtained in this study align with the results of previous studies, which also show differences in science learning outcomes before using multimedia learning (Rati, 2022). The results of other studies reveal that PBL interactive multimedia meets the criteria of validity and practicality in learning (Kuncahyono & Sudarmiatin, 2019). Subsequent findings also mention significant differences in science learning outcomes between students who study by following the conventional learning model and students who learn using the PBL model in grade five of elementary school (Margarita, 2018). Based on these results, multimedia can help students in learning. The advantage of interactive multimedia based on expert and student assessment lies in its suitability with student characteristics and making it easier for students to understand science subject matter. The ADDIE interactive multimedia model in science content is appropriate for use in learning activities for elementary school students. Teachers can use the developed multimedia to enhance a pleasant learning atmosphere. Interactive learning multimedia based on problem-based learning models is feasible for the learning process.

4. CONCLUSION

Based on the data analysis and discussion results, it can be concluded that interactive learning multimedia is in very good qualifications and is declared feasible based on the results of the validity test of experts. Thus, it is feasible to be used in the learning process in class. The use of interactive learning multimedia in the learning process is very effective in attracting students' interest in learning and making learning more interactive to improve student learning outcomes significantly.

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