Project-Based Learning Interactive Multimedia with Orientation of Environmental Problems Assisted by Articulate Storyline 3 for Grade V Elementary Schools

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A B S T R A K

Penelitian ini dilatarbelakangi oleh menurunnya hasil belajar pada muatan pembelajaran IPAS, serta penggunaan media dan model pembelajaran yang belum optimal. Penelitian ini bertujuan untuk mengembangkan Multimedia Interaktif berbasis Model PjBL dengan orientasi masalah lingkungan pada materi Ekosistem kelas V SD yang layak, praktis, dan efektif dalam meningkatkan hasil belajar siswa. Jenis penelitian ini adalah Research and Development (R&D) dengan menggunakan model ADDIE. Subyek penelitian ini adalah 4 orang ahli, 3 guru, dan 6 siswa serta 1 siswa kelas V SD yang berjumlah 25 orang. Penelitian ini menggunakan desain pre-experimental, one shot case study. Metode pengumpulan data yang digunakan adalah angket dan tes dengan instrumen berupa lembar skala penilaian dan tes pilihan ganda. Teknik analisis data yang digunakan adalah deskriptif kuantitatif dan deskriptif kualitatif. Hasil penelitian menunjukkan skor kelayakan ahli media dan ahli isi pembelajaran adalah 0,93 (sangat layak), penilaian kepraktisan media oleh guru adalah 98,52% dan kepraktisan media oleh siswa adalah 99% (sangat baik), dan Multimedia Interaktif berbasis model PjBL efektif dalam meningkatkan hasil belajar siswa pada materi Ekosistem kelas V. Kesimpulan dari penelitian ini adalah media yang dikembangkan layak, praktis, dan efektif dalam meningkatkan hasil belajar siswa kelas V pada materi Ekosistem.

A B S T R A C T

This research was motivated by the decline in learning outcomes in the learning content of IPAS and the use of media and learning models that could have been more optimal. This study aims to develop Interactive Multimedia based on the PjBL Model with an environmental problem orientation on Ecosystem material for grade V SD which is feasible, practical, and effective in improving student learning outcomes. This type of research is Research and Development (R & D) using the ADDIE model. The subjects of this study were four experts, three teachers, and six students, as well as 1 class V elementary school student totaling 25 people. This study used a pre-experimental design, one shot case study. The data collection methods were questionnaires and tests with instruments like rating scale sheets and multiple-choice tests. The data analysis technique used is descriptive quantitative and descriptive qualitative. The results showed that the feasibility score of media experts and learning content experts was 0.93 (very feasible), and the assessment of the practicality of the media by teachers was 98.52%. The practicality of the media by students was 99% (very good), and Interactive Multimedia based on the PjBL model effectively improved student learning outcomes in grade V Ecosystem material. This study concludes that the developed media is feasible, practical, and effective in improving the learning outcomes of fifth-grade students on Ecosystem material.

1. INTRODUCTION

Education plays a very fundamental role in terms of achieving the goals and ideals of a nation and state (Sari et al., 2022). Education is a deliberate and planned effort to create an environment and learning process that enables students to actively increase their potential in achieving the best quality for society, nation, and state (Salsabila et al., 2021; Sholihah & Maulida, 2020; Simatupang & Yuhertiana, 2021). Today's education is no longer just about teaching individuals to read and write but educating them with an attitude capable of dealing with developments in science and technology. The 21st-century era of development offers a new paradigm in education, which will also challenge professional teachers to continue to innovate to achieve a quality teaching and learning process system (Simbolon & Koeswanti, 2020; Sulistya, 2019). Education also cannot be separated from the curriculum that has been designed, compiled, and determined (Hasbi & Mahmudah, 2020; Rahmadayanti & Agung Hartoyo, 2022). Most elementary schools in Indonesia have implemented the Merdeka Curriculum. The Independent Curriculum is a curriculum whose application will be adjusted to the needs, environmental conditions, and competency achievements which are the main goals (Aditama et al., 2022; Ayu, 2021). The current learning

process is transitioning from the Covid-19 pandemic, where learning is based on technology (Garad et al., 2021; Lapitan et al., 2021). Learning by utilizing technology has become a lifestyle. Therefore, the presentation of learning media in the current era is possible based on information and communication technology. The use of learning media has yet to run ideally in the learning process (Arijumiati et al., 2021). Teachers often assume that by sticking to books and teacher explanations, students will understand the material presented (B. Pambudi et al., 2019).

Students will experience boredom during learning because learning is less interesting, making it difficult to understand the concepts. The teacher causes saturation in presenting the material and does not allow students to be more active in learning (Prijanto & Kock, 2021). The results of interviews in elementary schools support it. It is known that student learning outcomes have decreased, especially the learning content of Natural and Social Sciences. Ecosystem material is one of the materials in the learning content of Natural and Social Sciences, which is less attractive to students, affecting their learning outcomes. It can be said based on the results of interviews with the fifth-grade homeroom teacher it is known that in delivering Ecosystem material, students often look unenthusiastic and less active during learning, besides that there are no learning media related to Ecosystem material that can make students active and enthusiastic in learning the material. This data is supported by facts as evidenced by data from the Program for international student assessment (PISA) in 2018 published by the Organization for Economic Cooperation and Development (OECD), stating that Indonesia's science ability category is ranked 71st out of 79 PISA participating countries. with an average score of 389 which is below the international average score of 500 (Prastyo, 2020). It happens because problems in learning science result in low student learning outcomes. One of the problems in learning science is the low interest of students in learning, which causes a low desire to learn (Rini, 2018; Wiradarma et al., 2021).

Based on these problems, teachers must create a conducive and enjoyable learning atmosphere for students to achieve learning objectives properly. One of the learning models by 21st-century competencies and the Independent Curriculum is Project Based Learning (PjBL) (Fahlevi, 2022; Rahayu & Ismawati, 2022). The main goal behind developing this learning model is to create effective learning opportunities. Students can work collaboratively in their respective groups to answer questions encouraging problem-solving or overcoming challenges to create the final product (Aldabbus, 2018). In line with this question, it was stated that Project Based Learning (PjBL) is a project that focuses on product development or performance (Elisabet et al., 2019; Khoiri & Putri, 2020). Interactive Multimedia is a learning medium that combines two or more elements consisting of text, images, graphics, photos, audio, video, and animation in an integrated manner (D. Lestari et al., 2020; Worang et al., 2021). Interactive Multimedia based on the PjBL model is media designed in two directions to create interaction between teachers and students in learning. Interactive Multimedia has characteristics that can involve students directly in its operation in the learning process so that students are more active in learning (Kumalasani, 2018; Wedayanti & Wiarta, 2022). The PjBL model is a learning model that provides opportunities for teachers to manage learning in class by involving projects (Fauzia & Kelana, 2021; Mira Shodiqoh. & Mansyur, 2022). So, the design of PjBL-based interactive multimedia learning media is learning media that is packaged creatively and attractively consisting of images, video, audio, and so on that are interrelated, and allows for communication between teachers and students because in Interactive Multimedia there are project-based activities that will be carried out by students both independently and in groups.

Relevant research on PjBL-based Interactive Multimedia states that interactive multimedia is very interesting and effective in increasing student learning outcomes (W Rahmadhani et al., 2022). Interactive multimedia can increase learning motivation and outcomes in fifth-grade students' science learning (Putri & Ardi, 2021). Although much research on the development of interactive multimedia has been carried out, the development of interactive multimedia based on the PjBL model that has been developed has several advantages that distinguish it from previous studies, namely interactive multimedia based on the PjBL model, so steps contained in interactive multimedia are packaged according to PjBL model steps, in which there are interactive activities carried out directly by students in doing projects. Interactive Multimedia was developed with an orientation on environmental issues. The publication results from the development of Interactive Multimedia are HTML files that can be run via laptops, web browsers, tablets, or smartphones. Interactive Multimedia is a practical learning media because it can be repeated. One of the applications of the Project Based Learning (PjBL) learning model is in the subject of Natural and Social Sciences (IPAS) on Ecosystem material. Subjects of Natural and Social Sciences are one of the subjects contained in the Merdeka Curriculum. This study aimed to create interactive multimedia based on the PjBL model with an orientation on environmental issues assisted by Articulate Storyline 3 on Ecosystem material for fifth-grade elementary school students' learning outcomes for fifth-grade elementary school students. It is hoped that this research can improve the quality of education.

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2. METHOD

This research is a Research and Development (R & D) study using the ADDIE model. The ADDIE model consists of five stages: analysis, design, development, implementation, and evaluation (Mira Shodiqoh. & Mansyur, 2022; Setiawan et al., 2021). The ADDIE model is one of the many types of development research models that are chosen rationally. The ADDIE model is simple and easy to learn because it is a systematic learning design model with five easy-to-understand stages, making it easier to develop a product. The advantage of the ADDIE development model is that there is an evaluation at each stage so that it can minimize the level of errors or product deficiencies in the final stages of this model (Artha & Putra, 2021; Izzatunnisa et al., 2021; Pertiwi et al., 2021). In addition, ADDIE is also a general learning model suitable for development research. When used in development, this process is considered sequential and interactive (Dewanti & Yasmita, 2022; Rohaeni, 2020). The subjects of this study were four experts (2 media experts and two learning content experts), three teachers, six elementary school students in the practicality test, and one class of fifth-grade students in the effectiveness test. The trial design used in this study was the pre-experimental design, one shot case study. Data collection methods used are questionnaires and tests. This research was carried out in several stages. The analysis stage (analysis) carried out curriculum analysis, needs analysis, and analysis of student characteristics. The design stage was carried out by research instrument research by experts, media validation by experts, and practicality tests (teachers and students). The implementation phase used interactive multimedia based on the PjBL model for fifth-grade students at SD Negeri 1 Baktiseraga. Summative and formative evaluations carry out the evaluation stage. Data collection methods in this study were material expert questionnaires, media expert questionnaires, practicality questionnaires by teachers and students, and multiple choice questions used to determine the effectiveness of using interactive multimedia based on the PjBL model. The instruments used in this development research were closed questionnaires using rating scales and multiple-choice tests. The instrument grid used can be seen in Table 1, Table 2, Table 3, Table 4, and Table 5.

Table 1. Trial for Content Experts in Learning Content

No.	Aspect	Indicator	Total Item
1.	Content Quality	a) Clarity of presentation of the material.	8
		b) The suitability of the material with the learning objectives.	
		c) Depth of the material.	
		d) Breadth of material	
		e) Compatibility of the image with the material.	
		f) Suitability of animation with the material.	
		g) The suitability of the video with the material.	
		h) Clarity of problems by the surrounding environment and the project to be carried out with the material.	
2.	Language Quality	a) The clarity of the meaning of the word.	2
3.	Quality of practice questions/tests	a) The accuracy of using language is in accordance with the EYD rules.	1
		Total	**11**

(Source : Modified from Pratama & Sujana, 2022)

Table 2. Trial Instruments for Learning Media Experts

No	Component	Indicator	Total Item
1.	Text	a) The suitability of the type and size of the text.	3
		b) The clarity of the text on each subject matter.	
		c) Conformity of text color with the background.	
2.	Image	a) Image clarity on Interactive Multimedia.	4
		b) Image attractiveness.	
		c) Images support the explanation of the material.	
		d) Suitability of image placement.	
3.	Animation	a) Quality of animation on Interactive Multimedia	2
		b) Appropriateness of the animation used.	
4.	Videos	a) Video quality.	6
		b) Clarity of sound in the video.	
		c) The suitability of the images and animations in the video.	
		d) The suitability of the video on learning material.	
		e) Videos make it easier for students to understand the material.	
		f) The attractiveness of the video used.	

No	Component		Indicator	Total Item
5.	audios	a)	Appropriateness of music and sound effects.	1
6.	Layouts	a)	The suitability of the placement of the text.	3
		b)	Accurate media size.	
		c)	The accuracy of the composition of the menu.	
7.	Program Operation	a)	Ease of use of Interactive Multimedia.	2
		b)	Interactive Multimedia can be used repeatedly.	
		Total		**21**

(Source: modified from Pratama & Sujana, 2022)

Table 3. Practicality Test Instruments by Teachers

No.	Components		Indicator	Total Item
1.	Aspects of Learning Media Display	a)	The overall appearance of Interactive Multimedia is attractive.	5
		b)	Writing in Interactive Multimedia can be read clearly.	
		c)	Images in Interactive Multimedia are visible and attractive.	
		d)	Alignment of sound with back sound in video learning material.	
		e)	Interactive Multimedia color display is attractive.	
2	Content Quality Aspects	a)	The presentation of the questions given in the Interactive Multimedia is to the learning objectives.	2
3.	Interactive Multimedia Operational Aspects	a)	Interactive Multimedia already has problems caused by the surrounding environment.	2
		Total		**9**

(Bayu & Wibawa, 2021)

Table 4. Practicality Test Instruments by Students

No	Component		Indicator	Total Item
1.	Material aspect	a)	Clarity of the material presented.	3
		b)	The suitability of the language used in delivering the material.	
		c)	Ease of material.	
2.	Multimedia quality aspect	a)	Clarity of study instructions.	5
		b)	The attractiveness of the multimedia display.	
		c)	Interesting colors in Interactive Multimedia.	
		d)	Interesting images in Interactive Multimedia.	
		e)	Ease of use of Interactive Multimedia.	
3.	Usefulness aspect	a)	The use of media to help students understand the material/topic.	2
		b)	The attractiveness of the media to provoke students' learning interest.	
		Total		**10**

(Bayu & Wibawa, 2021)

Table 5. Instruments for Student Learning Outcomes

No	Material	Learning objectives		Question Indicator	Question Number	Cognitive Level
1	Ecosystem	1. Analyzing the relationship between living things in an Ecosystem in the form of food webs.	1.1	Students can analyze the meaning of ecosystems correctly.	1	C4
			1.2	Students can analyze units of living things in ecosystems.	2	C4
			1.3	Students can correctly analyze the interrelationships between elements in the Ecosystem in the surrounding environment.	4	C4
			1.4	Students can correctly find the relationship between the biotic and abiotic elements that make up the Ecosystem.	7	C4

No	Material	Learning objectives		Question Indicator	Question Number	Cognitive Level
			1.5	Students can analyze the food chain in an ecosystem precisely.	9	C4
			1.6	Students can sequence the food chain correctly.	10	C4
			1.7	Students can correctly infer the	11	C5
			1.8	state of ecosystems in food webs. Students can analyze the types of Ecosystems correctly.	12, 13	C4
		2. Describe the transformation process between living things in an Ecosystem.	2.1	Students can infer the meaning of metamorphosis through an illustration.	14	C5
			2.2	Students can correctly identify examples of animals that undergo complete and imperfect metamorphosis.	15, 16	C3
		3. Describe how energy transformation in an Ecosystem plays an important role in maintaining the balance of nature.	3.1	Students can analyze human behavior and problems that can affect the stability of ecosystems in the surrounding environment appropriately.	18	C4
			3.2	Students can analyze the impact of ecosystem imbalances caused by human activities in utilizing nature.	19	C4
			3.3	Students can advise on Ecological imbalance problems that are appropriately oriented toward environmental problems.	20	C5

For the instrument that has been designed to be said to be valid, it is necessary to test the validity of the content by judges who have competence in the variable being studied. Analysis of the content validity of the questionnaire instrument was tested using the Gregory formula. At the same time, the multiple-choice test instrument was tested for the validity of the instrument items using the biserial point correlation technique (γ_{pbi}). The reliability of multiple choice instruments uses the Kunder Richardson 20 (KR-20) formula. In addition, a different power test and level of difficulty were also carried out. After the instrument is feasible to use for data collection, the data that has been obtained is analyzed descriptively qualitatively and descriptively quantitatively. Qualitative data was obtained from a review by experts. Meanwhile, quantitative data was obtained from the rating scale of expert test validation results, practicality rating scale by teachers and students, and effectiveness test data.

3. RESULT AND DISCUSSION

Result

This research was conducted to develop Interactive Multimedia products based on the PjBL model with an orientation on environmental problems assisted by Articulate Storyline 3 on Ecosystem material for fifth-grade elementary school students to improve student learning outcomes. This research was carried out through five stages according to the ADDIE development model: analysis, design, development, implementation, and evaluation. At the analysis stage, a more in-depth investigation or study is carried out regarding the problems at the research site to be used as a reference in making appropriate media. The main activities of this analysis stage consist of curriculum analysis, needs analysis, and analysis of student characteristics. Based on the results of observations and interviews, it is known that the curriculum implemented in SD Negeri Baktiseraga is the Merdeka Curriculum. In science learning, learning resources in teaching modules and models could be more optimal in supporting learning. The media used has not accommodated student characteristics, so learning Natural and Social Sciences seems boring to students. This statement is reinforced by an analysis of the characteristics of students through distributing questionnaires. The results show that students prefer auditory and kinesthetic visual learning styles, are more interested when learning activities utilize technology, prefer learning using audio-visual media, and are more interested when involved in project activities. Based on this, one of the media that can be developed is interactive multimedia based on the PjBL model.

The design stage begins with selecting and determining the software to be used, namely Articulate Storyline 3. Then proceed with making a prototype. After completion, the prototype is guided to the supervisor to provide input and suggestions so that it is feasible to be developed into real media. The Interactive Multimedia prototype based on the developed PjBL model consists of 3 main parts: the opening screen, the initial screen, and the main screen. The first part is the opening display, which consists of filling in the student's identity, such as name and absent number, so that they can proceed to the next menu. The second part is the initial display which contains the content of the title of the material as well as initial buttons such as the hint button directing to the instructions menu, where the guide menu contains instructions for using the PjBL model-based Interactive Multimedia, the start button directs to the start menu which contains the main menus namely the material menu, project menu, and evaluation menu, as well as the information button directs to the information menu which contains information supporting the development of the PjBL model-based Interactive Multimedia such as learning objectives, list of developers, and list of references. Then the third part is the core view which consists of the main menus, namely the material menu, the project menu, and the evaluation menu. The Material Menu contains learning material, namely Ecosystem material. The project menu contains project implementation instructions and project videos regarding issues related to the surrounding environment that disturb the Ecosystem imbalance. From the problems presented in the video, it is hoped that students will be able to find a solution realized in a product to overcome these problems. The evaluation menu contains an evaluation in the form of a test that students must do with as many as 15 questions. The development stage is achieved by realizing the product design based on the prototype and the supervisor's suggestions and input. After the media has been made, it will be guided before being tested by experts. Some examples of media displays that have been made can be seen in Figure 1.

Figure 1. Display of Interactive Multimedia Based on the PjBL Model with an Orientation on Environmental Issues

The development stage also tests media experts, learning content experts and practitioners to review and determine the feasibility of the media being developed. Four experts assessed the PjBL model-based interactive multimedia feasibility test phase. After obtaining the assessments from the four expert lecturers, the data from the assessment results were analyzed using the Aiken Validity formula to obtain the eligibility index and eligibility qualifications for Interactive Multimedia based on the PjBL model with an orientation on environmental issues. In summary, the results of the Aiken Validity analysis can be seen in Table 6.

Table 6. Results of Interactive Multimedia Feasibility Test Based on the PjBL Model

Expert	Item	Evaluator		V	Description
		I	II		
Media	1-21	100	98	0,93	Very High Validity
Learning Content	1-11	53	51	0,93	Very High Validity

After being declared fit for use in the learning process, it is followed by a practicality test which is reviewed from the perspective of the teacher as a practitioner in learning and students as users of learning media. Data from the PjBL model-based practicality test of Interactive Multimedia will then be analyzed to determine the practicality of the developed media. Scores obtained through assessments given by expert practitioners are

analyzed to calculate the percentage score. In summary, the results of the practical analysis of interactive multimedia based on the PjBL model by teachers and students can be seen in Table 7 and Table 8.

Table 7. The Results of the Interactive Multimedia Practical Test Based on the PjBL Model by the Teacher

Practitioner	Score	Percentage	Average Percentage	Category
First practitioner	45	100%		
second practitioner	45	100%	98,52%	Very good
Third practitioner	43	95,56%		

Table 8. The Results of the Interactive Multimedia Practicality Test Based on the PjBL Model by Students

Practitioner	Score	Percentage	Average Percentage	Category
First student	49	98%		
second student	50	100%		
Third student	48	96%	99%	Very good
Fourth student	50	100%		
Fifth student	50	100%		
Sixth student	50	100%		

The implementation stage is carried out after the media is declared valid and practically used in learning. At this stage, the Interactive Multimedia based on the developed PjBL model was implemented or tried out in the target schools of this development research to know the effectiveness of interactive multimedia based on the PjBL model on the learning outcomes of fifth-grade students on Ecosystem material. The media effectiveness test was done through pre-experiments with a one-shot case study design. Analysis was performed using the one-sample t-test formula. Before that, a prerequisite test, namely the normality test of data distribution, must be carried out. Based on the results of hypothesis testing with the one-sample t-test technique, it was found that the significance value (2-tailed) was 0.000. These results indicate that the significance value is less than 0.05 (5% significance level) or $p < 0.05$. That is, H0 is rejected, and Ha is accepted. Therefore, Interactive Multimedia based on the PjBL model with an orientation on environmental problems assisted by Articulate Storyline 3 effectively improves student learning outcomes in fifth-grade elementary school Ecosystem material.

The evaluation stage is the last in this development research. At this stage, evaluation is carried out at each stage of development to improve the development of Interactive Multimedia based on the PjBL model. The evaluation phase carried out is formative and summative evaluation. Formative evaluation is carried out during the development or at each stage, namely at the design, development, and implementation stages. The aspects observed in formative evaluation are the course of the research process and the products produced at each stage. At the same time, summative evaluation is the final evaluation of all stages to reflect on the research process so that the resulting product is high quality. All stages in the research model have been carried out properly. That is because all the problem formulation has been answered, and the research objectives have been achieved. Obstacles or problems that hinder the course of research, in general, are limitations in time and effort in developing products. Due to these limitations, the research was only carried out until the pre-experimental implementation.

Discussion

This interactive multimedia was developed based on the Project Based Learning (PJBL) model with an orientation on environmental issues that have undergone a process of feasibility, practicality, and effectiveness testing. Several reasons make interactive multimedia based on the PjBL model obtain very good ratings by experts and practitioners and are used effectively in the learning process to improve student learning outcomes. First, this development research produces interactive multimedia based on the project-based learning (PjBL) model on Ecosystem material for fifth-grade elementary schools. This interactive multimedia has its characteristics compared to other interactive multimedia because it is based on the PjBL learning model with an orientation on environmental issues. The topic of material in interactive multimedia based on the PjBL model is also only devoted to Ecosystem material, the content in interactive multimedia will be adjusted to the syntax of the PjBL model. The PjBL model can train students to work independently or in groups in making and producing something. In addition, the Project Based Learning Model involves students in solving a problem and provides opportunities for students to express further their creativity which is expected to improve student learning outcomes (Nair & Suryan, 2020; Rante Datu et al., 2020; Surya et al., 2018). The PjBL model has been taught several times at SDN 1 Baktiseraga. Even though the application could be more optimal, students have been assigned to do a project. Student project implementation activities will get hands-on experience because students can learn by doing. Implementing student projects is required to develop critical thinking skills to solve problems and find solutions to produce a product. Teaching and learning activities carried out through the project-based learning stage can improve skills in behavior,

such as teamwork, collaboration skills, and affection between group members, as well as achieving high-level abilities in the form of critical and creative thinking skills as needed in the 21st century (Ayu, 2021; Rahardjanto et al., 2019).

Second, in the development of Interactive Multimedia based on the PjBL model, there are learning videos and project problem videos. Learning with video media when associated with the cone of experience in Edgar Dale's theory of Cone of Experience video media is located in the "see video/film" section. This position means video/film media is better than audio or image media. Video media is media that presents information in sound and visual form. Learning with video media involves the senses more than other visual aids (Darma et al., 2022; Kamelia, 2019; Nurwahidah et al., 2021). The more senses are involved and used in the learning process. The more likely information can be understood (R. G. Pambudi & Industri, 2018; Yuanta, 2020; Zaharah, 2020). At SDN 1 Baktiseraga, the learning process uses video learning media accessed via Youtube. Using video as a learning medium can increase student enthusiasm for participating in learning. Video displays that attract students' attention can make it easier for students to understand the material (Hakami, 2020; Setyawati et al., 2022).

Third, learning with interactive multimedia based on the PjBL model in the Ecosystem is in line with Ausubel's learning theory because the material discussed will be explored by linking it to the real conditions of the environment around students, such as the problems presented in interactive multimedia based on the PjBL model related to environmental problems. How to help students absorb new knowledge from a material, the initial concept that students already have must be related to the concept to be studied so that it determines the success or failure of a learning process (Ardiani & Anak Agung Gede Agung, 2022). The provision of learning in elementary schools is carried out by inviting students to relate the subject matter to real conditions in the daily lives of students, which is by applying the learning theory introduced by David P Ausubel. The use of interactive multimedia in the learning process also aligns with constructivism theory which states that a learner needs to build his knowledge from experience (S. Lestari, 2022; Putri & Ardi, 2021; Suparlan, 2019). It is appropriate because, in interactive multimedia, students can be directly involved in operating it. Project-based interactive multimedia also directs students to carry out an activity that aims to solve problems and produce products. Activities that involve students directly in the learning process will provide experience for students to understand the material being studied and understand the material longer (Anggraini et al., 2021; Wedayanti & Wiarta, 2022).

The findings of this study are strengthened by previous studies stating that PjBL-based Interactive Multimedia developed with the assistance of Adobe Flash CS6 Software with Action Script 3.0 can be used in science learning (Dwi agus Setiawan & Nur Kumala, 2020). Interactive multimedia used as learning media is very interesting and effective in improving student learning outcomes (Wahyu Rahmadhani et al., 2022). PjBL model-based thematic teaching materials in elementary schools are declared valid and practical to be used in thematic learning processes (Ismail et al., 2021). Learning video media Theme 6 Sub-theme 2 for fourth-grade students at SD Negeri 17 Pasar Masurai 1 was declared successful based on the acquisition of media validation values in the very valid category and the practicality of using media in the very practical category (Prananda et al., 2021). Animated video media in fourth-grade students' learning in elementary schools is stated to be valid and effective in improving student learning outcomes (Ponza et al., 2018). Android applications oriented to Ausubel's theory of social studies content are explained that the results obtained from the development feasibility test shows that android applications based on Ausubel's learning theory are very suitable for use in fifth-grade social studies content as well as in the learning process (Adiutami & I Wayan Sujana, 2022).

Based on the discussion, interactive multimedia based on the Project Based Learning (PJBL) model is a media innovation effectively used in the learning process. The advantages of this Interactive Multimedia are that it is directly integrated with the Project Based Learning (PJBL) learning model, which can be accessed via a link/HTML, making it easy to use wherever and whenever. In addition, the visualization of this interactive multimedia is more interesting and creative, which can increase student motivation in learning. In addition, not only does it contain material, but this interactive multimedia also has learning videos that support the material, videos of project-related issues, and evaluations that are useful for students to understand the material they have studied well. However, this research also has limitations in the scope of material, levels, learning content developed in interactive multimedia based on the PjBL model, and the number of subjects used in product implementation. The limitations of this study are in the scope of material, levels, and learning content developed in interactive multimedia, as well as the number of subjects used in product implementation. The material developed in interactive multimedia is limited to the science learning content for odd-semester fifth graders in Chapter 2, Harmony in Ecosystems. The number of subjects involved in implementing this product was only 25 people using the One Shot Case Study research design. The implication of this research is to provide additional variations in the existence of learning media in the form of interactive multimedia based on the PjBL model, which is suitable for application in the learning process

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4. CONCLUSION

The interactive multimedia prototype based on the developed PjBL model consists of 3 main parts: the opening display, the initial display, and the main display, with the overall display designed with images, text, and videos that can improve the quality of learning activities. It is also supported by test results which state that PjBL-based interactive multimedia with an orientation to environmental issues is feasible, practical, and effective in improving learning outcomes for fifth graders of SD Negeri 1 Baktiseraga on Ecosystem material. It is recommended that teachers can apply learning media to the learning process so that learning can run optimally.

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