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Development of Interactive Multimedia using Google Sites and Problem-Based Learning to Improve Numeracy in Trigonometry for 10th Grade Students

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ABSTRACT

Interactive multimedia based on Problem-Based Learning (PBL) is a digital teaching medium that combines multimedia elements such as text, images, audio, video, and animations with the PBL learning model approach using Google Sites. This research aims to produce interactive multimedia based on Problem-Based Learning (PBL) utilizing Google Sites to enhance numeracy skills in trigonometry material for 10th-grade high school students. This research uses a descriptive qualitative approach with the Research and Development (R&D) method and the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) development model. The research results are interactive multimedia based on Problem-Based Learning (PBL) utilizing Google Sites, which can be accessed using various electronic devices. This multimedia focuses on trigonometry material for 10th-grade high school students by presenting problem orientation in the form of contextual problems and language that is easy for students to understand. The research results also show that the developed product has been revised several times to produce interactive multimedia that is worthy of testing and useful. The percentage of validity of the interactive multimedia from subject matter experts is 100% (very valid) and 98% (very valid) from design experts. The percentage of practicality of the interactive multimedia by educators is 86% (very practical) and by students 87% (very practical), the percentage of effectiveness of the interactive multimedia from student response questionnaires is 92% (very effective), and from learning outcome tests in the form of pre-tests and post-tests using N-Gain with seven people in the medium category and 29 people in the high category.

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1. INTRODUCTION

Education is an important component of a country's life. It serves as the foundation for national progress and individual development. Education is a form of effort to improve the

intelligence of people's lives, as one of the state goals implied in the 1945 Constitution [1]. The 1945 Constitution's description of education is elaborated in Law No. 20 of 2003, explaining the purpose of education in Indonesia. The goal is to develop students' potential to become independent, creative, knowledgeable, and responsible individuals. Mathematics is one of the subjects that plays an important role in education. As one of the core disciplines, it not only supports logical thinking but also contributes directly to problem-solving abilities in daily life. Knowing the importance of education makes the government try to improve education in Indonesia, including improving reading and writing skills. Reading and writing are not limited to letters/alphabets; reading in mathematics, namely, numbers is often called numeracy [2].

The development of numeracy is very important to pay attention to because it is the initial ability that each student must possess to master various academic competencies and apply their mathematical knowledge in real life. Numeracy and math are related. The relationship between mathematics and numeracy lies in the components of the implementation of numeracy, which cannot be separated from the material coverage in mathematics. Mathematics emphasizes understanding the material, while numeracy is more interpreted as the ability to apply, formulate, and interpret knowledge of various basic mathematical concepts that have been owned to answer all problems in various contexts in life [3].

Numeracy skills are the skills and knowledge that (a) utilize different sorts of numbers and images related to fundamental arithmetic to unravel common issues in different settings of everyday life and (b) analyze data displayed in various shapes (charts, tables, charts, etc.) and after that utilize the interpretation of the comes about of the investigation to anticipate and make choices [4]. Numeracy could be a critical aptitude for understudies since this aptitude is closely related to the capacity to fathom scientific issues in lifestyle [5].

Numeracy skills are the ability to use, understand, and analyze mathematics in the context of problem-solving in everyday life. In our daily lives, math is often used, for example, when shopping, calculating the distance or time we take to go somewhere, and calculating the land area, which requires numeracy. Numeracy skills are needed to decide based on these different activities.

Previous research has shown a significant relationship between interactive multimedia and numeracy skills, based on the outcomes of research conducted by Devya et al., which shows that multimedia can improve students' numeracy skills [6]. Then, a significant relationship between the use of problem-based learning (PBL) models with numeracy skills, based on the outcomes of research conducted by Astutik, shows that utilizing problem-based learning (PBL) models in learning can improve students' numeracy skills [7].

Based on the necessities analysis conducted to identify gaps between ideal and real conditions in learning mathematics at SMAN 5 Jambi City. The outcomes of observations and interviews with teachers and students show some of the main problems, namely, students have difficulty understanding abstract basic mathematical concepts, using numbers and mathematical symbols, and solving math problems in everyday life, which shows a lack of student numeracy skills. The learning methods are still predominantly conventional, and the media used are less interactive, causing some learning objectives not to be achieved properly.

Furthermore, there is a lack of learning media that is interesting and can facilitate students' understanding in depth.

To overcome these problems, innovations are necessary in the learning process that can improve students' understanding of mathematical concepts and numeracy skills. One of the learning models that can be used is the expansion of interactive multimedia based on Problem-Based Learning (PBL). Problem-based learning (PBL) emphasizes designing learning that starts from real, relevant problems so students can deeply understand the material through problem-solving. Using Google Sites as a platform, interactive multimedia can be developed to provide students with a more interesting and interactive training experience. Interactive multimedia based on Problem-Based Learning (PBL) is expected to help students understand trigonometry concepts better through visualization and direct interaction.

In line with this, a study by Rahmawati et al. [8] found that applying the Google Sites website media based on Problem-Based Learning provides many benefits for students and teachers. Regarding the research the researcher will conduct, the similarity between the studied research and the relevant research is using Google Sites based on Problem-Based Learning, both used as learning media. At the same time, the difference lies in the material and the subjects of the research. The relevant research uses the material of Flat Side Space Shapes for eighth-grade junior high school students at the Quranic Science Boarding School, whereas this research will use Trigonometry material for tenth-grade students at SMAN 5 Kota Jambi.

This research aims to overcome this gap by developing a Problem-Based Learning (PBL) Interactive Multimedia product utilizing the Google Sites Website to Improve Student Numeracy Skills in Trigonometry Class X SMA. This research is expected to significantly contribute to the field of education, especially in designing teaching media that can help improve students' numeracy skills. Therefore, by understanding the process of developing interactive learning media based on Problem-Based Learning (PBL) to improve students' numeracy skills in mathematics learning, it is hoped that it can be a reference for educators or other researchers in developing interactive multimedia based on Problem-Based Learning (PBL).

2. METHOD

When delivering a product within the shape of intelligently mixed media-based Problem-Based Learning (PBL), the inquiry utilized is Research and Development (R&D). Research and Development (R&D) could inquire about the strategy utilized to create certain items and test the adequacy of these items [9]. The development model that will be utilized to create intuitively interactive media based on Problem-Based Learning (PBL) to make strides in students' numeracy skills in trigonometry fabric is to utilize the ADDIE demonstration. As the title suggests, the ADDIE Improvement Investigate Show could be a show with five development steps/phases, including analysis, design, development, implementation, and evaluation.

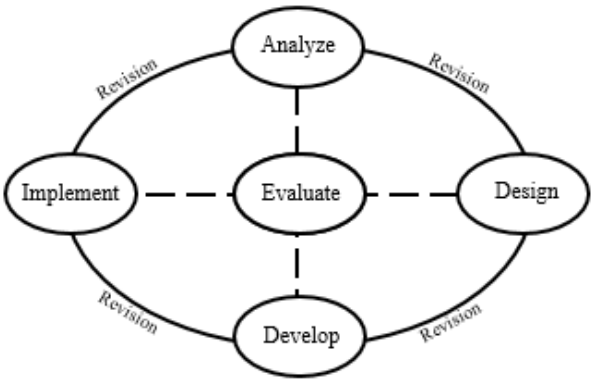

Figure 1. ADDIE development model [10]

The stages of the ADDIE development research model, according to Branch, are as follows [10]:

a. Analysis

In the ADDIE development research model, the first stage is to conduct an analysis to identify problems and causes of performance gaps. The following are six procedures at the analysis stage.

1) Validation of performance gaps is done by taking initial data related to the curriculum, learning system, students, current learning conditions and situations, and other things through observation and interviews.
2) Determining instructional objectives, this procedure is a form of response to the previous procedure. The objectives are expected to close the gaps (problems) found.
3) Analyse learner characteristics; this stage is also referred to as learner analysis. This procedure is carried out by identifying students' abilities, experience, motivation, and other things that need to be known related to the development carried out. Data is obtained by distributing test questions or questionnaires to students as the intended audience.
4) Identifying the resources needed. This procedure is carried out by identifying available resources such as technology, content, human resources, and other supporting resources.
5) Determine potential delivery systems. This procedure is carried out by reviewing the delivery of information (learning systems) that are potentially good to use and following the development carried out. This determination is based on instructional objectives, teacher, learner, and resource conditions.
6) Develop a project management plan. This procedure is carried out by developing a development plan related to who is involved and managing and developing a development timeline. This aims to manage the development process to be disciplined and purposeful. After analysis, the development objectives are clear, and the existing data can be used as a reference for development.

b. Design

Design or Plan exercises within the ADDIE advancement investigation demonstrate an efficient preparation that begins from planning the concept and substance within the item. The plan is composed for each item substance. Instructions for applying the plan or making

the item are composed clearly and in detail. The item plan is still conceptual at this organization and will underlie the advancement process within the following arrangement.

c. Development

Development or Advancement within the ADDIE advancement investigate model contains item plan realization exercises that have already been made. In the past, a conceptual system for actualizing an unused item was created. The conceptual system is, at that point, realized into a product that's prepared to be actualized. At this organization, it is additionally fundamental to be disobedient to degree item execution.

d. Implementation

Applying the item within the ADDIE improvement investigation shows that it plans to get criticism on the item created/developed. Input can be obtained by inquiring questions related to product development targets. Usage is carried out about the item plan that has been made. The implementation stage is carried out by testing multimedia starting from the Individual Trial (one-to-one trial), which is carried out to see the practicality of multimedia and obtain initial input related to the multimedia developed for the class X math subject teacher (Phase E) at SMA Negeri 5 Jambi City. Then, the Small Group Trial (small group trial) was carried out involving nine students with the provisions of minimum, standard, and maximum abilities based on the outcomes of the numeracy ability test and the recommendations of mathematics teachers and homeroom teachers. The small group trial used a practicality questionnaire by students to assess and provide comments as input, which will be used to improve the resulting multimedia.

After the data is obtained, the next step is to make revisions based on input and comments and test, then continue with the field test. Large Group Trial (field trip) After the Google sites-based learning media developed by researchers meet the criteria and get a valid predicate to be applied, and the product is ready to be implemented in class X (Phase E) students of SMA Negeri 5 Jambi City, totaling 36 students. Product testing is carried out with a one-group pretest-posttest design, where students are given a pre-test question first and then given treatment in the form of providing interactive multimedia based on Problem-Based Learning (PBL) utilizing the Google Sites website to improve students' numeracy skills in trigonometry material that has been developed. After giving learning media, it will be followed by post-test questions to see the outcomes of students' numeracy skills after utilizing interactive multimedia.

e. Evaluation

Evaluation of the assessment arranged within the ADDIE demonstrates that an advancement investigation is carried out to supply input with item clients so that corrections are made to agree with the assessment or needs that the item cannot meet. The extreme objective of assessment is to measure the accomplishment of improvement objectives.

Product quality criteria

The quality criteria of the developed product can be seen utilizing the criteria of Plomp & Nieveen; namely, there are three criteria for the quality of a product, as follows [11] :

a. Validity

A product is said to be valid if it can answer the needs, its components must be based on knowledge (content validity), and all components must be consistently linked to each other (construction validity). Validity indicates the extent to which the product or learning instrument follows established theories, concepts, or principles and is relevant to educational objectives.

b. Practicality

The practicality aspect is seen from the product developed that can be applied well, is useful, and is easily applied in the field, and there is consistency between the curriculum and the learning process. Practicality also refers to how easily the product or instrument is used by teachers or students in the learning process. A practical product can be applied without significant difficulty in terms of time, cost, and user readiness.

c. Effectiveness

Effectiveness shows how the product or instrument achieves the expected learning objectives, improving student learning outcomes or understanding. An effective product can produce a positive impact on the learning process or outcome, which is usually measured through improved learning outcomes, participation, or student engagement in learning.

The subject of The Test

Trial subjects in development research usually refer to the parties involved in testing the developed product. Product testing is a stage of evaluation to determine whether the designed interactive multimedia is suitable for use in learning activities. In this context, the trial in this research for individual testing was conducted with mathematics teachers from SMAN 5 Kota Jambi using a response questionnaire as a practicality test.

Then, a small group trial, consisting of six students who were not from the actual class, with varying abilities, including two high-ability students, two medium-ability students, and two low-ability students, was conducted to assess the practicality of the designed interactive multimedia. This stage was important to evaluate whether the media could accommodate different levels of student ability. Next, a large group trial was conducted in the actual class, specifically in class X7 at SMA Negeri 5 Kota Jambi. This was intended to assess the effectiveness of the designed interactive multimedia and to observe the improvement in students' numeracy skills after the learning process. The multi-stage testing process ensured a comprehensive evaluation of the media from both teacher and student perspectives.

The selection of SMAN 5 Kota Jambi as the trial location in this research is based on several strategic and academic considerations. Based on the initial observations and interviews with mathematics teachers, it was found that the X7 students in this school still

struggle to understand trigonometry material, especially in terms of numeracy skills related to contextual problem-solving. These findings highlight the urgency of implementing innovative learning tools that are not only practical but also effective in enhancing student comprehension. This indicates the need to develop learning media that can enhance student engagement in the learning process and strengthen their numerical thinking skills.

Types of Data and Data Sources

The types of data used in this research are qualitative and quantitative. Qualitative data is obtained from the product validation stage in the form of suggestions, criticism, input, and responses from a team of experts, both design experts and material experts, who are used to improve interactive multimedia products with Problem-Based Learning (PBL) learning with improving student numeracy skills in trigonometry material. This qualitative input serves as the foundation for iterative refinement of the multimedia product to ensure its relevance, clarity, and instructional effectiveness. In addition, qualitative data was also obtained from input obtained in individual trials and small group trials, which further enriched the understanding of how the multimedia was perceived and used by both teachers and students.

Meanwhile, quantitative data were obtained from validator assessments, student-teacher assessments through practicality sheets, and student response questionnaires. These sources provided measurable indicators of product feasibility and user acceptance. Then, quantitative data is also obtained by calculating the percentage of students' numeracy skills during the large group trial, which will be seen from the pre-test and post-test scores to measure the increase in students' numeracy skills after utilizing multimedia. The combination of these data types allows for a comprehensive evaluation of both the development process and the resulting impact of multimedia on student learning outcomes.

Data Collection Instrument

To get interactive multimedia with good quality, which includes a quality assessment with valid, practical, and effective criteria and to measure the achievement of the success of interactive multimedia development designed, a tool is used to collect data from this research in the form of data collection instruments. These instruments play a central role in ensuring that each phase of product evaluation, validation, practicality, and effectiveness is systematically and reliably assessed.

Valid criteria are used to obtain data stating the validity of the material and design of the designed product. There are two research instruments for the validity aspect: the material expert validation sheet for multimedia products and the design expert validation sheet for multimedia. These instruments ensure that both the content and visual-structural aspects of the product align with pedagogical standards. Practical criteria are used to obtain data stating the practicality of multimedia-designed products. There are two practical research instruments: multimedia practicality sheets (teacher response questionnaires) and multimedia practicality sheets (student response questionnaires). These provide insights into how easily the product can be implemented in actual classroom settings. For effective criteria, it is used to see the effectiveness of the product, namely in the form of outcomes

that are in line with expectations or the product can help students achieve the intended competencies, in this case, can improve students' numeracy skills, which can be seen from the outcomes of student numeracy tests and student responses, where instrument experts have validated each test instrument used. The triangulation of these instruments allows researchers to validate the overall success of the multimedia product in supporting learning goals, particularly in enhancing students' numeracy capabilities.

Data Analysis Technique

The data that has been collected is then analyzed to determine the validity, practicality, and effectiveness of interactive multimedia based on Problem-Based Learning (PBL) to improve students' numeracy skills in the trigonometry material developed. Data analysis techniques that would be carried out in this study are following the data collection instruments used, namely as follows:

a. Practicality Test Data Analysis

Practicality data instruments in the form of interactive multimedia practicality questionnaires, which have been given to teachers and students, will be analyzed utilizing a Likert scale, namely with the following scale:

SA = Strongly Agree (score 5)
A = Agree (score 4)
N = Neutral (score 3)
D = Disagree (score 2)
SD = Strongly Disagree (score 1)

According to Setyaningrum et al. to calculate the percentage of practicality from the data obtained from the assessment item scores utilizing the following formula [12]:

$$\text{Practicality Level } (v_p) = \frac{\sum x}{\sum n} \times 100\% \quad (1)$$

With:

v_p = Instrument Practicality Percentage
$\sum x$ = Total score of assessment items obtained
$\sum n$ = Total Maximum or Ideal Score Assessment

According to Riduwan, the percentage outcomes of practicality obtained will be classified in percentages as follows [13] :

Table 1. Practicality Criteria

Practicality Criteria	Practicality Level
$80\% \leq v_p < 100\%$	Very practical (can be used without revision)
$60\% \leq v_p < 80\%$	Practical (can be used but needs minor revisions)
$40\% \leq v_p < 60\%$	Moderately practical (can be used but needs major revisions)
$20\% \leq v_p < 40\%$	Less practical (not recommended for use)
$0\% \leq v_p < 20\%$	Not practical (cannot be used)

Based on these criteria, interactive multimedia with Problem-Based Learning (PBL) with improved students' numeracy skills on trigonometry material can be practical if the practicality level is at least at the “Practical” interval.

b. Effectiveness Test Data Analysis

According to Hikmah et al. (2020), the difference between the pre-test and post-test is calculated to determine the improvement of students' numeracy skills. The difference between the two tests is called gain.
The formula used to calculate students' scores is:

$$Score = \frac{Student\ Score}{Maximum\ Score} \times 100\% \quad (2)$$

The criteria for the level of students' numeracy skills can be seen in the table below [14]:

Table 2. Numeracy Ability Categories

Numeracy Ability Category	Criteria
$80 \leq Score < 100$	High
$60 \leq Score < 80$	Medium
$0 \leq Score < 60$	Low

The N-Gain calculation formula is as follows:

$$N - Gain = \frac{Score\ posttest - Score\ pretest}{Score\ max - Score\ pretest} \quad (3)$$

Furthermore, the outcomes of the N-Gain calculation are presented utilizing the following criteria [15]:

Table 3. N-Gain Interpretation

$N - Gain$	Criteria
$N - Gain > 0{,}7$	High
$0{,}3 \leq N - Gain < 0{,}7$	Medium
$N - Gain < 0{,}3$	Low

The interpretation of effectiveness based on the N-gain value can be seen in the following table [15]:

Table 4. Criteria for interpreting the effectiveness of N-gain

$N - Gain$	Criteria
40%	Not effective
$40\ \% - 55\%$	Less effective
$56\% - 75\%$	Moderately effective
$> 76\%$	Effective

The minimum limit of this interactive multimedia can be effective for use in the learning process if the N-gain is obtained from the numeracy test outcomes in moderate criteria.

Then, for the effectiveness data instrument of the form a student response questionnaire, which has been given to students, the data to be analyzed utilizing a Likert scale, namely with the following scale:

SA = Strongly Agree (score 5)
A = Agree (score 4)
N = Neutral (score 3)
D = Disagree (score 2)
SD = Strongly Disagree (score 1)

According to Setyaningrum et al. to calculate the percentage of effectiveness of the data obtained from the assessment item scores utilizing the following formula [12]:

$$\text{Effectiveness Level } (v_e) = \frac{\sum x}{\sum n} \times 100\% \quad (4)$$

With:

v_e = Instrument Effectiveness Percentage
$\sum x$ = Total score of assessment items obtained
$\sum n$ = Total Maximum or Ideal Score Assessment

According to Riduwan, the outcomes of the percentage of practicality obtained will be classified in percentages as follows [13]:

Table 5. Effectiveness Criteria

Effectiveness Criteria	Effectiveness Level
$80\% \leq v_e < 100\%$	Very effective (can be used without revision)
$60\% \leq v_e < 80\%$	Effective (can be used but needs minor revisions)
$40\% \leq v_e < 60\%$	Moderately effective (can be used but needs major revisions)
$20\% \leq v_e < 40\%$	Less effective (not recommended for use)
$0\% \leq v_e < 20\%$	Not effective (cannot be used)

Based on these criteria, interactive multimedia with Problem-Based Learning (PBL) learning will improve students' numeracy skills in trigonometry material, which can be used effectively if the level of effectiveness is at least in the “Effective” interval.

3. RESULTS AND DISCUSSION

There are outcomes obtained from this study, namely: (1) an interactive multimedia based on Problem-Based Learning (PBL) utilizing the Google Sites website to improve students' numeracy skills in trigonometry for class X SMA material, (2) assessment or responses by material experts and design experts to the learning multimedia that has been developed, which serve as validation of content accuracy and instructional design, (3) teacher responses and feedback obtained from students during the trial of the learning multimedia, as gathered through questionnaires that instrument experts had previously validated. Furthermore, (4) the initial ability scores (pre-test) and final ability scores (post-test) related to the use of interactive multimedia based on Problem-Based Learning (PBL) utilizing the Google Sites platform were collected to measure its effectiveness in improving

students' numeracy skills. This dual assessment provides both qualitative insight and quantitative evidence of the product's impact.

Interactive multimedia based on Problem-Based Learning (PBL) utilizing the Google Sites website to improve students' numeracy skills in trigonometry material was developed utilizing the ADDIE development model. Where the following stages of the ADDIE development model in this study are:

3.1 Analysis Stage (Analyze)

This analysis stage is carried out to obtain the data needed to design interactive multimedia based on Problem-Based Learning (PBL) utilizing the Google Sites website to improve students' numeracy skills in trigonometry. Based on the needs analysis, gaps between ideal and real conditions in learning mathematics at SMAN 5 Jambi City were identified. The outcomes of observations and interviews with teachers and students show some of the main problems, namely, students have difficulty understanding abstract basic mathematical concepts, using numbers and mathematical symbols, and solving math problems in everyday life, which shows a lack of student numeracy skills. The learning methods are still predominantly conventional, and the media used are less interactive, causing some learning objectives not to be achieved properly. Furthermore, a lack of learning media that is interesting and can facilitate students' understanding in depth.

To overcome these problems, innovations are needed in the learning process to improve students' understanding of mathematical concepts and numeracy skills. One of the learning models that can be used is the development of interactive multimedia based on Problem-Based Learning (PBL). Problem-based learning (PBL) emphasizes designing learning that starts from real, relevant problems so that students can deeply understand the material through problem-solving [16]. Using Google Sites as a platform, interactive multimedia can be developed to provide students with a more engaging and interactive learning experience [17]. Interactive multimedia based on Problem-Based Learning (PBL) is expected to help students understand trigonometry concepts better through visualization and direct interaction.

3.2 Design Stage

The next stage is the design stage. This stage began with the product's design being developed, namely interactive multimedia designing interactive multimedia based on Problem-Based Learning (PBL) utilizing the Google Sites website to improve students' numeracy skills in trigonometry material. This multimedia is intended for grade X students. However, this design is still temporary because it will undergo further development in the future, according to the suggestions and comments from the expert team.

At this stage, all the things that have been prepared in the initial design stage, the products that will be made following the preparation of flowcharts and storyboard writing, begin to be realized to produce quality products that can be used in learning activities [18] in making this interactive multimedia utilizing several websites and applications. Researchers use the Google Sites website, with additional applications and websites, namely YouTube, Canva, Cap Cut, Google Forms, and Google Groups, to support interactive

multimedia designs. Using supporting applications such as YouTube, Canva, CapCut, Google Forms, and Google Groups can enhance the interactivity of designed multimedia. This aligns with the opinion of Nurmiantun et al., who stated that using additional applications can make learning media more interactive [19].

3.3 Development Stage

After the design stage, the development stage is carried out to develop and realize the product that has been designed [20]. The design that has been made can be seen by scanning the QR Code in Figure 2 below:

Figure 2. QR Code interactive multimedia

At this stage of development, validation of research instruments and testing the quality of interactive multimedia products based on problem-based learning (PBL) utilizing the Google Sites website are carried out. Where at this stage, we will validate the multimedia products that have been designed through the assessment of material experts and multimedia design experts, as follows:

3.3.1 Validation of Research Instruments

The instruments used in this research are questionnaires and numeracy test questions, where the validator will validate the research questionnaire instruments starting from the material validation questionnaire, multimedia design validation, teacher practicality questionnaire and student practicality, numeracy test questions, and student response questionnaire. The outcomes of the validation assessment of the material validation questionnaire instrument and design validation were obtained 100% in the "Very Valid" category for the material validation questionnaire and 96% in the "Very Valid" category for the design validation questionnaire. Then, the outcomes of the assessment of the validation of the teacher's practicality questionnaire instrument and student practicality obtained 100% in the "Very Valid" category for the validation of the teacher's practicality questionnaire and 96% in the "Very Valid" category for the validation of the student practicality questionnaire. Then, the outcomes of the validation assessment of the student response questionnaire instrument and numeracy test questions were obtained: 100% in the "Very Valid" category for student response questionnaires and 96% in the "Very Valid" category for validation of numeracy test questions. It can be interpreted that the prepared questionnaire can and is suitable for use without revision for the validity, practicality, and effectiveness of multimedia [13].

3.3.2 Multimedia Quality Test Validation

After conducting a validity assessment in terms of material and design, based on the validation outcomes by a team of experts, the level of validity of the interactive multimedia developed is 100% in terms of material with the criteria "Very Valid" and 98% in terms of design with the category "Very Valid." The category "Very Valid" means that interactive multimedia is feasible and can be tested in research without revision from the validator [13].

3.4 Implementation Stage

The implementation stage is carried out for product testing, which consists of three stages, namely the interactive Multimedia practicality test, which consists of a one-to-one trial and a small group trial, then testing the effectiveness of interactive Multimedia, namely with a large group trial (field tryout). In addition, at this stage, numeracy tests were also carried out through pre-tests and post-tests.

3.4.1. Multimedia Practicality Test

a. One-to-one trial

This individual trial was conducted to obtain initial input and find out the practicality of interactive multimedia before being tested in the research class. This trial was conducted with one mathematics teacher who taught at SMAN 5 Jambi City [21]. After teachers assessed the practicality of multimedia, data from the questionnaire outcomes on the practicality of interactive multimedia were obtained. The practicality level of the interactive multimedia developed was 96% with the category "Very Practical." Thus, interactive multimedia is practical and can be used without revision [13].

b. Small Group Trial

After the one-on-one trial, the next stage is a small group trial that aims to determine the practicality of the interactive multimedia that has been revised in the individual trial [21]. After assessing the practicality of multimedia by students, data from the questionnaire outcomes of the practicality of interactive multimedia by students were obtained. The practicality level of the interactive multimedia developed was 93% with the category "Very Practical." Thus, interactive multimedia is practical and can be used without revision [13].

3.4.2. Effectiveness Test: field trip

The field trial stage was carried out to determine the effectiveness of the interactive multimedia that had been developed [21]. The field trial in this study was conducted on class X7 students of SMPN 5 Jambi City, totaling 36 students. The learning activities utilizing interactive multimedia based on Problem-Based Learning (PBL) utilizing the Google sites website carried out as many as five meetings, namely meeting 1, giving pre-test questions about numeracy skills to determine the numeracy skills of students before utilizing interactive multimedia.

Furthermore, two students are invited to learn utilizing interactive multimedia, where at this meeting discussing sine trigonometry. At the meeting, three students are invited to continue learning utilizing interactive multimedia, where at this meeting discussing cosine

trigonometry. Then, at the meeting, four students are invited to continue learning utilizing interactive multimedia, where at this meeting discussing tangent trigonometry. At meeting 5, we continued with the administration of post-tests and student response questionnaires to determine the effectiveness and improvement of students' numeracy skills after utilizing interactive multimedia. This is done to determine the effectiveness and students' responses to the use of the developed interactive multimedia [22].

Table 6. Results of Student Numeracy Ability Test Scores (Post-test)

No.	Students	Pre-test			Sum	Final score	Category
		1	2	3			
Maximum Score		24	24	24	72	$\frac{\text{Student Score}}{\text{Maximum Score}} \times 100\%$	
1.	S1	18	18	19	55	76	Medium
2.	S2	20	19	22	61	85	High
3.	S3	20	20	23	63	88	High
4.	S4	20	19	21	60	83	High
5.	S5	20	19	18	57	79	Medium
6.	S6	19	19	19	57	79	Medium
7.	S7	19	19	19	57	79	Medium
8.	S8	20	22	24	66	92	High
9.	S9	19	20	20	59	82	High
10.	S10	18	19	19	56	78	Medium
11.	S11	18	18	18	54	75	Medium
12.	S12	19	20	18	57	79	Medium
13.	S13	21	20	22	63	88	High
14.	S14	21	20	21	62	86	High
15.	S15	22	22	21	65	90	High
16.	S16	21	21	20	62	86	High
17.	S17	20	20	20	60	83	High
18.	S18	19	19	19	57	79	Medium
19.	S19	19	20	20	59	82	High
20.	S20	18	20	19	57	79	Medium
21.	S21	18	19	19	56	78	Medium
22.	S22	18	19	20	57	79	Medium
23.	S23	19	18	20	57	79	Medium
24.	S24	20	20	21	61	85	High
25.	S25	21	23	23	67	93	High
26.	S26	19	19	19	57	79	Medium
27.	S27	21	22	23	66	92	High
28.	S28	21	22	22	65	90	High
29.	S29	20	21	21	62	86	High
30.	S30	20	21	22	63	88	High
31.	S31	20	21	21	62	86	High
32.	S32	19	18	19	56	78	Medium
33.	S33	20	18	19	57	79	Medium
34.	S34	19	19	19	57	79	Medium
35.	S35	19	18	20	57	79	Medium
36.	S36	23	23	23	69	96	High
Average						83	High

After being given a pre-test at meeting 1, information was obtained that all X7 class students had low numeracy skills. Then, the researcher continued the research process by conducting learning utilizing interactive multimedia based on problem-based learning (PBL) with students with trigonometry material at meetings 2, 3, and 4. After the learning process

utilizing multimedia, the researcher saw the effectiveness of utilizing interactive multimedia by giving post-test questions and student response questionnaires. Information was obtained that the average score/value of students in class X7 SMAN 5 Jambi City was 83 with the category "High." The table above shows that of the 36 students of class X7 SMAN 5 Jambi City, 20 students have "High" level numeracy skills, and 16 students have "medium" level numeracy skills, which can be seen in the table above. The numeracy skills of students of class X7 SMAN 5 Jambi City have increased after carrying out learning activities utilizing interactive multimedia based on Problem-Based Learning (PBL) utilizing Google sites.

Table 7. N-Gain Calculation Results

No.	Student Code	Pre-test	Post-test	Post-test-Pre-test	Max-pretest score	N-gain	Criteria
1.	S1	39	76	38	61	0,61	Medium
2.	S2	36,	85	49	64	0,76	High
3.	S3	31	88	57	69	0,82	High
4.	S4	28	83	56	73	0,77	High
5.	S5	28	79	51	73	0,71	High
6.	S6	28	79	51	73	0,71	High
7.	S7	25	79	54	75	0,72	High
8.	S8	32	92	60	68	0,88	High
9.	S9	35	82	47	65	0,72	High
10.	S10	28	78	50	73	0,69	Medium
11.	S11	27	75	49	74	0,66	Medium
12.	S12	27	79	53	74	0,72	High
13.	S13	27	88	61	74	0,83	High
14.	S14	25	86	61	75	0,81	High
15.	S15	25	90	65	75	0,87	High
16.	S16	32	86	54	68	0,80	High
17.	S17	42	83	42	58	0,71	High
18.	S18	33	79	46	67	0,69	Medium
19.	S19	29	82	53	71	0,75	High
20.	S20	35	79	44	65	0,68	Medium
21.	S21	33	78	44	67	0,67	Medium
22.	S22	29	79	50	71	0,71	High
23.	S23	26	79	53	74	0,72	High
24.	S24	26	85	58	74	0,79	High
25.	S25	26	93	67	74	0,90	High
26.	S26	25	79	54	75	0,72	High
27.	S27	32	92	60	68	0,88	High
28.	S28	38	90	53	63	0,84	High
29.	S29	33	86	53	67	0,79	High
30.	S30	29	88	58	71	0,82	High
31.	S31	28	86	58	72	0,81	High
32.	S32	28	78	50	72	0,69	Medium
33.	S33	27	79	53	74	0,72	High
34.	S34	25	79	54	75	0,72	High
35.	S35	25	79	54	75	0,72	High
36	S36	46	96	50	54	0,92	High
Average N-Gain						0,76	High
Percentage						76%	Effective

Based on the outcomes of the N-Gain calculation data above, it was obtained that the number of students in class X7 SMAN 5 Jambi City out of 36 students, 29 students experienced an increase in student numeracy skills in the "High" category and seven students

who experienced an increase in numeracy skills in the "Medium" category. Then, the average N-gain outcome obtained is 0.76 with the category "High," and the percentage to measure the effectiveness of the N-gain score is 76%, which shows the category "Effective." So, it can be concluded that students' numeracy skills increase, as seen from the acquisition of an increase in pre-test and post-test scores. Therefore, interactive multimedia based on Problem-Based Learning (PBL) utilizing Google Sites is suitable for use in learning activities.

Table 8. Data on the Results of the Student Response Questionnaire

No	Assessment Items	Assessment					X
		SD	D	N	A	SA	
		1	2	3	4	5	
1.	The material presented is interesting to learn.			9	48	105	162
2.	The material presented can help students understand it.			6	56	100	162
3.	Features in multimedia help students master the material.			6	28	135	169
4.	The material studied has benefits in daily life.			6	60	95	161
5.	The use of language used in multimedia is easy to understand			9	48	105	162
6.	Multimedia is easy to use			6	52	105	163
7.	The use of Problem-Based Learning (PBL)-based multimedia can help students master trigonometry material.			6	32	130	168
8.	The use of multimedia based on Problem-Based Learning (PBL) can help students improve their mathematical problem-solving skills in daily life.			9	40	115	167
9.	Learning using multimedia makes learning engaging and exciting.			9	40	115	164
10.	The use of multimedia can provide convenience in the learning process.			6	32	130	168
	$\sum x$						1646
	$\sum n$						1800
	V_e						91%

After conducting a student numeracy test (Posttets), then the researcher gave a student response questionnaire (effectiveness questionnaire) to students of class X7 SMAN 5 Jambi City who filled out the response questionnaire, which can be seen in the table above. From the outcomes of the student response questionnaire assessment (effectiveness questionnaire), the effectiveness level of the developed interactive multimedia was 91% with the category "Very effective." Based on these gains, it can be said that the multimedia used is very effective and suitable for use without revision [13].

3.5 Evaluation stage

This evaluation stage aims to produce Problem-Based Learning (PBL)-based interactive multimedia utilizing Google Sites to enhance students' numeracy skills while meeting the criteria of validity, practicality, and effectiveness [23]. This evaluation stage is

carried out at each stage to improve the product developed and produce a quality product suitable for use.

a. Evaluation of the Analysis Stage (Analyze)

In this case, starting from the analysis stage, where researchers analyze by validating performance gaps, determining instructional objectives, analyzing learner characteristics, identifying required resources, determining potential delivery systems, and developing project management plans carried out through interviews with one of the mathematics teachers of SMAN 5 Jambi City and observation in class X7 SMAN 5 Jambi City, and this aims to find out problems or gaps in teaching and learning activities.

The outcomes obtained through interviews and observations show gaps in teaching and learning activities ranging from the use of learning methods or models that are less than optimal so that the learning process becomes passive, lack of student numeracy skills, to the lack of utilization of technology in creating interesting learning media. Therefore, researchers must create an active and innovative teaching and learning process by developing interactive multimedia based on Problem-Based Learning (PBL) utilizing Google sites to improve students' numeracy skills.

b. Evaluation of the Design Stage

At the next stage, namely the design stage. At this stage, the researcher begins to design the product to be developed as interactive multimedia based on Problem-Based Learning (PBL) utilizing the Google Sites website. The evaluation outcomes at this design stage are in the form of suggestions and input from the supervisor regarding the appearance or design of the interactive multimedia developed. Input or suggestions are obtained in the form of adding tools from the interactive multimedia itself, which input and suggestions aim to produce interactive multimedia designs that can increase student interest in learning and improve student numeracy skills [24].

c. Evaluation of the Development Stage (Development)

Furthermore, at this development stage, researchers began to make products that had been designed as interactive multimedia based on Problem-Based Learning (PBL) utilizing Google sites to improve students' numeracy skills. After the interactive multimedia is made, validation is carried out by a team of experts, namely material experts and design experts, to get suggestions and comments on the products developed in improving and perfecting interactive multimedia products based on Problem-Based Learning (PBL) in order to produce quality products and feasible to use [25].

d. Implementation Stage Evaluation

The outcomes of the evaluation at the implementation stage, namely after the interactive multimedia is validated by a team of experts, the researcher tests the practicality of interactive multimedia through individual trials and small group trials, where in both tests, the researcher gets a lot of suggestions and input needed in improving interactive multimedia, several aspects need to be improved starting from design and material so that

the interactive multimedia that has been designed becomes suitable for use in classroom research.

4. CONCLUSION

The outcomes of the development carried out by researchers are interactive multimedia products based on Problem-Based Learning (PBL) utilizing the Google Sites website that can improve students' numeracy skills in trigonometry material tested for validity, practicality, and effectiveness. Where in multimedia, there are interesting features, easy to use, and, of course, the activities carried out in multimedia are based on the syntax of Problem-Based Learning (PBL).

The validity of interactive multimedia is obtained from the outcomes of material validation with a percentage of 100% with the criteria "Very Valid," and the outcomes of design validation are 98% with the criteria "Very valid." The criteria for the practicality of interactive multimedia are obtained from the outcomes of the questionnaire on the practicality of interactive multimedia by teachers with a percentage of 86% with the criteria "Very Practical," and the level of practicality of interactive multimedia by students is 87% with the criteria "Very Practical." The effectiveness criteria for interactive multimedia are obtained from the outcomes of a student response questionnaire with a percentage of 91% with the criteria "Very Effective," and the implementation outcomes show that interactive multimedia based on Problem-Based Learning (PBL) utilizing Google sites that have been developed is effective. Based on the data obtained, it can be concluded that interactive multimedia based on Problem-Based Learning (PBL) utilizing Google Sites to improve numeracy skills in trigonometry material is feasible.

For further research, researchers suggest developing interactive multimedia by utilizing technology and other variations to produce better learning multimedia and attract students to make students interested in learning.

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