

Interactive media based on project-based learning using Lumi Education for IPAS subjects in 4th-grade elementary school

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Abstract

This research is motivated by the needs of fourth-grade students of SDN 5 Pandesari who tend to be passive and have low learning motivation, thus affecting the achievement of IPAS learning. The purpose of this study is to describe the development process, determine the validity, practicality, and effectiveness of PjBL-based interactive media using the Lumi Education application. This type of research is Research and Development (R&D) which uses the ADDIE development model as the basis for product development. The results in this study indicate that PjBL-based interactive media using the Lumi Education application: 1) valid for use in IPAS learning with a percentage of 96% from media experts with the category "Very valid", 92% from material experts with the category "Very valid", and 88% from linguists with the category "Very valid". 2) practical, with the acquisition of a percentage from teachers of 89% with the category "Very Practical", a limited trial of 86% with the category "Very Practical", and a broad trial of 87% with the category "Very Practical". 3) effective, with an N-gain score of 0.62 with a treatment effectiveness category of "Moderate". Based on these results, it can be concluded that this PjBL-based interactive media using the Lumi Education application is valid and practical for use in learning IPAS grade IV.

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1. Introduction

Low learning motivation and student activeness in class IV IPAS learning activities will affect student learning outcomes. As the researchers found in the observation and interview activities at SDN 5 Pandesari. Grade IV teachers in this school still use conventional methods without the support of creative and innovative media and activities. Meanwhile, fourth graders are more passive and easily bored, so the understanding and experience they gain from learning activities are not optimal. Furthermore, traditional methods do not match the characteristics and learning outcomes of IPAS itself, which aims to develop students' high levels of curiosity, ability to think critically and analytically, and ability to draw correct conclusions. (Dinda et al., 2023). The teaching of IPAS in elementary school itself is aimed at building students' skills in exploring and understanding the surrounding environment (Budiwati et al., 2023). Sagendra, (2022) said that IPAS learning in elementary schools needs to offer opportunities for students to explore and investigate so that their understanding of the surrounding environment can develop. Therefore, learning scenarios that involve students directly in IPAS learning activities are needed. However, the fourth-grade teacher of SDN 5 Pandesari explained that she sometimes finds it difficult to design a variety of learning that involves students.

Based on the above problems, many efforts can be made by teachers. Application of the project-based learning model is one of the ways. PjBL is very suitable for increasing student involvement in the classroom. PjBL is also proven to increase student learning motivation. The study demonstrated by Aji, et al., (2023) showed that students' motivation to learn can be increased through the use of PjBL. While a study by Kusuma & Japa, (2018) demonstrated that PjBL can improve student's learning outcomes in science education. PjBL itself has a basis or foundation that leads to John Dewey's theory of pragmatic and progressive learning (Williams, 2017; Fauzia, et al., 2020). In learning activities using the PjBL model, students are the main characters (Jalinus et al., 2017; Kusuma, 2018). Students are required to be able to explore the material more deeply, solve projects and problems that are structured in learning, and relate them to the real world (Duke et al., 2021). Apart from the student side, educators are also required to be more creative in implementing PjBL. (Tasci, 2015). Educators must be able to develop student's critical thinking skills and creativity without making the learning focus on the educator themselves. The advantage of PjBL is that it provides students with the opportunity to participate in

learning activities in a more direct and in-depth way through project-delivery activities. (Relmasira et al., 2019; Sholekah, 2020). In addition, with PjBL students can develop critical thinking, collaborative skills, analysis, and presentation of information (Anazifa & Djukri, 2017; Kokotsaki et al., 2016).

The process or stages of PjBL according to Eriza & Hadi, (2023) can be categorized into several phases, namely 1) Starting with basic questions, by asking students questions that relate to factual issues to generate initial discussion activities.; 2) Making project planning, through this phase students are expected to formulate project planning including actions, techniques, and also materials needed in the project completion process; 3) Developing a project completion schedule, in the form of schedule activities and stages of project completion by the teacher and agreed upon by students; 4) Monitoring project progress, in the form of supervision and assistance with project implementation by the teacher; 5) Measuring the results of the project, this phase is intended to determine the progress of each student and group, and provide feedback regarding the project stages that students have achieved; 6) Evaluating the overall experience, in the form of reflection activities on the entire project completion process by teachers and students.

The process towards the goals to be achieved with PjBL is very complex, so supporting components are needed to complete its implementation. The use of diverse, creative and innovative learning media is one of them. More research on the use of learning media can lead to creative and innovative learning (Rosario et al., 2021). Exploration of media use today is supported by widespread digitalization of education, aimed at improving learning quality (Alfiani et al., 2021; Setiawan & Kumala, 2020). There are so many technologies that can be utilized by teachers to develop learning media that are creative, innovative, interactive, and have easy and efficient preparation steps (Subhan et al., 2023). Media in learning is a tool used by teachers to clarify the delivery of messages with the aim of facilitating and accelerating the achievement of target learning objectives (Andriani & Ramadani, 2022; Agustina et al.). A media is said to be interactive if in its application the user can control the media freely. (Setiawan & Kumala, 2020). As for interactive learning itself, according to Hidayah et al., (2021) can be interpreted as a learning process that can create an educational learning atmosphere by involving interactions between teachers, students, and the surrounding environment. This interactive learning can help students connect more with teachers, peers, and the surrounding environment.

The utilization of interactive media using digital technology can help increase learning motivation, cognitive abilities, and the active role of students in the classroom (Dwiyi et al., 2020; Widayanti, 2023; Miaz et al., 2019). In addition, the use of technology in media development will also help educators hone their skills in the field of utilizing digital technology. Given that the current educational process must have evolved to adjust to the era of the industrial revolution that continues to roll forward (Kumala et al., 2020; Cholily et al., 2020). The utilization of digital technology in learning can be carried out, one of which is by utilizing the web or learning applications. Lumi Education is an example of a learning application that has proven to be feasible and effective to be utilized in learning activities (Azizovna, 2023; Oksaviona, et al., 2023). It is essentially a desktop application that allows users to create, edit, view and export interactive H5P (HTML5 Package) content for free both online and offline (Lumi, 2022). In addition to being utilized as a platform for creating interactive learning media, Lumi Education also allows teachers to upload and share their content with students that can be accessed online.

The use of interactive media development products using Lumi Education is proven to increase student interest in learning (Widayanti, 2023). This is in line with the study of Sumandal, (2023) who proves that utilizing Lumi Education can increase students' interest, motivation, and participation Triana et al. (2023) also proved that this platform has the potential to improve students' learning outcomes. Furthermore, other research on the application of Lumi Education was conducted by Depany, (2023) who found that the use of media through Lumi Education has the potential to improve students' critical thinking and communication skills. the researcher is interested in exploring the development of PjBL-based interactive learning media using the Lumi Education application in fourth grade IPAS learning, in the hope that through this application, it can help teachers improve the quality of learning in the classroom. In addition, the use of the PjBL model in the Lumi Education application has never been studied before. Therefore, it is a novelty in this study. The purpose of this study itself is to describe the development process and determine the degree of relevance, practicality and effectiveness of PjBL-based interactive media using the Lumi Education application.

2. Method

This study is a developmental research or Research & Development (R&D). The model used by the researcher to develop the product is ADDIE. The final product of this study is a PjBL-based interactive media on IPAS learning for 4th grade SD. The development process using the ADDIE model in this study is shown in Figure 1.

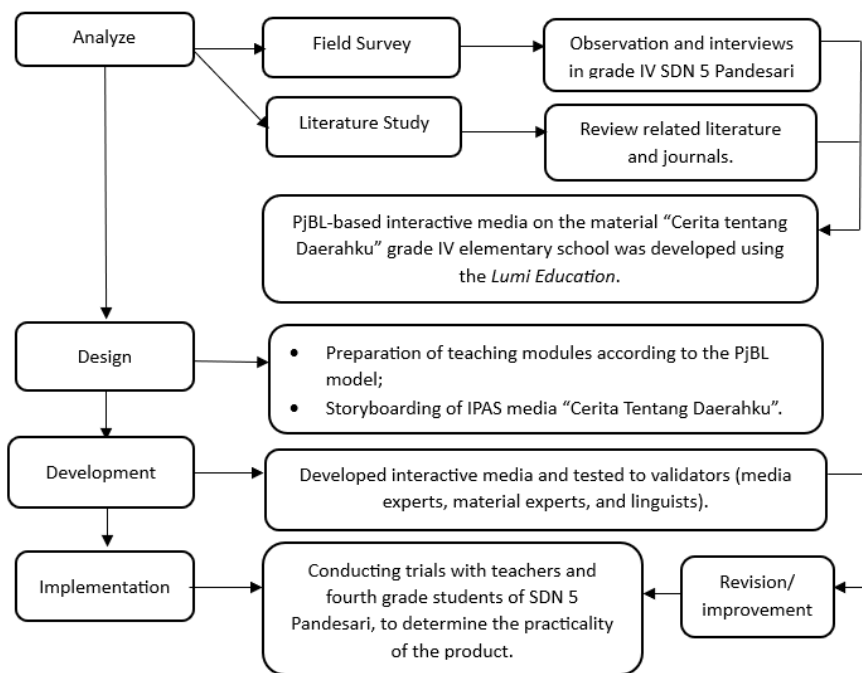


Figure 1. Initial Design of PjBL-Based Interactive Media Using Lumi Education Application

The location of this research was in class IV of SDN 5 Pandesari, Pujon Sub-district, in the academic year 2023/2024. Methods of data collection in this study included observation, interviews, documentation, questionnaires, and student evaluation questions. Observations were carried out to find out the IPAS learning process in the classroom, especially in the aspect of student activeness and also the availability of learning support facilities. Observation activities are supported by instruments in the form of observation sheets to facilitate researchers in measuring the results of these observations. Interviews in this study were conducted to obtain further information through the fourth grade teacher with a focus on the topic of student learning motivation, implementation of IPAS learning, and student learning difficulties. Documentation was carried out at all stages of the research by capturing each activity. Questionnaires in this study were used to measure the validity value from experts, as well as the practicality value from teachers and students. This questionnaire sheet itself consists of 3 validation questionnaires, 1 questionnaire for practicality by teachers, and 1 questionnaire for student responses. The contents of each questionnaire are arranged based on their respective indicators. The questionnaire sheet consists of positive questions with five answer options, namely 5 means very good, 4 means good, 3 means quite good, 2 means not good, and 1 means very bad. In addition, the validation and practicality questionnaires also contained one fill-in question intended as a place to provide further input by the respondents. The last data collection technique is student evaluation questions, which are used to measure student learning outcomes before and after treatment. This evaluation question consists of 10 multiple choice questions with HOTS, MOTS, and LOTS question types that are adjusted to the learning outcomes on the material "Stories About My Region".

The techniques of data analysis used in this research are qualitative and quantitative techniques.. The data that will be used in this study include: 1) Data obtained from the results of validation of PjBL-based interactive media using the Lumi Education application in elementary school IPAS learning by material, media, and language validators; 2) Data obtained from the results of practicality trials after going through the learning process in class IV SDN 5 Pandesari which consists of conducting a limited trial to 5 students, and a broad trial to 17 students; 3) Pre-test and post-test data obtained from the results of working on questions on the evaluation sheet instrument to measure the effectiveness of the product. The data that has been collected from the validation and practicality questionnaires in the form of quantitative data are presented in the form of Likert scale according to the criteria listed in Table 1 (Source: Pranatawijaya et al., 2019) and processed into qualitative data by interval analysis where the final results were transformed into the form of percentage values.

Table 1. Weighted Likert Scale Values

Criteria	Score
Very Good (SB)	5
Good (B)	4
Good Enough (CB)	3

Not Good Enough (K)	2
Very Bad (SK)	1

Here is the percentage calculation formula used to analyze the data that has been obtained through the validation and practicality questionnaires.

$$P = \frac{\sum x}{\sum x_i} \times 100\% \quad (1)$$

Description:

P	= Percentage of sub-variables
$\sum x$	= Total scores of each sub variable
$\sum x_i$	= Total maximum score

Through the percentage obtained, the level of validation and practicality of the product can be determined. The level of validation and practicality is classified into several categories which can be seen in Table 2 (modification of Tulniza and Hidayati, 2020).

Table 2. Criteria for Validation and Practicality of Lumi Education Interactive Media

Percentage (%)	Criteria	Description
85-100	Very Good	No Revision
69-84	Good	No Revision
53-68	Good Enough	Partial Revision
37-52	Not Good Enough	Revised
>36	Very Bad	Revised

The obtained data from the pre-test and post-test were analyzed for effectiveness through the Normalized Gain (N-gain) calculation to show the difference in student learning outcomes, before and after learning. The N-Gain calculation formula is shown below.

$$(g) = \frac{Sp_{post} - Sp_{pre}}{Smaks - Sp_{pre}} \quad (2)$$

Description:

(g)	= Gain score
Sp _{post}	= Post-test score
Sp _{pre}	= Pre-test score
Smaks	= Maximum score

Afterward, the obtained N-gain scores were converted into the following Table 3 (modification of Erawati dkk., 2020) criteria.

Table 3. N-gain Criteria

N-gain score	Criteria
N-gain > 0.70	High N-gain
0.30 ≤ N-gain ≤ 0.70	Medium N-gain
N-gain < 0.30	Low N-gain

3. Results and Discussion

3.1. Results

This development study will create a product in the form of a PjBL-based interactive learning media using the Lumi Education application. The phases of this development study include the phases of analysis, design, development, implementation, and evaluation based on the ADDIE research methodology. The analysis phase aims to collect data as a basis for product development (Ningrum et al., 2022). In the analysis phase, the researchers conducted a literature review and field survey in the form of observations and interviews at SDN V Pandesari. In the literature review, the researchers analyzed the curriculum and found that new subjects have been incorporated into the current Merdeka curriculum. That is IPAS who combining Science and Social Studies. IPAS is offered with the hope that students will be able to manage their natural and social environments in an integrated way. (Dinda et al., 2023). In addition to the novelty in subjects, the independent curriculum also includes project learning. When researchers conducted a field study in class IV of SDN 5 Pandesari, researchers found that this school had implemented the independent curriculum. Meanwhile, in its implementation, the fourth grade teacher admits that sometimes it is difficult to implement project learning. This is due to the

concept and supporting media that must vary in each learning project, as well as the character of students who tend to be passive and easily bored. On the day the researchers conducted observations, the implementation of IPAS learning in Class IV SDN 5 Pandesari still used a conventional model. Where the teacher only explains the material and students listen and then solve the evaluation questions. These findings underlie researchers to develop a PjBL-based interactive media using the Lumi Education application.

The design stage, in this stage the researcher designs the product according to the results of the analysis. First, researchers designed the Teaching Module in accordance with the CP and TP in the IPAS Chapter 5 Material "Cerita Tentang Daerahku", and adjusted to the steps of the PjBL model. Next, researchers create an interactive media storyboard that will be compiled using the Lumi Education application. In addition, in this stage, researchers also collected media constituent content such as text, images, links, and interactive activities. The images that researchers collected were mostly sourced from the Pinterest and Freepik platforms. Interactive activities, researchers get through features that already exist in the Lumi Education application. The link feature in the media is a link to news events in Malang Regency and its surroundings. The results of this first draft design can be seen in Figure 2 below.

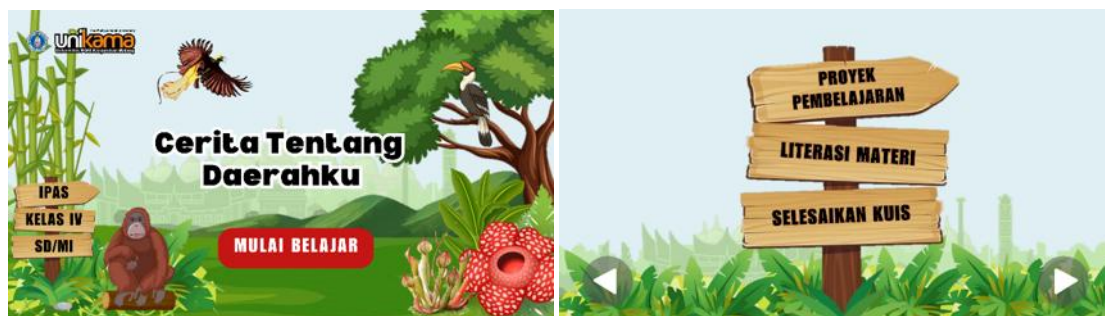


Figure 2. First Draft Design of PjBL-Based Interactive Media Using Lumi Education Application

The development stage is the stage of making media according to the concept that has been designed. This interactive media development process utilizes the Lumi Education application as the main platform. The process of making this media includes designing the background and appearance of the media, preparing learning scenarios according to the teaching module, to including interactive features in the media. After the media creation process through the Lumi Education application is complete, the next step is to carry out the validation test of the resulting product. This validation test was carried out with 3 validators, consisting of media experts, linguists, and material experts. The results of product validation by experts showed the acquisition of values as listed in Table 4, namely 96% from media experts with the category "Very valid", 92% from material experts with the category "Very valid", and 88% from linguists with the category "Very valid".

Table 4. Results of Product Validation by Experts

Subject	Percentage (%)	Criteria
Media Expert	96	Very valid
Material Expert	92	Very valid
Linguist	88	Very valid

The implementation stage, at this stage, tested the practicality of the product through the fourth grade teacher, limited trials on 5 students, and a broad trial on 17 fourth grade students of SDN 5 Pandesari as the research subject. The results obtained from the practicality test by the teacher were 88.8% with the category "Very Practical", the limited trial was 85.6% with the category "Very Practical", the broad trial was 87.2% with the category "Very Practical". Furthermore, the researcher present the results of the practicality test in Table 5.

Table 5. Results of Product Practicality Test by Teachers and Students

Subject	Percentage (%)	Criteria
Teacher	88.8	Very practical
Small Group Students	85.6	Very practical
Large Group Students	87.2	Very practical

At the implementation stage, the product effectiveness test was also carried out through measuring student learning outcomes before and after treatment. The average score of students before being given treatment measured through the implementation of the pre-test was 58.8 and after being given treatment, the average score of the students through the implementation of the post-test was 84.1. The following researchers present a diagram of the average acquisition of student scores which can be seen in Figure 3. Furthermore, the acquisition of values obtained through the pre-test and post-test of each student is then measured through the

calculation of Normalized Gain (N-gain). The average N-gain score in this study was 0.62 with a treatment effectiveness category of "Moderate".

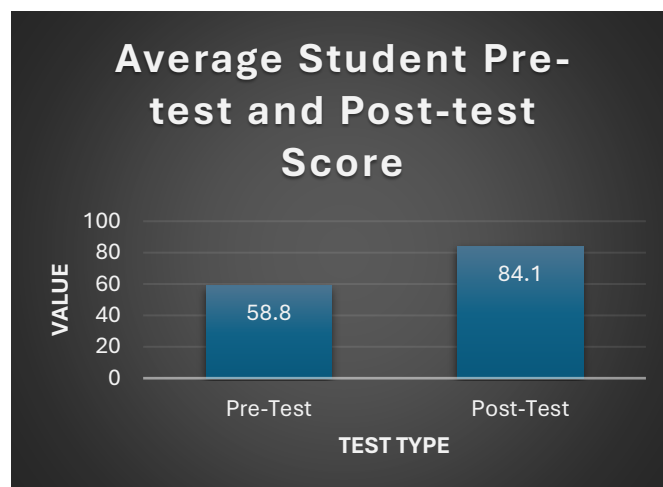


Figure 3. Results of the Average Students Pre-test and Post-test Scores

Evaluation Stage, at this stage an analysis of product deficiencies is carried out which is obtained through qualitative data from the results of validation tests by experts, and practicality tests by fourth grade teachers as practitioners. In this interactive media product using Lumi Education, researchers received corrections from experts to add a home button, the number of news links, developer profiles, and include an instruction manual as a companion to the product.

3.2. Discussion

The development product in this research is PjBL-based interactive learning media using the Lumi Education application aimed at grade IV SD, especially in IPAS learning. This interactive learning media utilizes digital technology, namely the Lumi Education application. The utilization of digital technology adapts to the era of the industrial revolution 4.0 which requires educators to implement technological aspects in learning activities (Mahadewi et al., 2019; Setiawan & Kumala, 2020). In addition, the content in this research product is compiled based on the latest curriculum, namely the Merdeka Curriculum. So that the content presented contains relevant learning material. The product of this study also represent real problems present in students' environments, following the PjBL model where learning is linked to problems and real-life situations in students' environments. (Wahyuni & Rahayu, 2021). These things make interactive learning media products in this study can be said to be valid for use in learning. It is also proven by the acquisition of the "Very Valid" category value from three expert validators.

In the practicality test, the product in this study has received the category "Very Practical" both from teachers, small group students, and large group students. This interactive media product can indeed be used very easily because it is equipped with instructions on each navigation feature and also interactive activities. In addition, the features in this interactive learning media product include a variety of activities that can be filled directly by students during learning. The variety of interactive activities in the media can increase student learning motivation so that it also affects the improvement of student learning outcomes (Setiawan & Kumala, 2020). In line with similar research on interactive media conducted by Harahap & Siregar, (2020) which proves that the application of interactive learning media can increase student motivation and learning outcomes. Access to this media page is also very simple, only through links and barcode scans students will be directed directly to the media display page on the Lumi Education page. Students can access the media through their smartphones and computers flexibly, anywhere and anytime.

Through the effectiveness test, it was found that the implementation of interactive learning media based on PjBL using the Lumi Education application can improve student learning outcomes. The results of this increase are certainly inseparable from the influence of the learning model used, namely PjBL. PjBL provides experience for students to be directly involved in each stage of learning (Jalinus et al., 2017; Kusuma, 2018). The following is the effectiveness of the PjBL model when examined at each step: 1) Through the step of providing basic questions, students will be able to link learning activities with the real world, because the questions are given based on factual problems. Students' ability to solve problems will also be developed in this stage. Proven by Rahmzatullaili et al., (2017) that PjBL can improve students' ability to solve problems; 2) Making project planning, in this stage students are required to develop their critical thinking skills in order to develop a project

design that will be completed. In line with research Winarti et al., (2022) and Damanik & Situmorang, (2022) who have proven that PjBL can increase students' ability to think critically.; 3) Develop a project completion schedule, in this step students will discuss with group members and also the teacher. So, through PjBL, students' collaborative skills and decision-making skills will be developed (Kumalaretna & Mulyono, 2017). 4) Monitoring project progress, at this stage the teacher monitors student performance, while students are in the process of completing the project. Where PjBL encourages students to be more active, creative, and collaborative. In line with research Yasa et al.(2023) and (Titu, 2015) about improving creative thinking skills through PjBL; 5) Measuring project results, students can improve their communication and evaluation skills at this stage. 6) Evaluating the whole experience, at this stage students will gain a complete knowledge. So that their understanding of learning will increase. These factors make PjBL effective to be used in learning. Apart from the influence of using the PjBL model, the preparation of activities in the media also has an influence on the effectiveness of the product. The activities in the media invite a lot of direct student interaction, such as answering questions through text and voice recordings, summarizing the results of discussions directly in the media slides, and also mini games. Students consider these activities as new and interesting in learning activities, so that it will affect the improvement of their understanding and learning outcomes. This is aligned with research (Wulandari et al., 2017) which found that there was an increase in student activity and learning outcomes through interactive multimedia with educational games.

Through the presentation of the scores in each trial category, we can conclude that this PjBL-based interactive learning media using the Lumi Education application is valid, practical, and effective to be implemented in IPAS learning activities for grade IV SD. The results of this study are in line with similar research conducted by Anyan et al., (2023) who argued that the use of interactive media using Adobe Flash Professional applications can increase student interest and learning outcomes. The same results were also obtained by Antari et al., (2023) where the results of student learning in IPAS learning can be improved through the use of PjBL-based electronic modules. Because the products produced in this study proved to be valid, practical, and effective, researchers hope that this product can help teachers to create more optimal learning activities, and help improve the achievement of learning objectives in IPAS learning itself. Researchers also hope that the results of this development research can be used as a reference for further research.

4. Conclusion

The findings of this study suggest that a PjBL-based interactive learning media product using the Lumi Education application was developed based on the five-phase ADDIE research procedure. Through the analysis stage, it is shown that PjBL-based interactive learning media needs to be developed for grade IV SDN 5 Pandesari, especially in IPAS learning. At the design stage, a design in the form of teaching modules and storyboards has been produced which will be used as the basis for making products. At the development stage, PjBL-based interactive media products were produced using the Lumi Education application and also the implementation of product validation tests. The results of the product validation test stated that the PjBL-based interactive media using the Lumi Education application was valid for use in IPAS Learning with the category "Very Valid" and a percentage of 96% from media experts, 92% from material experts, and 88% from linguists. Furthermore, at the implementation stage, where the product is tested on teachers and fourth grade students of SDN 5 Pandesari to see its practicality and effectiveness. The results of the implementation stage show that PjBL-based interactive media using the Lumi Education application is practical and effective for use in IPAS Learning with the acquisition of the "Very Practical" category and a percentage of 88.8% from fourth grade teachers, 85.6% from small group students, and 87.2% from large group students. The average student pre-test score was 58.8 and the average post-test score was 84.1. Then the acquisition of the effectiveness category "Moderate" with an average N-Gain score of 0.62. The evaluation stage, carried out through revisions and improvements to the suggestions obtained from experts at each stage.

Based on the conclusions of the above research findings, the researchers make the following suggestions: 1) for schools, the use of PjBL-based interactive media can be used as an alternative in an effort to maximize the delivery of material in IPAS learning. 2) for teachers, the use of interactive applications such as Lumi Education can make it easier for teachers to create creative, innovative, and fun learning. The use of this kind of application can also improve the skills of teachers. 3) for other researchers, this research can be used as a reference or consideration in conducting similar research.

Author Contributions

All authors have equal contributions to the paper. All the authors have read and approved the final manuscript.

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