

Development of Mathematics Learning Media Based on Google Sites Contains Mathematical Literacy for Eighth Grade Junior High School Students

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ARTICLE INFO

Article history

Received: 11 June, 2025

Revised: 27 June, 2025

Accepted: 15 July, 2025

Published: 31 July, 2025

Keywords

google sites;
mathematics learning media;
mathematical literacy;
relations and functions

ABSTRACT

This study aims to develop a Google Sites-based mathematics learning medium that incorporates mathematical literacy within the topic of Relations and Functions for eighth-grade junior high school students, as well as to assess its validity and practicality. The background of the study stems from students' difficulties in understanding Relations and Functions, along with the need for learning media that can enhance both motivation and mathematical literacy skills. This research is a development study employing the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) and was conducted at SMP Negeri 10 Yogyakarta. Data collection techniques included observations, interviews, and questionnaires, using instruments such as validation questionnaires completed by subject matter experts and media experts, as well as student response questionnaires administered to eighth-grade students at SMP Negeri 10 Yogyakarta. The study involved 5 students in a small group trial and 31 students in a large group trial. Evaluation results showed that the media met the "Good" criteria, with scores of 82.00 for the content aspect and 87.00 for the media aspect, indicating its suitability for use. Practicality testing with the small and large groups yielded an average score of 101.15, meeting the "Very Good" criteria. Therefore, this learning medium is considered valid and practical for use as an instructional tool for teaching Relations and Functions with integrated mathematical literacy.

How to Cite: Dewi, B. S., & Rusmining. (2025). Development of mathematics learning media based on google sites contains mathematical literacy for eighth grade junior high school students. *Jurnal Pendidikan Matematika Universitas Lampung*, 13(2). <http://dx.doi.org/10.23960/mtk/v13i2.pp109-123>

INTRODUCTION

The digital age has penetrated various aspects of life, including education, and encouraged the creation of engaging, interactive, and effective learning media. (Mulyati & Evendi, 2020). Advances in technology and science in the field of education encourage educators to continue searching for new methods and approaches in designing learning that is appropriate for the characteristics of the current generation. (Handayani & Sulisworo, 2021). One of the main challenges in education is how to utilize technological developments to improve the quality of learning, especially in subjects that are often considered difficult and challenging, such as mathematics.

Mathematics is a compulsory subject at all levels of education, as stipulated in Law No. 20 of 2003 on the National Education System. However, in practice, mathematics is still often viewed as a difficult, abstract, and intimidating subject by most students. (Anderha & Maskar, 2021). According to the National Council of Teachers of Mathematics (NCTM), the main objectives of learning mathematics include not only mastery of concepts, but also the development of critical thinking skills, problem solving, communication, and linking between concepts (Jawa et al., 2022). This goal is very relevant, especially in teaching the material, namely Relations and Functions. Relation and function material is known to be complex because it has many complex terms, graphs, and diagrams, so students often have difficulty understanding it (L. D. Kurnia et al., 2022).

The difficulty in understanding Relation and Function material is reinforced by research (Rosidah et al., 2019), which shows that students experience obstacles in understanding the concepts of Relations and Functions, distinguishing between relations and functions, and in operating function values. Based on the results of observations and interviews with 8th grade mathematics teachers at SMP Negeri 10 Yogyakarta, it is known that the school has implemented the Merdeka Curriculum and uses various digital learning media such as Liveworksheet, Quizizz, and Kahoot. However, the media is generally only used for practice questions or material reinforcement, not yet optimally used to build in-depth understanding of concepts. While understanding this material is an important part of learning mathematics (Atiaturrahmaniah et al., 2021). As a result, the Relation and Function material remains a challenge, as reflected in the low average daily assessment score of 41,7. In addition, student responses regarding learning media needs based on pre-research survey data are represented in the following pie chart.

Do you need learning media that can help make the learning process easier and more interesting?
34 jawaban

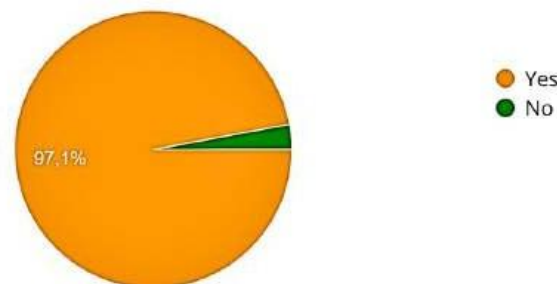


Figure 1. Percentage of Media Requirements

Based on a pre-research survey conducted on 34 students in class VIII A of SMP Negeri 10 Yogyakarta, as shown in Figure 1, 97.1% of students felt they needed learning

media that was simpler, more enjoyable, and easier to access. They also expect digital-based media such as interactive websites, quizzes, and apps like Quizizz and Kahoot.

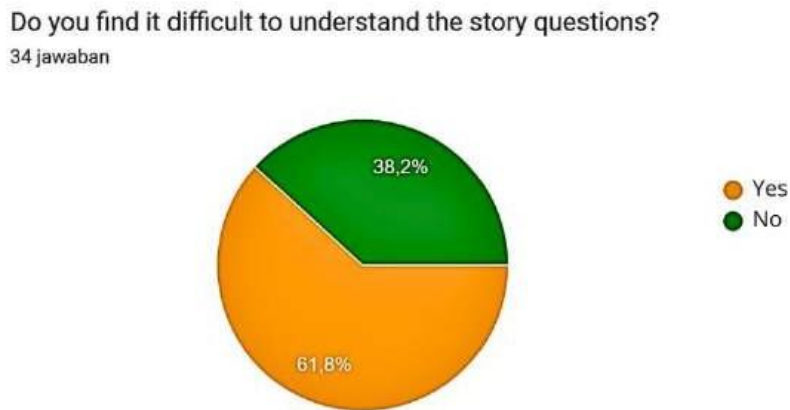


Figure 2. Percentage of Difficulty in Understanding Story Questions

In addition, 61,8% of students had difficulty in understanding questions in the form of narratives or stories, which indicates weak mathematical literacy skills. In fact, mathematical literacy is important to help students relate mathematical concepts to the context of everyday life (Delima et al., 2022). Mathematical literacy is the ability to think critically and logically in solving problems and is not only limited to calculations but includes problems encountered in everyday life (Kusumawardani et al., 2018). So this finding indicates the need for learning media that are not only interesting and easy to access, but also explicitly integrate mathematical literacy competencies.

Previous studies have attempted to develop digital learning media in mathematics with satisfactory results. The study by (Rikani, Istiqomah, 2021) developed a Google Sites-based mathematics learning medium on the topic of Three-Variable Linear Equation Systems and received scores of 4.7 (Very Good category) and 4.0 (Good category) for content and medium, respectively. Additionally, it received a response from students and obtained a score of 3.6 (Good category), but this learning media did not explore the material on Relations and Functions or integrate mathematical literacy. The research by (Syam & Izzati, 2020) developed learning media using Construct 2 for the Relations and Functions material, and the validation results by subject matter and media experts showed that the media was in the “Very Valid” category. In addition, the media received responses from students and teachers and was in the “Very Practical” category. However, the learning media requires software installation, which limits accessibility, and does not integrate mathematical literacy.

Compared to these studies, this study has several unique features. First, the focus of this study is on relational and functional material, which is known to present high

cognitive challenges and is still rarely the focus of media development. Second, this study uses the Google Sites platform, which can display various learning materials such as text, images, videos, and audio, and is easily accessible to students as it only requires a smartphone/computer connected to the internet (Sari & Rochmiyati, 2023). Google Sites is an attractive tool to study because it is free, easy to develop, allows for collaboration among users, provides free online storage up to 100 MB, and is searchable with Google's search feature (Jubaidah & Zulkarnain, 2020). Third, the media developed in this study integrates mathematical literacy through the presentation of story-based problems, real-life contexts, and reasoning activities. Finally, this media is designed to align with the Merdeka Curriculum, making it more relevant and applicable in the current educational context. Therefore, this study contributes a more comprehensive and targeted approach to addressing mathematical learning barriers through digital media.

METHOD

Types and Models of Research

This study applies the Research and Development (R&D) method, which aims to produce website-based learning media using the Google Sites platform. The development model used is ADDIE, which consists of five interrelated development stages: analysis, design, development, implementation, and evaluation. (Anafi et al., 2021). This model was chosen because its stages are simple, systematic, and allow for continuous evaluation and refinement of the product at each stage. The ADDIE development model according to Branch (Hidayat & Nizar, 2021) the following scheme is created:

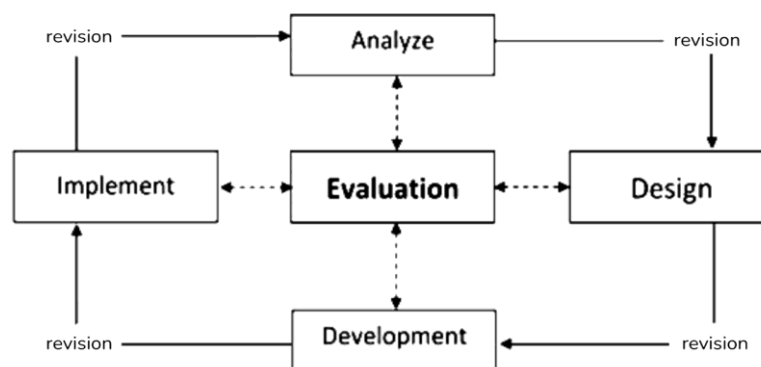


Figure 3. ADDIE Concept

Observing the concept in Figure 3, it appears that each stage in the ADDIE model must be evaluated and revised to improve product development quality and reduce problems in the school environment.

Time, Place, and Subject of Research

This study was conducted in the second semester of the 2024/2025 academic year at SMP Negeri 10 Yogyakarta with research subjects consisting of two subject matter experts and two media experts who are lecturers in the Mathematics Education Study Program, Faculty of Teacher Training and Education, Universitas Ahmad Dahlan, and mathematics teachers at SMP Negeri 10 Yogyakarta, as well as students from class VIII A at SMP Negeri 10 Yogyakarta. This study, the small group trial involved 5 students, while the large group trial involved 31 students.

Development Procedure

Media development is carried out in five stages, including: 1) Analysis: includes analysis of curriculum, media needs, and materials through literature studies, direct observation, interviews with teachers, and distribution of questionnaires to students; 2) Design: media structure design, material compilation, questions, and website interface design; 3) Development: creation of learning media and validation by subject matter experts and media experts to test the validity of the media; 4) Implementation: The trial was conducted in two stages, namely small and large groups, to test the practicality of the media based on students' responses to the media; 5) Evaluate: Evaluations are conducted at the end of each stage, and a final evaluation is conducted based on the results of implementation to improve the product.

Research Instruments and Data Collection Techniques

The instruments used were a media validation questionnaire for subject matter and media experts and a student response questionnaire on learning media. Data was collected through validation questionnaires and student response questionnaires. The data collected consisted of qualitative data in the form of suggestions and responses from experts and students, and quantitative data in the form of assessment scores from validation questionnaires and student responses.

Data Analysis Techniques

The data analysis was conducted to determine the validity and practicality of the media that had been developed. Qualitative data analysis was conducted by examining suggestions and responses as a basis for product improvement. Quantitative data analysis using Likert scale scoring guidelines. The Likert scale is shown in Table 1.

Table 1. Likert Scale

Scale	Categories
5	Very Good
4	Good
3	Pretty Good
2	Not Good
1	Very Poor

Source: (Sugiyono, 2015; Vivien Pitriani et al., 2021)

The collected data was then averaged using the following formula.

$$\bar{X} = \frac{\sum x}{N}$$

Description:

$$\bar{X} = \text{Average score}$$

$$\sum x = \text{Total score}$$

$$N = \text{Total assesment}$$

Next, the results were interpreted using the following five-point ideal assessment criteria.

Table 2. Five-Point Scale Criteria for Ideal Assessment

Interval	Criteria
$\bar{X} > \bar{X}_i + 1,80 SBi$	Very Good
$\bar{X}_i + 0,60 SBi < \bar{X} \leq \bar{X}_i + 1,80 SBi$	Good
$\bar{X}_i - 0,60 SBi < \bar{X} \leq \bar{X}_i + 0,60 SBi$	Pretty Good
$\bar{X}_i - 1,80 SBi < \bar{X} \leq \bar{X}_i - 0,60 SBi$	Not Good
$\bar{X} \leq \bar{X}_i - 0,60 SBi$	Very Poor

Source: (Habsyi et al., 2022)

Keterangan:

$$\bar{X} = \text{Empirical or actual score}$$

$$\bar{X}_i = \text{Ideal Average}$$

$$= \frac{1}{2} (\text{max. ideal score} + \text{min. ideal score})$$

$$SBi = \text{Standard deviation}$$

$$= \frac{1}{6} (\text{max. ideal score} - \text{min. ideal score})$$

$$\text{Max. ideal score} = \text{total number of criteria} \times \text{highest score}$$

$$\text{Min. ideal score} = \text{total number of criteria} \times \text{lowest score}$$

The developed learning media can be declared valid in terms of material and

media if the average validity score meets the minimum criteria of Good, and can be declared practical if the average practicality score also meets the minimum criteria of Good (Habsyi et al., 2022).

RESULTS AND DISCUSSION

Media Development

This research produced a product in the form of Google Sites-based mathematics learning media containing material on Relations and Functions for eighth-grade junior high school students. This media is designed to support the learning outcomes of the Merdeka Curriculum and contains mathematical literacy competencies. Development was carried out using the ADDIE model through five stages, namely analysis, design, development, implementation, and evaluation. The following is a description of the stages of developing mathematics learning media.

Analysis

The analysis stage is the first step in the ADDIE development model, which aims to identify learning needs and problems. In line with argument (T. D. Kurnia et al., 2019), the analysis stage is carried out to determine the requirements and needs in the learning process and to identify existing problems. Researchers conducted direct observations during the implementation of PLP II, interviewed eighth-grade mathematics teachers at SMP Negeri 10 Yogyakarta, and distributed questionnaires to students. Curriculum analysis showed that the school had implemented the Merdeka Curriculum and used Phase D Learning Outcomes for Algebra as a reference. Learning objectives were determined using references from the Grade VIII Junior High School/MTs Mathematics Teacher's Guidebook (Tohir et al., 2022).

Media needs analysis showed support from the school, such as internet access, computer labs, and smartphone use policies in the classroom. However, mathematics learning has not fully captured students' attention because the approach used is still limited to conventional media. Most students stated that they need engaging and interactive digital media to support their understanding. In line with (Wahid, 2018), learning media is important to improve students' learning achievements because it functions as a means to convey learning materials so that the learning process is clearer, more engaging, interactive, and efficient.

Additionally, an analysis of the material shows that Relations and Functions is one of the most challenging topics for students due to its abstract nature and the numerous terms and visualizations involved. Data from daily exams in 2022 reinforces this finding, with an average score of only 41.79. Teachers also reported challenges in developing learning media that align with the characteristics of this material. Therefore, the topic of

Relationships and Functions was selected as the focus for media development to address these challenges. Additionally, mathematical literacy skills are important for students to apply in order to solve problems (Jannah & Hayati, 2024).

Design

After completing the analysis stage, the researchers proceeded to the design stage to develop Google Sites-based mathematics learning media. The design process was based on the results of a joint evaluation with the supervising lecturer of the findings from the previous stage. The design stage is the phase in which researchers plan the media, including the creation of the learning media design concept, preparation of materials, questions, and answers, as well as the development of background images, illustrations, characters, and background music (Vivien Pitriani et al., 2021). The first step was to develop research instruments comprising three types: expert content validation sheets (21 indicators), expert media validation sheets (22 indicators), and student response questionnaires (24 indicators). All instruments were validated by expert lecturers from the Mathematics Education Program at Universitas Ahmad Dahlan.

Researchers also designed a flowchart as a media navigation flow, which makes it easier for users to access various parts of the media systematically. The design of the material was formulated in accordance with the Merdeka Curriculum, and began with the collection of content references. The material covers prerequisite material (Sets) and core material (Relations and Functions), supplemented with apersepsi, material descriptions, learning videos, and exercises related to everyday life. At the Design stage, the developed learning media ensured that learning objectives were achieved (Muhammad et al., 2025). The media structure is designed in several main pages, including: home page, concept map, learning outcomes and objectives, and mathematical literacy based on the PISA framework (OECD, 2013). Furthermore, there are special pages for each topic, namely Sets, Relations, and Functions. Additional features such as quizzes, worksheets, bibliographies, and author profiles are also integrated to make the media more informative and interactive. All content is designed to support enjoyable independent learning and includes mathematical literacy competencies.

Development

The development stage was carried out after the design of Google Sites-based mathematical learning media containing mathematical literacy was completed. The development stage is the phase where the previously created design is realized into a tangible product in accordance with software design principles (Harjanta & Herlambang, 2018). At this stage, the researchers realized the product through a series of technical processes, ranging from adding visual elements, integrating content, to setting the display in the Google Sites platform.

Visual elements such as page titles, illustrative images, and worksheets were designed using the Canva application. The worksheet was then converted to an interactive format via the Liveworksheet platform so that it could be completed online. Meanwhile, interactive quizzes were developed using two platforms: Quizizz for prerequisite material on Sets and ZEP Quiz for core material on Relations and Functions. Educational video content was also produced using Canva for visual animations and Capcut for audio editing, then uploaded to YouTube to be integrated into the website. All these elements were then systematically and interactively organized in Google Sites, enabling the media to be accessed via links without requiring students to download them.

After the media has been developed, a validation stage is carried out to ensure the suitability of the material and appearance of the media. Validation covers two aspects, namely material and media, which are assessed by two material experts and two media experts. The validators consist of lecturers and mathematics teachers who are competent in their fields. The validation results provide important feedback in the form of input and suggestions for improvement, which are then used as a basis for revising and refining the media before it is tested on students. The results of the assessment by the material experts are as follows.

Table 3. Total Score from Expert Assessment

No	Validator	Total Score	Criteria
1	Validator 1	90,00	Very Good
2	Validator 2	74,00	Good
<i>Average (X)</i>		82,00	Good

Based on Table 3, the average score obtained from the overall assessment by subject matter expert 1 and subject matter expert 2 is 82,00. In accordance with the ideal assessment criteria by subject matter experts, it can be interpreted as falling within the range of $71,40 < x \leq 88,20$ or included in the Good criteria. Thus, based on (Habsyi et al., 2022) The mathematics learning media met the criteria for material validity. Meanwhile, the results of the media expert's assessment were as follows.

Table 4. Total Score of Assessment Results by Media Experts

No	Validator	Total Score	Criteria
1	Validator 1	91,00	Very Good
2	Validator 2	83,00	Good
<i>Average (X)</i>		87,00	Good

Based on Table 4, the average total score obtained from expert validators 1 and 2 was 87,00. In accordance with the ideal assessment criteria by media experts, it can be interpreted as being within the range of $74,80 < \bar{x} \leq 92,40$ or included in the Good criteria.

Thus, based on (Habsyi et al., 2022) Mathematics learning media meet the criteria for media validity. Thus, the mathematics learning media that have been developed can be declared valid.

Based on the validation results obtained from subject matter experts and media experts, a number of revisions were made to the learning media to improve the quality of content and appearance. The following changes were made based on the experts' evaluation results.

1. Changes in font type usage.



Figure 4. Display Before Font Revision



Figure 5. Display After Font Revision

2. Addition of usage guidelines for the media included in the Home Page.



Figure 6. Media usage guidelines display

Implement

Implementation is the stage of carrying out the design and development process with the main objectives of supporting learners in achieving learning goals, ensuring solutions to problems encountered in the learning process, and making sure that learners acquire the necessary knowledge, skills, and attitudes (Srikandika et al., 2019). The implementation stage is carried out after the learning media has been declared suitable for testing by subject matter and media experts. The purpose of this stage is to evaluate the practicality of the media based on student responses through two trials: a small group trial and a large group trial.

A small-scale trial was conducted on March 12, 2025, involving five eighth-grade students from SMP Negeri 10 Yogyakarta who were randomly selected based on teacher recommendations. The purpose of this pilot test was to identify technical issues, errors, or media readability. The results indicated that some participants encountered challenges such as small font sizes and game features that did not function properly on certain devices. Based on this feedback, the media was refined before being tested on a larger scale.

A large-scale trial was conducted on March 19, 2025, involving 31 students from the same class. The purpose of this activity was to measure the practicality of the media on a larger scale. The implementation procedure included an initial explanation by the researcher, the use of the media by the students through their own devices, and the completion of a response questionnaire. The results of this pilot study provided data

supporting the conclusion that the Google Sites-based learning media developed is practical to use, easy to access, and received positive feedback from students in the mathematics learning process. The evaluation results from the subject matter expert are as follows.

Table 5. Total Score of Student Response Questionnaire Assessment Results

No	Validator	Total Score	Criteria
1	Small Group Trial	99,80	Good
2	Large Group Trial	102,50	Very Good
<i>Average (X)</i>		101,15	Very Good

Based on Table 5, the average total score of the student response questionnaire in the small group and large group trials was 101,15. In accordance with the ideal assessment criteria for student responses, it can be interpreted that it is within the range of $\bar{x} > 100,80$. Thus, based on (Habsyi et al., 2022) the mathematics learning media met the criteria for practicality of media in the Excellent category. Thus, the media can be declared practical.

Evaluate

The evaluation stage is carried out continuously at every phase in the ADDIE development model, not just at the end of the process. According to Branch (2009), the purpose of the evaluation stage is to assess the quality of the product and the instructional process, both before and after the implementation stage (Hidayat & Nizar, 2021). The initial evaluation is carried out after the analysis stage, where researchers and supervisors review the results of observations, interviews, and pre-research questionnaires to determine the appropriate material and media requirements. At the design stage, the evaluation focused on the clarity of mathematical literacy components and media navigation. The evaluation results encouraged the addition of descriptions to the material menu and navigation buttons between pages to facilitate use.

The evaluation during the development stage is based on input from subject matter experts and media experts. Subject matter experts suggest improvements to learning objectives to meet the ABCD format, content revisions, refinement of terminology, and the addition of contextual questions in the worksheets. Meanwhile, media experts recommend the use of sans serif fonts, adjusting title sizes, adding user targets, usage guidelines, and animations in the media display.

The final evaluation was conducted during the implementation phase based on student feedback. Suggestions included the need to increase the font size and provide alternative quiz links that are compatible with all devices. All evaluation results were used to refine the media before it was declared ready for widespread use in literacy-based mathematics learning.

CONCLUSION

This study successfully developed Google Sites-based mathematics learning media containing mathematical literacy for Grade VIII junior high school students on the subject of Relations and Functions using the ADDIE development model. The development process consisted of five stages, namely: analysis, design, development, implement, and continuous evaluation at each stage of development.

The validation results show that this media is valid in terms of material (average score of 82,00) and media (average score of 87,00), both of which fall within the “Good” criteria in the ideal assessment criteria. In addition, the practicality of the media based on student responses falls within the “Very Good” criteria, with an average score of 101,15, so it can be considered practical. Therefore, this learning medium is suitable for use as an alternative digital medium that can stimulate learning motivation and support the understanding of mathematical concepts as well as the development of students' mathematical literacy.

As a follow-up, it is recommended that the developed learning media be improved to enhance its quality to achieve the “very good” category in terms of validity. Given that the practicality assessment results indicate a very positive response from students, further testing should be conducted involving a broader and more diverse group of participants to assess the consistency of the media's practicality under various learning conditions. Additionally, future research should not only focus on validity and practicality but also assess the effectiveness of the media in improving learning outcomes through quantitative measurement of competency achievement. This Google Sites-based mathematics learning media is also expected to serve as a reference for developing similar learning media to achieve better quality.

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