Randwick International of Education and Linguistics Science (RIELS) Journal
Vol. 5, No. 2, June 2024 | Page 535-551 |
https://www.randwickresearch.com/index.php/rielsj

Development of Interactive Learning Media Based on Problem-Based Learning: Improving Geography Learning Outcomes

DOI: https://doi.org/10.47175/rielsj.v5i2.989

| Diki Audina[1,*] | Abdul Hamid K[2] | R. Mursid[3] |

[1,2,3]Department of Education Technology, Postgraduate, Universitas Negeri Medan, Medan, Sumatera Utara, Indonesia

[*]dikiaudina1992@gmail.com

ABSTRACT

The aim of this research is to produce interactive learning media based on a problem-based learning model that is feasible, practical, and effective in improving student learning outcomes in geography subjects. The ADDIE development model was the type of research used. The results of the research show: the material validation test obtained a score of 98% in the very feasible category, the media validation test obtained a score of 94% in the very feasible category, the design validation test obtained a score of 100% in the very feasible category, the individual and small group trials obtained a score of 86% in the very feasible category. , and the field trial obtained a score of 91% in the very worthy category, with an overall average result from the respondent category of 93%. The use of PBL-based interactive learning media in the experimental class obtained an average learning outcome of 84.17, while in the control class, which used video media and printed books, it obtained an average learning outcome of 79.50. The research data was declared normal and homogeneous. The results of the independent samples t test show tcount = 2.38 and ttable = 2.00 with a significance level of α = 0.05, so tcount > ttable. It can be interpreted that H0 is rejected and H1 is accepted, which means that the PBL-based interactive learning media product developed is effective. Furthermore, based on the results of the N-Gain calculation, a score of 60.78% was obtained, so this PBL-based interactive learning medium is classified as "quite effective" in the "medium" category.

KEYWORDS

interactive media; Problem-Based Learning; geography

INTRODUCTION

Education is expected to be able to accompany students in developing their potential, but the implementation of education is only a formality and an obligation that must be carried out. The implementation of education in the field needs to be improved so that it can realize the ideals of national education, namely developing the potential of students to become human beings who have faith and are devoted to God Almighty, have noble character, are healthy, knowledgeable, capable, creative, independent, and become democratic and responsible citizens.

Things that are the focus of efforts to improve the quality of education include the teaching staff, namely the quality of teachers, instructional design, funding, facilities, and infrastructure, as well as the entire ecosystem involved in educational institutions, including students and the community/parents of students. In this regard, it is the duty of

all ecosystems involved in educational institutions to achieve quality education as expected.

Implementation in the field still found teachers who were not active independently or in an organized manner utilizing the self-development facilities that were available, such as PMM (Free Teaching Platform), Teacher Mobilization Program, Batik Maker (ICT-based learning), and others. Many teachers are comfortable with their existing habits, so they are reluctant to upgrade themselves as a means of implementing higher-quality learning.

The complex problems above must, of course, receive special attention to improve education in Indonesia in general as well as the quality of education, especially in the schools where each is assigned. For this reason, all educational actors should take part in carrying out their duties with a full sense of responsibility. Problems in learning at Maitreyawira Deli Serdang Private High School in the implementation of learning are still found to be obstacles that need to be considered as evaluation material. The obstacles encountered during learning are students' low interest in learning; most students still think that studying geography is not that important; and when using cellphones in learning, class conditions become more uncontrolled.

Children's fighting power in other subjects apart from that is still relatively low, including geography subjects. This affects students' learning outcomes in geography subjects in the hydrosphere material, which is still relatively low when viewed from a classical perspective. Geography as a subject in school is very important in that it can contribute to overcoming local, regional, and world problems, as well as forming responsible citizens who contribute to national and world problems. In accordance with the concept of Pancasila students with global diversity, The scientific characteristics of geography are truly one of the subjects taught at the primary, secondary, and tertiary levels of education.

Learning outcomes are students' abilities obtained after learning activities (Nugraha, 2020). Learning outcomes are certain competencies or abilities achieved by students after following the teaching and learning process and include cognitive, affective, and psychomotor skills (Wulandari and Mudinillah, 2022). The opinion of Mustakim (2020) is that learning outcomes are everything achieved by students with certain assessments that have been determined by the curriculum of previous educational institutions.

According to Prastowo (2015), learning is a process of a person's mental activity in interacting with the environment so that it has an impact on positive changes in behavior, including changes in aspects of attitude, knowledge, and skills.

Interactive learning media is a teaching delivery system that presents material in various ways, such as recording a video recorder with a computer (Arjulayana, 2018). Interactive learning media are media that are designed as a whole, such as images, text, audio, animation, and simulations, which are used in learning to clarify abstract material or concepts into concrete ones that are equipped with tools and provide flexibility in operating the learning media (Deliany et al. 2019).

Interactive learning media has many advantages, such as presenting information in the form of text, images, and sound simultaneously. Sadiman (2014) states that there are four benefits of interactive learning media: (1) to clarify the presentation of the message so that it is not too verbalistic; (2) to overcome limitations in space, time, and sensory power; (3) to overcome the passive nature of students; and (4) to make it easier for teachers to convey the content of lesson material. To produce quality learning media, it is necessary to contribute learning models that can attract students' attention.

Interactive learning media are all forms and means of conveying information that are created or used in accordance with learning theory and can be used for learning purposes in

conveying messages, stimulating students' thoughts, feelings, attention, and will so that they can encourage a learning process that is deliberate, purposeful, and controlled (Suryani, 2018). Reddi & Mishra (2003) stated that interactive media is an integration of elements of several media (audio, video, graphics, text, animation, etc.) into one synergistic and symbiotic whole that produces more benefits for the end user than any one of them. media elements can provide individually.

The statement about interactive learning media above is relevant to the results of Hutagalung's (2021) research, which states that the interactive learning multimedia developed is able to improve learning outcomes. In line with that, based on the results of direct observations that have been carried out in class, another alternative solution for overcoming problems in learning geography in the classroom is by implementing an innovative learning model in the classroom, namely the PBL model.

According to Duch (1995), the meaning of the PBL model is a teaching model that is characterized by real problems as a context for students to learn critical thinking and problem-solving skills and gain knowledge. According to Suyatno (2009), PBL is a problem-based learning model where the problem is used as a stimulus that encourages students to use their knowledge to formulate a hypothesis and search for relevant information in a student-centered manner through discussion in a small group to obtain a solution to the given problem.

According to Lubis et al. (2023), the PBL model is defined as a learning model that involves students trying to solve problems by going through several stages of the scientific method so that students are expected to be able to learn knowledge related to the problem and, at the same time, to have skills in solving problem.

Research by Dewantara et al. (2020) shows the need for PBL-based interactive multimedia on biology material. The results of this research show that 67.2% of students stated that immune system material was the material that was considered the most difficult, 93.3% of students wanted the development of new learning media, and 54% of students wanted interactive multimedia. The conclusion of this research is that it is necessary to develop learning media in the form of PBL-based interactive multimedia on the "Immune System" material for class XI SMA.

Arifin (2014) states that there are three main characteristics of problem-based learning: (1) It is a series of learning activities, meaning that in its implementation, there are a number of activities that students must carry out. Problem-based learning requires students to be actively involved in communicating, developing thinking power, searching for and processing data, and drawing up conclusions, not just listening, taking notes, or memorizing learning material. (2) Learning activities are directed at solving problems. Without problems, learning will not occur; (3) problem solving is carried out using a scientific thinking approach.

According to Rusman (2012), the characteristics of the PBL learning model are as follows: (1) The problem becomes the starting point in learning; (2) The problems raised are unstructured problems that exist in the real world; (3) Problems require multiple perspectives: (4) Problems challenge students' knowledge, attitudes, and competencies, which then require identification of learning needs and new areas of learning; (5) Learning self-direction is the main thing; (6) Utilization of diverse knowledge sources, their use, and evaluation of information sources is an essential process in PBL; (7) Learning is collaborative, communicative, and cooperative; (8) Developing inquiry and problem solving skills is as important as mastering content knowledge to find a solution to a problem; (9) synthesis and integration of a learning process; and (10) PBL involves evaluating and reviewing student experiences and learning processes.

Meanwhile, according to Trianto (2009), the characteristics of the PBL learning model are: (1) asking questions or problems; (2) focusing on inter-disciplinary relationships; (3) authentic inquiry; (4) producing products or work and presenting them; and (5) cooperation.

In compiling PBL-based interactive learning media, the use of the Canva application will be assisted as a tool that will be used to develop PBL-based learning media. Canva is a graphic design platform that allows users to create various types of visual content easily without requiring in-depth graphic design skills. The app is designed to be a user-friendly tool, allowing people of all skill levels to create attractive and professional designs.

According to Wulandari & Mudinillah (2022), Canva is an application that is popular among teachers to use in creating learning media. There are various interesting template features for use in creating learning media that were developed to design interactive learning media so that Canva media has a more communicative meaning and visualization of learning media that attracts more students' attention.

Canva is an online design application that provides various graphic designs such as infographics, video, audio, ppt, resumes, flyers, posters, and so on (Mudinillah, 2022). Triningsih (2021) explains that Canva can make it easier for teachers and students to carry out learning activities based on technology, skills, creativity, and other benefits. This is because it can attract students' attention and interest in learning by presenting more interactive learning media.

Pelangi (2020) explains the benefits of Canva for teachers and students, namely as a technology-based application that provides a learning space for teachers who carry out learning by relying on the learning media contained in the Canva application. Using the various templates provided by Canva is not only useful for teachers, but students also feel the benefits of gaining more creative and interesting learning knowledge.

The formulation of the problem in this research includes: (1) how to develop PBL-based interactive learning media products (PBL); (2) what is the feasibility level of PBL-based interactive learning media; (3) what is the level of practicality of PBL-based interactive learning media; and (4) what is the level of effectiveness of PBL-based interactive learning media.

RESEARCH METHODS

This research was carried out at Maitreyawira Deli Serdang Private High School. The time for carrying out the research is in the even semester of the 2023–2024 academic year in class X SMA.

The subjects of the research were students at Maitreyawira Deli Serdang Private High School. This type of research, namely research and development, is research that aims to produce a product through a development process (Mulyatiningsih, 2013).

The development model used in this research is the ADDIE development model developed by Lee and Owens (2004). The ADDIE development model is more appropriate to use for developing application-based learning media, the development stages are used systematically and are easy to understand in developing learning media. There are five stages in the ADDIE development model, namely: (1) analysis, (2) design, (3) development, (4) implementation, and (5) evaluation.

The data collection techniques that will be used in collecting data in this research are as follows: observation, interview, questionnaire, and learning results test.

The Learning Outcomes Test is used to measure students' cognitive learning outcomes. The level of difficulty of the test used to measure students' cognitive abilities in the pretest and posttest is the same. Previously, 35 questions were tested, but after being tested, 20

questions were declared valid. The following is a grid of questions after testing (validity).

Table 1. Grid of learning outcomes test questions

No	Subject matter	Question Domain	Number of Questions
1	Understanding hydrology	C4	1
2	Elements of the hydrological cycle	C3-C5	3
3	Various types of hydrological cycles	C4	2
4	Inland waters	C3-C4	3
5	Groundwater and watershed conservation	C4-5	3
6	Sea waters	C4-C5	3
7	Territorial sea boundaries, continental shelf and EEZ	C4	2
8	Potential, distribution and utilization of sea water	C4	3
Amount			20

Trial of the Learning Outcome Test Instrument

Before the learning outcomes test is used to collect data, the test is first tried to find out whether it meets the requirements for test validity, test reliability, test difficulty index, and test discriminating power.

Test Validity Test

The validity of test items shows the accuracy of a test item to measure what it wants to measure. This can be determined by correlating the scores obtained from the test items with the total score. By using the product moment correlation formula with rough numbers proposed by Pearson as follows:

$$r_{xy} = \frac{N\Sigma xy_{-(\sum x)}(\sum y)}{\sqrt{(N\Sigma x^2 - (\sum x)^2(N\Sigma y^2 - (\Sigma y)^2)}}$$

Information :

r_{xy} = Test validity coefficient
N = Total number of students
X = Item score
Y = Total item score

The test validity test was carried out to compare the results of the rcount calculation with rtable using a significance level of 5%. If $r_{table} > r_{count}$ then the question item is said to be invalid, conversely if $r_{table} < r_{count}$ then the question item is said to be valid.

Test Reliability Test

Test reliability shows the consistent level of a test when used on the same subject at different times. This means that a test will give relatively the same results. The reliability of geography learning outcomes tests using PBL-based interactive media will be calculated using the Cronbanch Alpha formula**.**

The test reliability index obtained is consulted with the correlation index, as follows:

Table 2. Question Item Reliability Criteria

Correlation Figures	Information
0,80 - 1,00	Very High
0,60 - 0,79	High
0,40 - 0,59	Medium
0,20 - 0,39	Low
0,00 - 0,19	Very Low

(Source: Arikunto, 2018)

Data analysis technique

The data obtained from the validation and trial processes is in the form of quantitative and qualitative data. Quantitative data in the form of suggestions and responses from respondents. This data is used as a guide when revising the product being developed. Quantitative data from the questionnaire results is analyzed using descriptive statistics to find the average of the assessment results, then converted to qualitative data so that the quality of the media product being developed is known.

Interpretation of the appropriateness of the material, interactive learning media, and learning design is carried out through descriptive statistical calculations. Data collection was carried out using questionnaires distributed to material, media, and design experts to provide an assessment of the feasibility of the interactive media being developed.

Table 3. Likert Scale Categories

No	Category	Value Score
1.	Very Worth	4
2.	Decent	3
3.	Inadequate	2
4.	Not Eligible	1

(Source: Sugiyono, 2020)

Data processing is carried out using the following formula

$$\ddot{P} = \frac{X}{Xi}\ x\ 100\%$$

Information:

P : Percentage

X : Respondent's answer in one item

Xi : Ideal value in one item

Formula for processing data for all items

$$P = \frac{Number\ of\ Scores\ Obtained}{Sum\ of\ Ideal\ Scores\ for\ All\ Items}\ x\ 100\%$$

To see the feasibility criteria which state that the product being developed is suitable for use, see Table 4 below:

Table 4. Feasibility Percentage Scale

Percentage of Achievement	Criteria
76 – 100 %	Very Eligible
56 – 75 %	Eligible
40 – 55 %	Enough
0 – 39 %	Not Eligible

(Source: Arikunto, Suharsimi, 2018)

To find out whether the distribution of learning outcomes data is normal or not, you can use the normality test. To test the homogeneity of data, the F test can be used. The test criteria are if Fcount < Ftable at a significance of 0.05 then the research data is homogeneous.

Hypothesis testing

$H_0 : \mu_1 = \mu_2$
$H_1 : \mu_1 > \mu_2$
Information:
μ_1 : average learning outcomes of students taught using PBL-based interactive learning media in geography subjects.
μ_2 : average learning outcomes of students who are not taught using PBL-based interactive learning media in geography subjects.

To test the hypothesis, the T independent sample test formula will be used. With a value of $\alpha = 0.05$ (two tail test)

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{n_1 + n_2 - 2}\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

Information:
t : calculated price
$\bar{x}_1$: average score of the experimental class
$\bar{x}_2$: average score of the control class
n_1 : number of experimental class samples
n_2 : number of control class samples
S_1^2 : experimental class group variance
S_2^2 : control group variance

The test criteria are H0 accepted if tcount < ttable and H0 rejected if tcount > ttable obtained from the t distribution list with good dk = (n-1) and $\alpha = 0.05$ level.

N-Gain Test

The N-Gain test was carried out to test effectiveness, by comparing the pretest and posttest results from the experimental class and control class. Data analysis in testing the effectiveness of the PBL-based interactive learning media developed uses the following formula:

$$N\ Gain = \frac{Post\ Test\ Score - Pretest\ Score}{Ideal\ Score - Pretest\ Score}$$

The ideal score is the maximum or highest score that can be obtained. The distribution of N Gain value categories can be seen in Table 5 below.

Table 5. Categorization of N-Gain Score

N-Gain Value	Category
g > 0,7	High
0,3 ≤ g ≤ 0,7	Medium
9 > 0,3	Low

(Source: Guntara, 2021)

Based on Table 5, learning media is said to be effective if student learning outcomes obtain an N-Gain score > 0.3 in the medium or high category. Meanwhile, the division of N-Gain acquisition categories in the form of percent (%) can be seen in Table 6 below:

Table 6. Interpretation of N-Gain Percentage

Percentage (%)	Interpretation
> 40	Ineffective
40 – 55	Less Effective
56 – 75	Moderately Effective
>76	Effective

(Source: Hakke, R.R. (Hartati, 2016))

Based on Table 6 above, learning media can be said to be effective if students' learning outcomes obtain an N-Gain percentage score of >56 in the category of quite effective or effective.

RESULTS AND DISCUSSION

Results

The feasibility of PBL-based interactive learning media is based on the validation results of expert lecturers consisting of 1 material expert validator, 1 media expert validator, and 1 design expert validator.

Validation is carried out by sending a PBL-based interactive learning media link using the Canva application to the validators along with a validation sheet for further inspection and assessment of suitability by the validators. The validation data obtained from expert lecturers are as follows:

Table 7. Learning Material Expert Validation Results

No	Assessment Aspects/Indicators	Score	(%)	Criteria
I. Comprehensive View				
1.	The cover design depicts geography learning	4	96%	Very Eligible
2.	Learning objectives are in accordance with learning outcomes	4		
3.	Attractiveness of Media page design visualization	4		
4.	Media content framework structure	4		
5.	Instructions or instructions for using Media	4		
6.	Media is adapted to student characteristics	4		
7.	Adequate references/sources of reading material	3		
II. Format and Writing				
8.	Limitations on each subject matter in the media	3	96%	Very Eligible
9.	Everything is identified and can be read clearly	4		
10.	Clarity of the numbering system for each page	4		
11.	Systematic content layout in Media	4		
12.	Consistency of the material presentation system in Media	4		
13.	The relationship between layout and student learning needs	4		
III. Fill				
14.	Conformity of material coverage with learning outcomes	4	89%	Very Eligible
15.	Arrangement of material in accordance with the flow of learning objectives	4		
16.	Suitability of material coverage with learning needs	3		
17.	Media content varies according to students' diverse learning styles	3		

No	Assessment Aspects/Indicators	Score	(%)	Criteria
18.	Description of the media developed to describe geography learning	3		
19.	Instructions for using the media are clear	4		
20.	Media is developed referring to learning objectives	4		
21.	Media implicitly describes student activities	3		
22.	Completeness of essential materials	3		
23.	Delivery of the final learning objectives in accordance with the elements in geography learning	4		
24.	There is an initial learning assessment to measure students' initial understanding	3		
25.	There is a formative assessment that supports the student learning process	4		
26.	There is a summative assessment to measure students' cognitive aspects	4		
27.	The assessment developed can measure student understanding	4		
IV. Language				
28	Good and correct use of Indonesian	3	85%	Very Eligible
29	Clarity of sentences used in the media	3		
30	Ease of understanding language in media	3		
31	Suitability of language to students' level of thinking	4		
32	The arrangement of each slide in Media is easy to understand	4		
V. Independent Study				
33	Media can attract students' interest in learning	3	88%	Very Eligible
34	Media can help students learn independently	4		
Average			91%	Very Eligible

Table 8. Media Expert Validation Results

No	Assessment Aspects/Indicators	Score	(%)	Criteria
I. Comprehensive View				
1.	Clarity of instructions for using Media	4	82%	Very Eligible
2.	Flow consistency	3		
3.	Sustainability	3		
4.	System efficiency	4		
5.	Layout	2		
6.	Tools function properly	3		
7.	Media can be used easily	4		
II. Quality (Technical/Appearance)				
8	Display quality Media	3	75%	Eligible
9	Text readability	3		
10	Selecting type and size of letters	2		
11	Letters in Media can be read easily	3		
12	The animation displayed is very interesting	3		
13	Harmony of background color with button placement in Media	4		
III. Quality of Audio Use				
14	Video player sound	4	92%	Very Eligible
15	Sound and video settings	3		
16	Videos supporting material	4		
Average			83%	Very Eligible

Student trials were carried out to identify deficiencies in the PBL-based interactive learning media being developed and to determine students' responses to the media being developed.

Table 9. Individual Trial Results

No	Assessment Aspects/Indicators	Respondent			%	Criteria
		1	2	3		
I. Appropriateness of Content						
1.	Clarity of study guide	4	4	4	100%	Very Eligible
2.	Systematic material arrangement	3	4	4	92%	Very Eligible
3.	Material Suitability	3	4	4	92%	Very Eligible
4.	Assignment in accordance with PBL syntax	4	3	3	83%	Very Eligible
5.	Evaluation according to the material topic	4	3	4	92%	Very Eligible
II. Quality (Technical/Appearance)						
6.	Beauty of the main layer appearance	3	3	4	83%	Very Eligible
7.	Readability of text on the main screen	4	4	3	92%	Very Eligible
8.	Image suitability	4	4	3	92%	Very Eligible
9.	Color composition	3	3	3	75%	Eligible
10.	Ease of displaying the contents of links on the main media screen	3	3	2	67%	Eligible
III. Usefulness						
11.	Level of understanding of material using the media developed	3	3	3	75%	Eligible
12.	Ease of learning using the media developed	3	4	4	92%	Very Eligible
13.	Interest in learning using developed media	4	3	3	83%	Very Eligible
14.	Attractiveness and convenience of the PBL model	3	3	4	83%	Very Eligible
Average					86%	Very Eligible

Table 10. Results of Small Group Trials

No	Assessment Aspects	Average Percentage (%)	Criteria
1.	Content Eligibility	85%	Very Eligible
2.	Technical Quality/Appearance	83%	Very Eligible
3.	Usefulness	90%	Very Eligible
Average		86%	Very Eligible

Table 10 above shows the results of a small group trial with 10 respondents obtaining an average score of 86% with the criteria "very feasible". Thus, the development of PBL-based interactive learning media is ready to be used in learning activities in geography subjects.

Table 11. Field Trial Results

No	Assessment Aspects	Average Percentage (%)	Criteria
1.	Content Eligibility	90%	Very Eligible
2.	Technical Quality/Appearance	92%	Very Eligible
3.	Usefulness	93%	Very Eligible
Average		**91%**	Very Eligible

Based on the data in Table 11 above, the average value of field trial results is 91% with the criteria "very feasible". These results were obtained from the recapitulation of 30 students responding to the PBL-based interactive learning media that was developed. So it can be concluded that PBL-based interactive learning media has met the eligibility requirements to be applied to geography learning in the classroom.

Table 12. Recapitulation of Media Validation Results

No	Respondent/Validator	Average Percentage	Criteria
1.	Subject Matter Expert	99%	Very Eligible
2.	Media Expert	94%	Very Eligible
3.	Design Expert	100%	Very Eligible
4.	Practicality Test (Teacher)	95%	Very Eligible
5.	Individual Trial	86%	Very Eligible
6.	Small Group Trial	86%	Very Eligible
7.	Field Trial	91%	Very Eligible
Average		**93%**	Very Eligible

Data on Learning Outcomes of Experimental Class Students

The effectiveness of PBL-based interactive learning media in geography subjects developed using the Canva application can be measured by analyzing student learning outcomes data. Student learning outcomes were obtained from two stages carried out, namely pre-test before using interactive media and post-test after using PBL-based interactive learning media.

Obtaining data on student learning outcomes using PBL-based interactive learning media in geography learning obtained the lowest score of 75, the highest score of 100, the average score (mean) was 84.17, the mode was 84.25, the median was 84.50, and standard deviation of 8.06. To find out the learning outcomes of students using PBL-based interactive learning media in geography subjects, the details are presented in Table 13 below:

Table 13 Frequency Distribution of Learning Outcomes of Experimental Class Students

No	Interval Class	Absolute Frequency	Relative Frequency (%)	Cumulative Frequency (%)
1.	71 – 75	6	20%	20%
2.	76 – 80	4	13%	33%
3.	81 – 85	7	23%	57%
4.	86 – 90	6	20%	77%
5.	91 – 95	4	13%	90%
6.	96 – 100	3	10%	100%
Total		**30**	**100%**	

Data on Learning Outcomes of Control Class Students

Data on student learning outcomes using video media and printed books in geography learning from 30 students obtained the highest learning outcome score of 95 and the lowest 70, with an average score of 79.50, mode 82.64, median 80.50, and standard deviation 7.09. The following Table 14 presents data on student learning outcomes.

Table 14. Frequency Distribution of Learning Outcomes of Control Class Students

No	Interval Class	Absolute Frequency	Relative Frequency (%)	Cumulative Frequency (%)
1.	66 - 70	5	17%	17%
2.	71 - 75	3	10%	27%
3.	76 - 80	7	23%	50%
4.	81 - 85	9	30%	80%
5.	86 - 90	5	17%	97%
6.	91 - 95	1	3%	100%

No	Interval Class	Absolute Frequency	Relative Frequency (%)	Cumulative Frequency (%)
Total		30	100%	

Normality test

The data normality test uses the Liliefors test with the null hypothesis (H0) which states that the sample comes from a normally distributed population. Acceptance and rejection (H0) are based on a comparison of Ltable prices with Lcalculated prices at the significance level α = 0.05. If Lcount < Ltable then the data is normally distributed. A summary of the results of the data normality test in the experimental class and control class is presented in Table 15 below:

Table 15. Summary of Data Normality Test using the Liliefors Test

No	Data	Class	Lcount	L_{table}	Conclusion
1.	Pretest	Ekperiment	0,119	0,131	Normal
2.	Pretest	Control	0,110	0,131	Normal
3.	Post test	Eksperiment	0,124	0,131	Normal
4.	Post test	Control	0,114	0,131	Normal

Based on the data in Table 15 above, it is known that the results of the pretest data normality test in the experimental class obtained Lcount < Ltabel (0.119 < 0.131) and in the control class also Lcount < Ltabel (0.110 < 0.131). Normality results in the post test data for the experimental class Lcount < Ltable (0.124 < 0.131) and in the control class Lcount < Ltable (0.114 < 0.131). So, it can be concluded that the pre-test data and post-test data in the experimental class and control class are normally distributed at a significance level of α = 0.05.

The homogeneity test was carried out to determine whether the data was homogeneous or not between the experimental class group and the control class group. The homogeneity test plays an important role in evaluating the homogeneity of variations between the experimental class group and the control class group being compared. The homogeneity test calculation used is Fisher; the sample has a homogeneous variance if Fcount < Ftable at the significance level α = 0.05. A summary of the results of the data homogeneity test in the experimental class and control class is presented in Table 16 below.

Table 16. Summary of Fisher's Test Data Homogeneity Test

No	Data	Class	F_{count}	F_{table}	Conclusion
1.	Pretest	Ekperiment	0,970	1.861	Homogen
2.	Pretest	Control			
3.	Post test	Eksperiment	1,293	1.861	Homogen
4.	Post test	Control			

In Table 16 above, it shows that the results of the calculation of the homogeneity test of pretest data in the experimental class and control class at a significant level of α = 0.05 obtained Fcount < Ftable (0.970 < 1.861), so it can be concluded that the pretest data in the two classes has the same variance, or is homogeneous. Then, when testing the homogeneity of post-test data in the experimental class and control class, a significant level of α = 0.05 (1.293 < 1.861) was obtained, so it can be concluded that the post-test data in both classes had the same or homogeneous variance.

Hypothesis testing

The research conducted hypothesis testing to assess the effectiveness of the developed product and determine if there was a significant difference in geography learning outcomes between the experimental class, which used PBL-based interactive learning media, and the control class, which used video media and printed books. When the learning process takes place, this hypothesis test is carried out using the independent sample t test. With a value of α = 0.05 (two tail test). As a basis for the independent sample t test, if the significance value of the t test is > 0.05, then H0 is accepted and H1 is rejected. This means that there is no influence between using PBL-based interactive learning media and not using PBL interactive media on geography learning outcomes. Conversely, if the significance value of the t test is <0.05, then H0 is rejected and H1 is accepted. The following Table 17 below will present the T test data (Independent Samples T)

Table 17 Independent Samples Test Results

	Eksperiment	**Control**
Mean	86,16666667	81,5
Variance	64,97126437	50,25862
Observations	30	30
Pooled Variance	57,61494253	
Hypothesized Mean Difference	0	
df	58	
t Stat	**2,381139525**	
P(T<=t) two-tail	0,020562935	
t Critical two-tail	**2,001717484**	

Based on Table 17, tcount = 2.381 and ttable = 2.002 with a significance level of α = 0.05 so tcount > ttable. It can be interpreted that H0 is rejected and H1 is accepted. Thus, there is a significant difference in the average learning outcomes of students who use PBL-based interactive learning media and the learning outcomes of students who do not use PBL-based interactive learning media in geography subjects.

N-Gain Test

The N-Gain test was carried out to test effectiveness, by comparing the pretest and posttest results from the experimental class and control class. The following N-Gain test calculation results are presented in Table 18 below:

Table 18. N-Gain Test Results

	Experiment Class	**Control Class**
Average	60,782	44,262
Minimum	37,5	25
Maximum	100	75
N Gain Score	0,608	0,443
N Gain Score (%)	60,782	44,622

Based on the data in Table 18 above, it shows that the average N-Gain score for the experimental class using PBL-based interactive learning media obtained a score of 60.782%, including the interpretation of "quite effective" in the "medium" category. Furthermore, the calculation for the control class, which did not use PBL-based interactive learning media, obtained a score of 44.262%, including the interpretation of "less

effective" in the "medium" category. So, it can be concluded that PBL-based interactive learning media is quite effective in teaching geography in class X of Maitreyawira Private High School, Deli Serdang, compared to learning using video media and printed books.

Discussion

The validation results from material experts received a score of 98% with very adequate criteria. Media expert validation obtained a score of 94% with very appropriate criteria. Meanwhile, the design expert validation was given a score of 100% with very feasible criteria. After experts stated that this PBL-based interactive learning media product for geography subjects was very worthy of being tested in the field, The results of individual trials were 86% (very feasible), and those of small group trials were 86% (very feasible). It was concluded that interactive media based on the PBL learning model in geography subjects was declared very suitable for use as a learning medium for class X students at Maitreyawira Private High School, Deli Serdang.

Reddi & Sanjaya (2003) stated that interactive media is an integration of elements of several media (audio, video, graphics, text, animation, etc.) into one synergistic and symbiotic whole that produces more benefits for the end user than any one of them. media elements can provide individually. Through interactive learning media, students are facilitated with various learning content, such as visual and audiovisual materials, to make the learning process easier for them.

According to Suyatno (2009), PBL is a problem-based learning model where the problem is used as a stimulus that encourages students to use their knowledge to formulate a hypothesis and search for relevant information in a student-centered manner through discussion in a small group to get a solution to the problem. that is given. In line with this understanding, the application of PBL in interactive learning media directs students in groups to collaborate in solving the problems they face, learn to express opinions, respect each other, and be creative in expressing ideas.

The practicality of a product can be determined after conducting field trials, namely, the sample in this study was 30 students. Field trial results were 91% (very feasible). Meanwhile, the response from geography subject teachers as practitioner validators (teachers) who utilized PBL-based interactive learning media in geography learning obtained a score of 95% (very decent).

This is in line with the opinion of Trianto (2009) that the practical aspect can only be influenced if: (1) experts and practitioners state that what is being developed can be applied; and (2) reality shows that what has been developed can be implemented.

Testing the effectiveness of the PBL interactive learning media product that was developed was carried out by comparing the average value of learning outcomes for the experimental class, which used PBL-based interactive learning media, and the control class, which only used video media and printed books in the learning process, so the learning outcomes were 84.17 . percent for the experimental class and 79.50% for the control class on hydrosphere dynamics and its impact on daily life with 30 students in each class. Furthermore, from the results of the T test, tcount = 2.381 and ttable = 2.002, with a significance level of $\alpha = 0.05$, so that tcount > ttable. It can be interpreted that H0 is rejected and H1 is accepted, which means that the interactive learning media product developed is effective for use in improving student learning outcomes in geography subjects. Based on the N-Gain calculation, this PBL-based interactive learning medium is classified as quite effective, with a score of 60.78%.

The effectiveness of PBL-based interactive learning media can apparently improve student learning outcomes in geography subjects and be able to improve the ability to

collaborate well, improve critical thinking, and manage time well because, in the interactive learning media product developed, a group-based learning syntax has been prepared that allows students to face problems that they must solve together with their designated group of friends, and the completion time for the assignments given has been adjusted to the available time allocation.

In line with research conducted by Anggreni et al. (2021), the results of the assessment by learning design experts obtained a percentage of 90% with very good qualifications; the results of the assessment by learning media experts obtained a percentage of 90% with very good qualifications; the results of the assessment Individual trials carried out by 3 students obtained an overall percentage result of 92% with very good qualifications; the results of the small group trial assessment carried out by 9 students obtained an overall percentage result of 94% with very good qualifications. Based on the research results, it can be concluded that PBL model-oriented interactive multimedia on science content is suitable for use in the learning process.

Margarita (2018), in her research entitled "Development of Digital-Based Media Lift: The Flap Encyclopedia in Social Studies Learning in Class IV SDN Sekaran 01 Semarang," stated that the limited trial results shown in 2 elementary schools that did not use media produced an average pretest score of 72.56 and posttest 80.12 and sig. (2-tailed) 0.004. Furthermore, in the 2 elementary schools that used media, the average pretest was 75.74, the average posttest was 83.62, and a sig. (2-tailed) 0.000 was generated. Based on interactive multimedia that is developed and valid, the material contained in interactive multimedia can enable students to learn indirectly and independently.

Wulandari (2022) The final product research results show: (1) the material expert test is in very good qualifications (83.08%), (2) the learning design expert test is in very good qualifications (84.12%), (3) the learning media expert tests are in very good qualifications (83.51%), (4) individual trials are in very good qualifications (91.67%), (5) small group trials are in very good qualifications (93.00%), and (6) limited field trials are in very good qualifications (94.24%), and are suitable for use in the biology learning process. The results of hypothesis testing prove that there is a significant difference between the learning outcomes of students who are taught using interactive multimedia-based learning media and the learning outcomes of students who are taught using conventional learning media. This is shown by the results of data processing, tcount = 25.08 > ttable = 2.0105, with dk = (n1 + n2) at the significance level $\alpha = 0.05$. It was concluded that the effectiveness of using interactive media was 78.32%, while conventional media was 67.00%.

Based on the results of research that has been carried out and supported by the theories regarding PBL-based interactive learning media above, the PBL-based learning media that has been developed is effective for use in geography learning. Apart from that, the teacher's ability to act as a good facilitator in utilizing technology in learning has a very important influence on increasing student enthusiasm, motivation, and learning outcomes

CONCLUSION

The conclusions that can be put forward are as follows:

1. PBL-based interactive learning media for geography subjects in class The score obtained from material experts was 98%, media experts were 94%, design experts were 100%, individual trial results were 86%, small group trials were 86%, and field trial results were 91%, with an average percentage of 93% in the "very feasible" category.
2. The PBL-based interactive learning media developed has met the criteria for being effective in improving student learning outcomes. This can be proven from the research

results, which show that the average learning outcomes in the experimental class are 84.17 and the learning outcomes in the control class are 79.50, meaning that the interactive learning media products developed are effective for use in improving student learning outcomes in subjects. geography. Based on the results of the t test calculations, tcount = 2.381 and ttable = 2.002, with a significance level of α = 0.05, so tcount > ttable. It can be interpreted that H0 is rejected and H1 is accepted, which means there is a difference. Furthermore, based on the results of the N-Gain calculation, a score of 60.78% was obtained, so this PBL-based interactive learning medium is classified as "quite effective" in the "medium" category.

REFERENCES

Anggreni, N. L., Jayanta, I. N. L., & Mahadewi, L. P. P. (2021). Multimedia Interaktif Berorientasi Model Problem Based Learning (PBL) Pada Muatan IPA. *Mimbar Ilmu*, *26*(2), 214–224. https://doi.org/10.23887/mi.v26i2.35715

Arikunto, S. (2018). *Managemen Penelitian*. Jakarta: Rineka Cipta.

Arjulayana. (2018). The Use of Video in Teaching Listening Skill. *Globish (An English-Indonesian Journal for English, Education and Culture*, 6 (1). https://jurnal.umt.ac.id/index.php/globish/article/view/660

Deliany, N., Hidayat, A.& Nurhayati, Y. (2019). Penerapan Multimedia Interaktif untuk Meningkatkan Pemahaman Konsep IPA Siswa di Sekolah Dasar. *Educare*, 90-97. https://jurnal.fkip.unla.ac.id/index.php/educare/article/view/247

Dewantara, R. B., Suarsini, E., & Lestari, S. R. (2020). Analisis kebutuhan pengembangan multimedia interaktif berbasis PBL pada materi biologi SMA. *Jurnal Pendidikan: Teori, Penelitian, Dan Pengembangan*, 5(6), 749-753. https://www.neliti.com/publications/487785/analisis-kebutuhan-pengembangan-multimedia-interaktif-berbasis-problem-based-lea

Duch. (1995). *Pembelajaran Berbasis Masalah*. Jakarta: Sejarah Indonesia.

Hutagalung, T. H. (2021). Pengembangan Multimedia Pembelajaran Interaktif Berbasis PBL Pada Kompetensi Keahlian Rekayasa Perangkat Lunak SMK. *Tesis.* Medan: Program Pascasarjana Universitas Negeri Medan.

Lee, A. W. W. & Owens, D. L. (2004). *Multimedia-based Instructional Design*. California: Pfeiffer.

Lubis, T. Y., Sinaga, B., & Mulyono, M. (2023). Learning Tool Project to Create PBL Model to Stimulate Computational Thinking Ability of Students. *Randwick International of Education and Linguistics Science Journal*, *4*(4), 965-971. https://doi.org/10.47175/rielsj.v4i4.858

Margarita, N. (2018)."Pengembangan Multimedia Interaktif Sebagai Alat Bantu Pembelajaran Dengan Model Pbl Untuk Peningkatan Hasil Belajar Matematika." *Journal for Lesson and Learning Studies 1(3)* 243-257. https://ejournal.undiksha.ac.id/index.php/JLLS/article/view/15388

Mulyatiningsih, E. (2013). *Metode Penelitian Terapan Bidang Pendidikan*. Bandung: Alfabeta.

Mustakim. (2020). Efektivitas Pembelajaran Daring Menggunakan Media Online Selama Pandemi Covid-19 pada Mata Pelajaran Matematika. Al Asma: *Journal of Islamic Education* 2(1). https://journal.uin-alauddin.ac.id/index.php/alasma/article/view/13646

Nugraha, S. A., Sudiatmi. T., Suswandri, M. (2020). Studi Pengaruh Daring Learning Terhadap Hasil Belajar Matematika Kelas IV. Ambon: *Jurnal Inovasi Penelitian*. 1 (3). https://stp-mataram.e-journal.id/JIP/article/view/74

Pelangi, G. (2020). Pemanfaatan Aplikasi Canva Sebagai Media Pembelajaran Bahasa Dan Sastra Indonesia Jenjang SMA/MA. *Jurnal Sasindo Unpam*, *8*(2),1-18. http://www.openjournal.unpam.ac.id/index.php/Sasindo/article/view/8354

Prastowo, Andi. (2015). *Panduan Kreatif Membuat Bahan Ajar Inovatif*. Yogyakarta: Diva Press.

Reddi, U. V. & Sanjaya, M. (2003). *Educational Multimedia- A Handbook for Teacher-Developers*. New Delhi: The Commonwealth of LearningCommonwealth Educational – Media Centre for Asia.

Rusman. (2012). *Belajar dan Pembelajaran Berbasis Komputer Mengembangkan Profesionalisme Guru Abad 21*. Bandung: Alfabeta.

Sadiman, A. S. (2014). *Media Pendidikan: Pengertian, Pengembangan dan Pemanfaatanya*. Jakarta: Rajawali Pers.

Sugiyono. (2020). *Metode Penelitian Kuantitatif, Kualitatif, dan R & D*. Bandung: Alfabeta Tanjung.

Suryani, N. (2018). *Media Pembeljaarann Inovatif*. Bandung: PT Remaja Rosdakarya

Suyatno. (2009). *Menjelajah Pembelajaran Inovatif*. Sidoarjo: Masmedia Buana Pustaka.

Trianto. (2009). *Mendesain model pembelajaran inovatif-progresif*. Jakarta: Kencana Prenada Media Group.

Triningsih, D. E. (2021). Penerapan Aplikasi Canva untuk Meningkatkan Kemampuan Menyajikan Teks Tanggapan Kritis Melalui Pembelajaran Berbasis Proyek. *Paper Knowledge. Toward a Media History of Documents*,*15*(1), 128-144. https://doi.org/10.30957/cendekia.v15i1.667

Wulandari, T. & Mudinillah, A. (2022). Efektivitas Penggunaan Aplikasi CANVA sebagai Media Pembelajaran IPA MI/SD. *Jurnal Riset Madrasah Ibtidaiyah (JUMIA)*, *2*(1), 102-118. https://doi.org/10.32665/jurmia.v2il.24