Volume 8, Nomor 1, 2024
Numerical: Jurnal Matematika dan Pendidikan Matematika
http://journal.iaimnumetrolampung.ac.id/index.php/numerical
DOI:https://doi.org/10.25217/numerical.v8i1.

Development of Interactive Learning Multimedia Based on Google Site on the Sequence and Series Material for Grade XI IPA I Students of SMA Negeri 1 Tilango

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Article Info
Article History:
Received: 07-10-2024
Revised: 05-11-2024
Accepted: 09-12-2024

Keywords:
E-Modul;
4-D Model;
Fractions

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Abstract

This research aims to produce interactive learning multimedia based on Google sites on sequence and series material in class XI IPA I SMA Negeri 1 Tilango with valid, practical and effective criteria. This research and development (Research and Development) uses the function D model, but its distribution is only carried out on a limited basis in research schools. The subjects in this research were class XI IPA I students at SMA Negeri 1 Tilango. The object of this research is interactive learning multimedia developed based on Google Sites in rows and rows. The results of the research were: (1) This learning multimedia has met the validity criteria because it has gone through the validation stage from 5 validators (5 media validators and 5 material validators). The average response obtained from media and material validators was "Yes", which means that on average validators gave a good response to learning multimedia; (2) the assessment of the practicality of the media has practical criteria in the "Very Good" category by the teacher, with a score of 4.75 and by students in small and large group trials, namely 3.27 and 3.45; (3) the effectiveness of multimedia from the results of the percentage of positive student response questionnaires, namely 86%.
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INTRODUCTION

The impact of technological development on human life is evident in the many innovations that utilize technology to simplify tasks, including in the field of education. Technological advancements significantly influence the education sector by enabling the use of information and communication technology (ICT) in the learning process to improve education quality. The development of ICT has facilitated access to information and communication. Currently, learning is not confined to the same place and time but can occur at different locations and times, such as through e-learning and teleconferences [1]. In addition, learning resources are not limited to printed books but can be accessed through the internet, e-books, e-journals, and similar platforms [2].

Although advanced technology has significant potential as an effective learning tool, it also presents challenges for teachers in the learning process. One primary challenge is the lack of adequate technological skills among teachers. Many educators are either untrained or lack sufficient support to utilize advanced technology effectively in their teaching. This condition can

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hinder their ability to use technology efficiently, possibly resulting in unengaging and unmotivating learning experiences for students. The abstract nature of mathematics further complicates teaching and learning in this subject [3]. This complexity is reflected in the significant number of students who fail to meet minimum competency standards and exhibit low academic performance, primarily due to teacher-dominated learning methods [4].

Interactive learning methods can address these issues by inspiring and motivating students to participate actively and by fostering creativity and independence, tailored to their interests and developmental stages [5]. One effective strategy involves using interactive learning media. Media plays a crucial role in teaching success by bringing unique dynamics to the learning process [6]. The concept of "interactive" refers to two-way communication between components, such as interactions between humans and computers [7]. By leveraging interactive learning media, students receive feedback on their activities, enhancing their learning experience.

One of the subjects that benefit from interactive multimedia is mathematics. This field is essential at all educational levels [8]. However, mathematics is often perceived as difficult due to its abstract nature, requiring logical and systematic thinking. Consequently, many students find it challenging and unappealing [9]. Among the various mathematical topics, sequences and series are vital for high school curricula, particularly in grade XI, as they are often applied in real-life scenarios such as business and economics [10].

Research has identified common errors in solving problems related to sequences and series, including conceptual errors, data usage mistakes, language interpretation issues, technical errors, and errors in drawing conclusions, with conceptual errors being the most frequent at 25.92% [11]. To address these challenges, employing interactive multimedia can help students understand and retain concepts more effectively [12].

Several studies have explored the development of multimedia for mathematics education, both pre- and post-pandemic. For instance, multimedia-based tools for teaching quadrilaterals were found effective in facilitating learning [13]. Similarly, video-based interactive multimedia has been shown to enhance flexibility and engagement in learning [14]. Another study demonstrated that multimedia designed using Macromedia Flash significantly improved problem-solving skills [15].

At SMA Negeri 1 Tilango, observations reveal that students are allowed to bring mobile phones to school. However, mathematics learning primarily relies on textbooks and teacher lectures, leading to students' disinterest and difficulty understanding the material [16]. Adopting solutions aligned with Industry 4.0, such as using ICT-based interactive multimedia, can address these issues by enhancing student engagement and motivation [17].

Interactive multimedia combines various media elements like text, sound, images, and videos, facilitating better comprehension and independent learning [18]. Google Sites offers an accessible platform for creating multimedia resources, allowing students to access materials anytime and anywhere. This study aims to develop and evaluate the feasibility of Google Sites-based interactive multimedia for teaching sequences and series.

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METHODS

Research 4d Model

The research method utilized in this study is Research and Development (R&D). According to Afri and Sembiring [19], R&D is a research method used to produce a specific product and test its effectiveness. This study employs the 4D development model, which stands for Define, Design, Develop, and Disseminate. As the name implies, the 4D model comprises four stages: define, design, development, and dissemination. However, in this study, the dissemination stage is limited to a constrained dissemination process, where the interactive learning multimedia is only distributed to the school under investigation due to time and resource constraints.

The research subjects were the students of Class XI Science 1 at SMA Negeri 1 Tilango during the second semester of the 2022/2023 academic year. The research instruments included media expert validation sheets, material expert validation sheets, teacher response questionnaires, and student response questionnaires. Data collection techniques involved validation, teacher response questionnaires, and student response questionnaires. Data analysis was conducted using descriptive analysis, which involved the following:

Expert Validation Data Analysis

Validators provided feedback and assessments of the interactive learning multimedia based on Google Sites. The assessment consisted of three categories: Yes, Doubtful, and No. These responses were utilized to interpret suggestions and inputs from validators, which guided the revision of the developed multimedia.

Table 1. Expert Validation Criteria

Response	Criteria
Yes	Appropriate
Doubtful	Less Appropriate
No	Not Appropriate

Student Response Questionnaire

Student responses were analyzed to determine whether the interactive learning multimedia based on Google Sites could engage students in learning mathematics. The data collected from the student questionnaires during the product trial were analyzed using a Likert scale with the following criteria:

Table 2. Likert Scale for Student Assessment

Response	Criteria
Category	Score
Strongly Disagree (SD)	1
Disagree (D)	2
Agree (A)	3
Strongly Agree (SA)	4

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Based on the percentage results, the data were categorized according to the following Table 3:

Table 3. Student Response Categorization

Response	**Criteria**
Percentage Interval (%)	Criteria
75% < score 100%	Very Good
50% < score 75%	Good
25% < score 50%	Less Good
25%	Not Good

Research Procedures

1. **Define Stage**: This stage aims to determine and define the requirements for the development of a product that aligns with user needs. Learning is a process that provides rewards and achieves educational targets [20].
2. **Design Stage**: The objective of this stage is to design a learning medium by converting print-based media into electronic media.
3. **Develop Stage**: This stage aims to produce an electronic module validated by material and media experts. Validation sheets are designed to evaluate the electronic module.
4. **Disseminate Stage**: Although this stage was limited in scope, the developed multimedia was disseminated to the specific school under study.

RESULTS AND DISCUSSION

Development of Interactive Learning Multimedia Based on Google Sites for Arithmetic and Geometric Sequences Material

The research focuses on the development of interactive learning multimedia based on Google Sites for the topic of arithmetic and geometric sequences. The research subjects are students of Class XI IPA 1 at SMA Negeri 1 Tilango during the even semester of the 2023/2024 academic year. This study adopts the 4D model by Thiagarajan, which includes four stages: Define, Design, Develop, and Disseminate. The dissemination stage in this research is limited to the school where the study is conducted and does not involve widespread distribution. This limitation aligns with the research objective, which is to develop a high-quality interactive learning multimedia without extending to mass distribution or commercialization. The results obtained from each development stage are detailed as follows:

Define Stage

Front-End Analysis

Front-end analysis aims to identify problems in the learning process. This involves communication with mathematics teachers and observations of the learning process in Class XI IPA 1 at SMA Negeri 1 Tilango. The findings reveal several challenges faced by teachers, such as students' lack of attention during lessons and a high level of off-task activities in the classroom. Consequently, students struggle to understand the concepts of arithmetic and geometric sequences taught by the teacher.

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Learner Analysis

Learner analysis examines the characteristics of the students. The analysis identifies issues such as students' low motivation and enthusiasm for learning mathematics, particularly regarding sequences and series. This lack of motivation is attributed to the material being presented primarily in textual form, with minimal use of engaging media to support learning. Additionally, students often use Google as a learning resource alongside printed textbooks, and almost all students own smartphones. However, these smartphones are not yet optimized for learning purposes. Based on these findings, the researcher developed interactive learning multimedia using Google Sites, aiming to address the challenges faced by both teachers and students in learning mathematics, especially sequences and series.

Concept Analysis

This step involves analyzing the subject matter for Class XI IPA 1 at SMA Negeri 1 Tilango. The selected material aligns with the needs of teachers and students as well as the specified learning indicators. The topic includes arithmetic and geometric sequences and series. The specific indicators are as follows:

1. Explain the concept of arithmetic sequences and series.
2. Determine the nth term of an arithmetic sequence.
3. Calculate the sum of the first n terms of an arithmetic series.
4. Solve problems related to arithmetic sequences and series.
5. Solve real-life problems involving arithmetic sequences and series.
6. Explain the concept of geometric sequences and series.
7. Determine the nth term of a geometric sequence.
8. Calculate the sum of the first n terms of a geometric series.
9. Solve problems related to geometric sequences and series.

Task Analysis

Task analysis identifies and designs assignments for students to complete during the learning process to achieve minimum competency levels. Tasks include discussions, practice exercises, and evaluation tests. Discussions are based on key tasks students need to master, practice exercises follow specific topics, and evaluation tests are conducted at the end of the chapter.

Formulation of Learning Objectives

This stage involves translating basic competencies into specific learning objectives based on the results of the previous analyses. These objectives guide the development of the multimedia teaching materials. The defined objectives are emphasized in the electronic teaching module to be developed.

Design Stage

The chosen learning media for the arithmetic and geometric sequences material in Class XI SMA Negeri 1 Tilango is interactive multimedia based on Google Sites. This choice is informed

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by the learner analysis, concept analysis, task analysis, and specified learning objectives. Additionally, smartphones are used as supporting tools during the learning process.

The format design outlines the content structure of the learning media, which aligns with the material and the 2013 curriculum. The media includes comprehensive content on arithmetic sequences, arithmetic series, geometric sequences, and infinite geometric series, presented in an interactive format to enhance students' learning experience. The following sections were designed using Microsoft Word:

Figure 1. Homepage

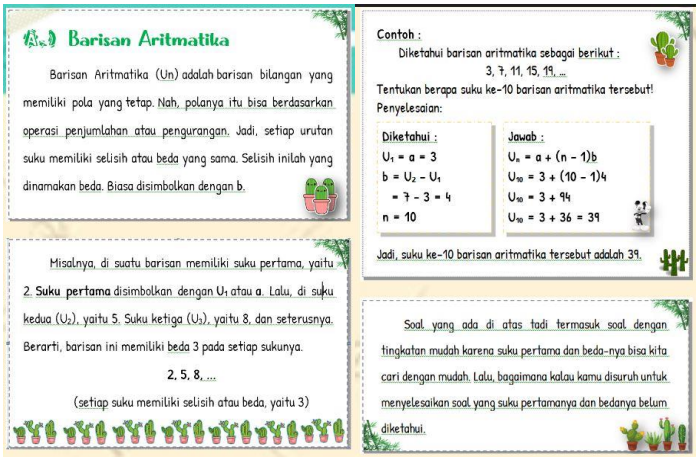

Figure 2. Arithmetic Sequences Page

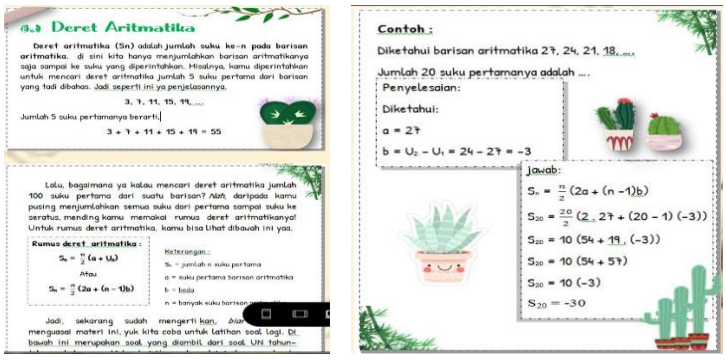

Figure 3. Arithmetic Series Page)

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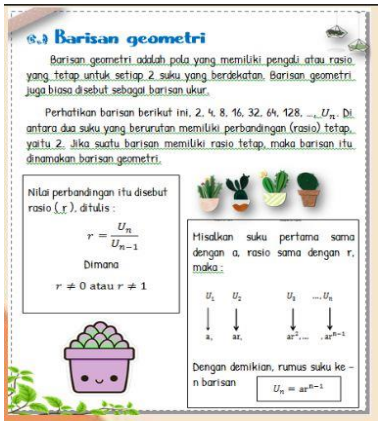

Figure 4. Geometric Sequences Page

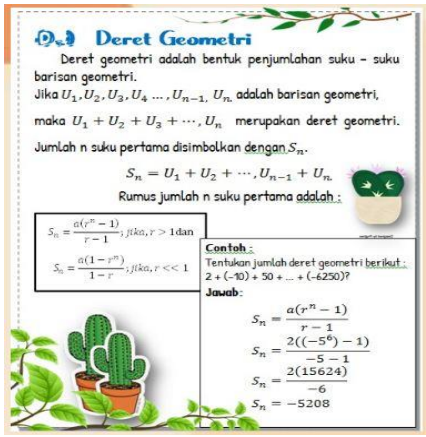

Figure 5. Geometric Series Page

Figure 6. Infinite Geometric Series Page

Designing the E-Module

The initial design results include the media plan used to collect the data required in the development process. The multimedia learning design refers to the analysis results conducted during the define stage and the other previous stages. This stage will produce the initial product, which will be further developed in the next stage, referred to as Draft I.

The following is the initial design for an interactive learning multimedia based on Google Sites:

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Main Menu Page

This page contains buttons for the learning objectives, materials, videos, exercises, and LKPD (Lembar Kerja Peserta Didik or Student Worksheets), which focus on the topic of sequences and series.

Figure 7. Main Menu Page

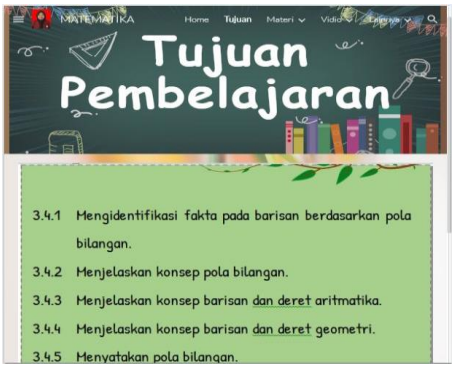

Figure 8. Learning Objectives Page

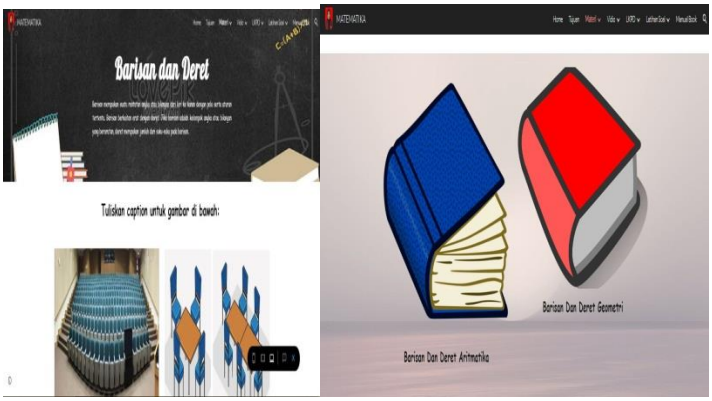

Figure 9. Materials Page

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Image 10: Video Page

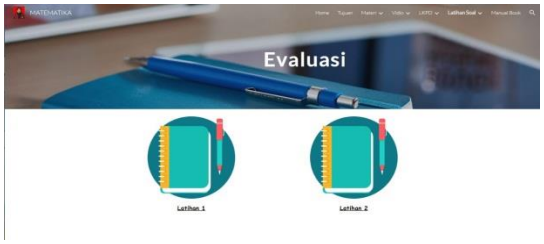

Image 11: Exercise Page

Image 12: LKPD Page

Development Stage

The purpose of the development stage is to create an interactive learning multimedia based on Google Sites that is suitable for use in classroom learning activities. This stage includes expert validation, design revisions, and limited trials. The results of expert validation and limited trials are outlined as follows:

Expert Validation

The product that has been designed can be validated and revised by subject matter experts and media experts. The aspects to be evaluated by the subject matter experts include 13 categories with responses of "yes," "uncertain," and "no," while the media experts evaluate 21

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aspects with the same response options. Experts are allowed to provide suggestions on the quality of the content in the developed interactive multimedia. The media validation results are shown in the following table:

Table 1. Media Validation Results

No.	Aspects Evaluated	Validator 1	Validator 2	Validator 3	Validator 4	Validator 5
1	Design Appearance Attractive	Yes	Yes	Yes	Yes	Yes
2	Menu Layout Not Confusing	Yes	Uncertain	Yes	Yes	Yes
3	Appropriateness of Images with Material	Uncertain	Yes	Uncertain	Yes	Yes

In addition to the media validation results, the following table shows the results of the content validation:

Table 2. Content Validation Results

No.	Aspects Evaluated	Validator 1	Validator 2	Validator 3	Validator 4	Validator 5
1	Learning Objectives Clearly Stated	Uncertain	Yes	Yes	Yes	Yes
2	Content Presented in Order	Uncertain	Yes	Yes	Yes	Yes
3	Images and Animations Clarify Material	Yes	Yes	Uncertain	Yes	Yes

Trial Results

In the limited trial stage, the researcher received feedback from teachers regarding the interactive multimedia, with a rating of 90%, indicating that the feedback was positive. The trial was conducted with a class of 15 students from XI IPA 1 at SMA Negeri 1 Tilango during the odd semester of the 2022/2023 academic year. In this trial, the researcher taught as usual, using the developed multimedia. At the end of the lesson, the researcher distributed a questionnaire to gather student feedback. The results from the students' responses to the trial indicated a positive response with 86%. The detailed results are presented in Appendix 6, with the following breakdown:

Table 3. Trial Results

No.	Respondent	Score	Average Score	Response Percentage	Category
1	1	54	3.6	90%	Very Good
2	2	56	3.73	93%	Very Good

The results indicate that the multimedia received a very positive response from the students, and therefore, it can be concluded that the interactive multimedia can be used for teaching mathematics, especially for the topic of sequences and series.

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Dissemination Stage

The dissemination stage was conducted at SMA Negeri 1 Tilango on April 27, 2023, with the subject being high school mathematics teachers.

The development of interactive learning multimedia based on Google Sites follows the 4D development model by Thiagarajan [21], which includes the stages of define, design, development, and dissemination. The development process is outlined as follows:

In the define stage, an initial analysis was conducted, including student analysis, material analysis, task analysis, and objective specifications. This analysis addressed the fundamental issues faced by class XI students at SMA Negeri 1 Tilango in learning mathematics, specifically on the topic of sequences and series. As a result, the interactive multimedia based on Google Sites was developed. After the analysis, the researcher collected information regarding the students' basic abilities and knowledge development. This was done through classroom observations.

In the material analysis, the content included in the interactive multimedia was designed according to the school's curriculum (Curriculum 2013). Based on this curriculum, the first competency to be mastered in the topic of sequences and series is solving contextual problems related to arithmetic and geometric sequences and series. The task analysis was aligned with the teaching module. Furthermore, the learning objectives were derived from the tasks determined in the previous stages.

In the design stage, media selection, format selection, and initial design were carried out. The selected medium was interactive multimedia based on Google Sites, chosen to address the problems found in the classroom. During this stage, the researcher reviewed other interactive multimedia sources for comparison and reference to ensure high-quality multimedia design.

The next stage is the development stage, where the multimedia was validated by media and subject matter experts. The validation was conducted using expert validation sheets to assess whether the designed multimedia was suitable or not. After the initial design was validated, revisions were made and re-submitted for re-validation. The media validation was followed by a readability test using a sample of three students, and then a limited trial to gather student feedback on the multimedia.

The results of the readability test and teacher feedback were positive, and the interactive multimedia was considered ready for use in teaching.

CONCLUSION

Based on the research and discussion presented previously on the development of interactive learning multimedia based on Google Sites, it can be concluded that: (1) Through the 4D development model consisting of four stages, a product in the form of an interactive learning multimedia based on Google Sites has been produced, which can be used for mathematics learning, especially on the topic of sequences and series; (2) This learning multimedia has met the validity criteria as it has undergone validation from five media validators and five content validators. The average response received from media validators was "Yes," and the average response from content validators was also "Yes," indicating that the validators gave positive feedback on the multimedia learning tool. The multimedia has also met the practicality criteria as it has gone through a trial stage with an average score of 95% from teacher responses and 86%

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from student responses. This shows that the multimedia tool is of excellent quality. Based on the conclusion, the following suggestions can be made: (1) It is hoped that the interactive learning multimedia based on Google Sites can be adopted as a learning medium in schools, allowing teachers to develop it further for other subjects; (2) For researchers who wish to develop similar interactive learning multimedia based on Google Sites, it is important to pay attention to the suggestions from the validators as outlined in the discussion and to be more creative in the development process by consulting additional references available on the internet or YouTube.

REFERENCES

[1] R. Kartika, "The Role of ICT in Learning Process," *Journal of Educational Technology*, vol. 9, no. 3, pp. 110–119, 2019.
[2] M. Aditya, "Educational Media Development in the Digital Age," *Journal of Innovative Education*, vol. 7, no. 2, pp. 98–105, 2018.
[3] V. Takaendengan et al., "Challenges in Mathematics Education: Abstract and Conceptual Nature," *International Journal of Mathematics Education*, vol. 11, no. 1, pp. 45–52, 2022.
[4] I. Abbas, "Teacher-Centered Learning and Its Impact on Students' Performance," *Education and Development Journal*, vol. 5, no. 4, pp. 201–210, 2012.
[5] Rusman, "Interactive Learning in Education," *Pedagogical Advances*, vol. 12, no. 2, pp. 134–145, 2018.
[6] A. Maryani, "Interactive Media in Education," *Journal of Media Studies*, vol. 8, no. 3, pp. 76–83, 2019.
[7] S. Suleman et al., "Mathematics Education Across Levels," *Educational Review*, vol. 15, no. 4, pp. 54–67, 2023.
[8] T. Maulia, "Applications of Sequences and Series in Everyday Life," *Mathematics and Its Applications Journal*, vol. 6, no. 2, pp. 99–106, 2022.
[9] T. Purboningsih, "Conceptual Challenges in Solving Mathematics Problems," *Education Research Bulletin*, vol. 4, no. 5, pp. 123–130, 2020.
[10] P. Handayani et al., "Error Analysis in Mathematics Learning," *Journal of Educational Science*, vol. 10, no. 3, pp. 110–119, 2020.
[11] A. Trinoviawati, "Contextual Challenges in Learning Sequences and Series," *Mathematics Education Insights*, vol. 9, no. 1, pp. 88–96, 2019.
[12] S. Damopolii et al., "Multimedia for Quadrilaterals: A Case Study," *International Journal of Digital Learning*, vol. 7, no. 4, pp. 210–220, 2019.
[13] R. Suseno et al., "Interactive Mathematics Media," *Journal of Digital Teaching Resources*, vol. 8, no. 2, pp. 167–175, 2020.
[14] W. Septian et al., "Macromedia Flash in Mathematics Education," *Educational Media Studies*, vol. 14, no. 1, pp. 45–60, 2021.
[15] R. Sari et al., "Interactive Multimedia in Mathematics," *Science and Technology Journal*, vol. 12, no. 5, pp. 134–145, 2022.
[16] H. Putriani and N. Hudaidah, "Education in Industry 4.0," *Journal of Innovative Teaching*, vol. 6, no. 2, pp. 78–89, 2021.

Print ISSN: 2580-3573, Online ISSN: 2580-2437

[17] Y. Mitrawalida, "Interactive Learning: A Student-Centered Approach," *Educational Techniques Journal*, vol. 9, no. 3, pp. 101–112, 2018.

[18] E. Suryanto, "Google Sites for Interactive Learning," *Journal of Technology in Education*, vol. 11, no. 4, pp. 177–188, 2018.

[19] Afri, F., and Sembiring, B. R., "Research and development methods for product effectiveness," *Journal of Educational Innovation*, vol. 12, no. 3, pp. 101-115, 2022.

[20] Sutiah, "Learning processes in achieving educational targets," *Educational Development Journal*, vol. 8, no. 2, pp. 89-96, 2016.

[21] S. Thiagarajan, "The 4D Model of Instructional Design," *Educational Technology*, vol. 14, no. 3, 1974, pp. 24-29.

Print ISSN: 2580-3573, Online ISSN: 2580-2437