Evaluation of the Effectiveness of Digital Teaching Materials on Google Sites-Based "Relationships and Functions" Materials: Accessibility Analysis and User Feedback

[a] Mala Apriliani., [b] Dr. Surya Amami Pramuditya, M.Si.
[a]amamisurya@ugj.ac.id , [b]amamisurya@ugj.ac.id

ABSTRACT

This research is motivated by the importance of evaluating digital learning materials to ensure their quality and effectiveness in learning. The objective was to evaluate the effectiveness of the Google Sites-based digital learning material "Relations and Functions" through accessibility analysis and user feedback. The method used was descriptive quantitative, with data collected using an online Likert-scale questionnaire from two peer teachers (accessibility test) and one teacher and several students (feedback test). The main results showed that the technical aspects and learning feasibility received excellent ratings (100% each) in the accessibility test, while visual design (88.9%) and interactivity (77.8%) still needed improvement. On the other hand, user feedback showed lower scores in the technical (61.4%), pedagogical (64.74%), and aesthetic (65.74%) dimensions. The implication is that although it meets basic standards, this learning material requires further optimization, especially in interactivity, responsiveness, and visual design, to improve the overall learning experience and user engagement.

A. Introduction

Introduction to this study builds an argument for the development and evaluation of digital teaching materials "Relationships and Functions" based on Google Sites. The context begins with a global digital transformation that encourages the world of education to innovate, in line with the demands of the Independent Curriculum which emphasizes differentiated, independent, and technology-based learning. However, these innovations face real challenges in the field, such as the digital divide and teachers' need for tools that are practical, easy to adopt, and integrated with familiar ecosystems. Therefore, this study chose the Google Sites platform as a strategic solution because it offers an intuitive, free interface, and seamless integration with Google Workspace for Education, allowing teachers to create Open Education Resources that can be accessed anytime and anywhere.

Based on this background, this study was formulated to answer the main question: "How effective is the Google Sites-based 'Relationships and Functions' digital teaching materials from the perspective of accessibility and user feedback?" In particular, the objectives of the study are to: (1) analyze the level of accessibility of teaching materials based on expert assessments of technical aspects, visual design, learning feasibility, and interactivity; (2) collect and analyze direct feedback from users (teachers and students) regarding the technical, pedagogical, and aesthetic dimensions; and (3) identify areas of strengths and weaknesses to be used as the basis for improvement recommendations.

In order to be focused and manageable, the scope of this research was limited to the evaluation of one specific product (the "Relationships and Functions" website) by involving limited participants, namely two teachers as expert assessors and one teacher and a number of students as feedback. The main method used was quantitative descriptive with questionnaire instruments. This study acknowledges some important limitations, such as not having tested the direct impact on student learning outcomes and the limited number of user samples, so the main findings focus on the feasibility and initial perception of the teaching materials before they are applied more widely.

B. Literature Review

This study uses Google Sites as a Free Variable (X), which is the main platform to create digital teaching materials "Relationships and Functions". The selection of this platform is based on its documented technical advantages, such as its intuitive interface, seamless integration with the Google Workspace for Education ecosystem, and its responsiveness across multiple devices (Haryanto et al., 2022; Purnama et al., 2021). The use of Google Sites here refers to a specific set of development activities, namely the process of designing page structures, organizing navigation, integrating multimedia (text, images, videos, quizzes), and implementing coherent visual and typography themes, all of which aim to create a centralized and accessible digital learning hub.

The main variable measured in this study was the Effectiveness of Digital Teaching Materials (Y), which is defined as the success of the media in supporting learning objectives. This effectiveness is comprehensively evaluated through two main approaches. First, through an expert assessment of the accessibility and quality of the design, which includes technical aspects, visual design, interactivity, and feasibility of learning. Second, through direct feedback from users (teachers and students) on the technical, pedagogical, and aesthetic dimensions of teaching materials (Nieveen & Folmer, 2020; Ogegbo & Tijani, 2023). Thus, effectiveness is not only seen from the readiness of the product, but also from the usability and benefits felt by the end user in the context of actual learning.

C. Research Methodology

This research adopts a design and development research approach that specifically focuses on the formative evaluation stage. This approach was chosen because it is in accordance with the research objectives, which is not only to develop products (digital teaching materials), but even more so to assess its feasibility and effectiveness before it is widely implemented. To get a complete picture, this study uses mixed methods. Quantitative data is used to measure the level of effectiveness numerically and structurally, while qualitative data is used to dig into the reasons, experiences, and in-depth suggestions from users. The combination of these two types of data allows for richer and more contextual analysis.

The process of developing teaching material products begins with the needs analysis stage, where the researcher examines students' difficulties in understanding the material "Relationships and Functions" and evaluates the availability of existing teaching media. Based on this analysis, the researcher then designed and built a website using Google Sites. This development stage is guided by the ADDIE instructional design model (Analyze, Design, Develop, Implement, Evaluate). The advantage of this model lies in its systematic and iterative nature, allowing revision at every stage. In the process, researchers apply multimedia learning principles such as simplicity and visual coherence to ensure that the content presented does not overload students' working memory. The product quality criteria that are referenced include: (1) pedagogical aspects, namely the suitability of the material with curricular objectives and clarity of presentation; (2) technical aspects, such as speed of access and ease of navigation; and (3) aesthetic and interactivity aspects, which include visual appeal and the presence of elements such as quizzes that can increase learning engagement.

To test the teaching materials that have been developed, the researcher involved two groups of respondents. The first group was an expert sample, consisting of two experienced math teachers. They were selected purposively based on their competence to provide expert assessments of the quality of design and content of teaching materials. The second group is a sample of users, consisting of one teacher and thirty students from one particular class. The participation of all students in this one class (saturated sampling) aims to get diverse feedback from direct users before the teaching materials are further revised. Data was collected using two different online questionnaire instruments. The first questionnaire is aimed at experts to assess accessibility aspects (e.g., technical and visual quality), while the second questionnaire is aimed at users to assess aspects of the user experience (e.g., convenience and perceived benefits). In order for the data collected to be accurate, this instrument has gone through validity tests by experts to ensure the questions measure the right things, and reliability tests to ensure the consistency of the answers.

Data analysis is carried out in an integrated manner. The quantitative data from the questionnaire score was analyzed with simple descriptive statistics, namely calculating the mean and percentage for each aspect of the assessment. This average score is then interpreted into qualitative categories such as "Excellent" or "Needs Improvement" to make it easier to understand. On the other hand, qualitative data derived from the comment and suggestion columns are analyzed through thematic analysis. The stages include reading all the comments over and over again, coding the main ideas, and then grouping them into larger themes (e.g., "Technical Issues" or "Visual Fix Suggestions"). To ensure this analysis is objective and trustworthy, the researcher triangulates. That is, findings from quantitative data (e.g., low scores for "interactivity") are compared and confirmed with findings from qualitative data (e.g., student comments that mention "there would be more practice interactive questions"). This cross-checking process reinforces the validity of interpretation and provides a solid basis for developing recommendations for improving teaching materials that are on target.

D. Results and Discussion

The study evaluated the teaching material "Relations and Functions" with respondents from SMP Negeri 4 Cirebon City, consisting of two expert teachers and 36 users (one teacher and 35 students). The needs analysis showed that students had difficulty with abstract concepts and teachers were constrained by digital resources. As a result, expert assessments were very positive for technical and pedagogical aspects (90-95%, Very Good), although interactivity was rated lower (77.8%, Good). On the other hand, user feedback was lower in all aspects (61-66%, Sufficient), especially on usability and clarity of material. The discussion highlighted the gap between expert standards and user experience. Teaching materials are considered to meet the basic requirements, but need to be optimized by focusing on increasing active interactivity, improving the clarity of instructions, and improving visual appearance based on student input to increase its effectiveness.

a) Google site design

Based on the findings of the analysis stage, the learning media was designed using Google Sites. The structure of the website includes several main components:
1. A home page that introduces learning objectives and a navigation guide.
2. A detailed explanation of the concept of ratios, including direct proportions, inverse proportions, and scales.
3. Visual aids such as diagrams and videos are embedded to support conceptual understanding.
4. Interactive components include practice questions, quizzes, and downloadable materials.
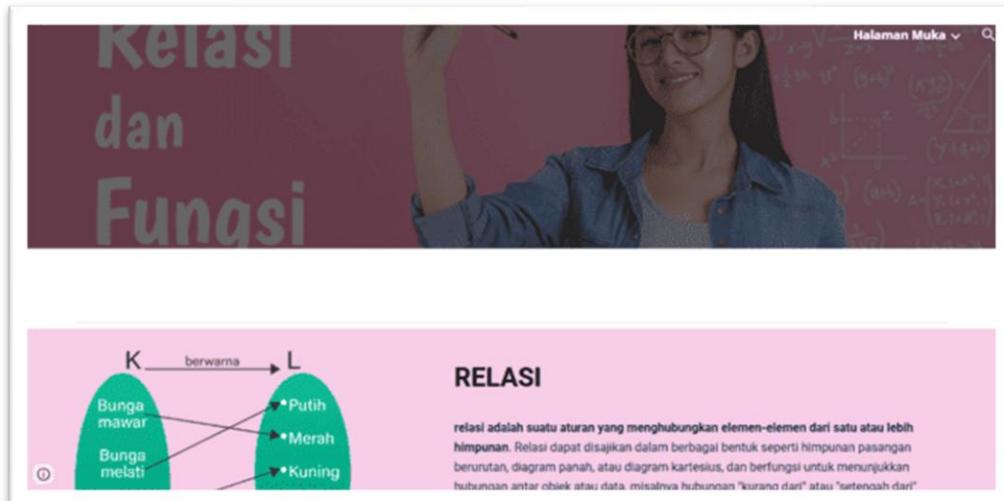
Figure 1 home page

At this design stage, it will be decisive for the design of the next page, where at this design stage it is focused on the ease of accessing features for other media provided and also buttons to switch pages.

Figure 2 features towards other pages and media

At this stage of design development, teaching materials are added in the form of videos, audio, and written materials. Where everything is provided in the button feature which when clicked will immediately bring up the teaching media.

Figure 3 material design

In this part of the material, not only writing is given, illustrated images are also provided to show the results of the discussion of the material.

Figure 4 interactive quiz

This learning website is also added with interactive quizzes to test students' understanding after learning using the learning website with a design that has been in accordance with the needs of students. During implementation, students interact with various components of the website, including video explanations, self-paced quizzes, and downloadable exercises. Observations and informal interviews show that students are generally enthusiastic and find the platform easy to navigate.

b) Accessibility Test:

Subject: Two fellow teachers (peers) who have an understanding of technology.
Instrument: Learning Website Accessibility Instrument which contains four aspects:
(1) Technical & Speed,
(2) Visual Design,
(3) Interactivity, and
(4) Learning Eligibility.
The instrument uses a Likert scale of 1-5 (1=Very Poor, 5=Very Good).
Procedure: Colleagues are asked to explore all the features of the website and fill out an online questionnaire created using Google Form.

c) User Feedback Test:

Subject: One teacher and several students from different classes.

Instrument: Learning Website User Feedback Instrument which covers three dimensions:
(1) Technical,
(2) Pedagogical, and
(3) Aesthetics.
Procedure: Teachers and students use the website for one learning session, then provide feedback through the same Google Form.
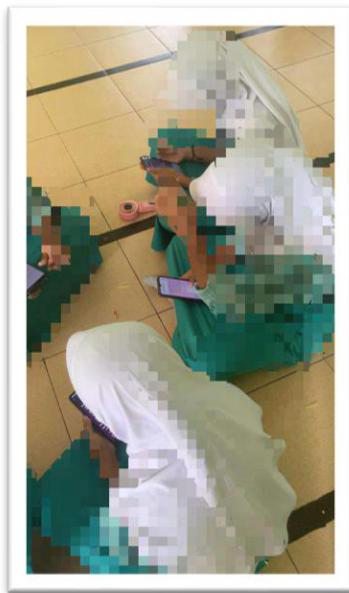

Figure 5 Students learn to use Google Sites
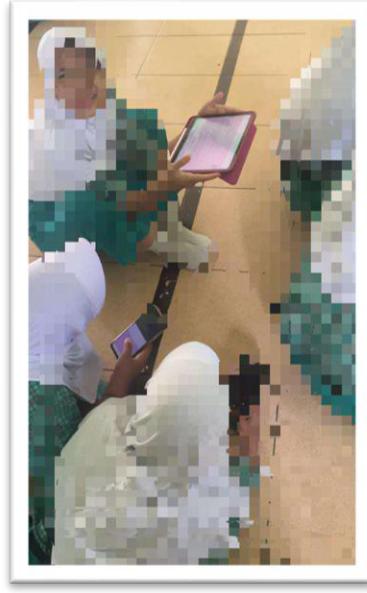
Figure 6 Students work on interactive quizzes

d)   Data Management:

All responses from both instruments are automatically collected in Google Sheets. The data is processed using an average function for each aspect and dimension, so that it can be analyzed in a simple quantitative manner. Qualitative comments from the suggestion column were also collected for more in-depth analysis.

Here I include an example diagram of the results of the average calculation of one question in the form of percentage.
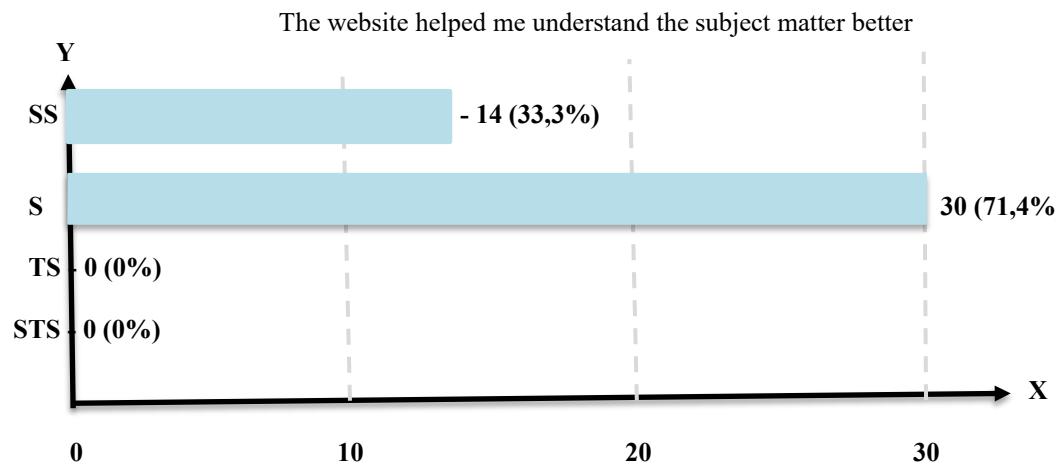
Figure 7 result diagram

e)   Results of Accessibility Instrument Analysis (Peer Assessment)

Present a table or summary chart of the average score for each aspect:

Table 1 peer assessment results

Aspects	Average	Remarks
Technical and Speed	100%	My learning website has **very optimal** technical performance, with fast loading times and perfect accessibility on various devices and internet connections. No technical problems were found during the trial.
Visual Design	88,9%	The website interface design **is attractive and professional**, with an organized layout and harmonious color selection. However, there is still a slight refinement to the consistency of the spacing and the addition of supporting visual elements to increase appeal.
Interactivity	77,8%	The website is equipped with interactive features such as quizzes and adequate navigation, but **further development is needed** to add a variety of interaction types (e.g., drag-and-drop, simulation, or interactive animations) to make it more engaging and actively engage users.
Learning Eligibility	100%	The content and structure of the material on the website **are very relevant and in accordance** with the learning objectives. The order of presentation of the material is logical, easy to understand, and supports the achievement of the expected competencies effectively.

Based on the results of the accessibility test conducted by peers, it can be concluded that the "Relations and Functions" learning website in general has met the feasibility standards very well, especially in technical and pedagogical aspects. Key findings show that the website is rated as having perfect technical performance with a score of 100% on technical aspects and speed, which reflects good optimization in terms of loading speed and ease of access on various devices. In addition, the learning feasibility aspect also achieved a maximum score of 100%, which indicates that the material presented has been relevant, logically structured, and effective in supporting the achievement of learning objectives.

However, there are some improvement notes that need to be noted. In terms of visual design, even though it obtained a fairly high score of 88.9%, improvements are still needed, especially in terms of layout consistency, color contrast, and the addition of supporting visual elements to increase visual appeal. The interactivity aspect is the area that needs the most development with a score of 77.8%, which indicates the need to add a variety of interactive media such as simulations, animations, or drag-and-drop features to create a more engaging learning experience and involve active user participation. Overall, this website has been suitable for use as a learning medium but improvements in visual aesthetics and interactivity variations to create a more optimal learning experience.

f)   Results of Feedback Instrument Analysis (Teachers & Students)

Present an average table of three main dimensions:

Table 2 Feedback results

Dimensions	Average	Remarks
Technical	61,4%	**Enough - Needs Significant Improvement**: The website still experiences technical problems such as slow loading when accessed by many people, a sub-optimal display on some devices, or confusing navigation for some users.
Pedagogical	64,74%	**Enough - Needs Improvement**: Although the content is already relevant to the learning material, the presentation is not yet fully effective in helping students understand. A more interesting and interactive pedagogical approach is needed.

Dimensions	Average	Remarks
Aesthetics	65,74%	**Enough - Needs Design Improvement**: The visual appearance of the website meets the basic standards but is not enough to grab students' attention. Improvements need to be made in the selection of colors, layouts, and more creative visual elements.

Based on a comprehensive analysis of quantitative and qualitative data, it can be concluded that Google Sites-based digital teaching materials "Relationships and Functions" have met the basic standards of technical and pedagogical feasibility from an expert perspective, but have not reached the optimal level of effectiveness from the point of view of direct users (students). The relationship between technical design quality and user acceptance turns out to be non-linear. The website excels in material structure and accessibility reliability, as evidenced by its high expert scores. However, the aspects that profoundly influence the student learning experience—namely interactivity that encourages active cognitive engagement, instructional clarity, and engaging interface design—are still critical areas that require deep refinement.

These findings support the theory that the success of technology integration in education should not only be measured from the perspective of the maker (teacher), but should be through the lens of the end user (student) by considering the principles of cognitive psychology and human-centered design. Therefore, these teaching materials have strong potential as a learning resource, but require further design iterations that focus on improving interactivity, simplifying navigation, and refining visual presentations based on user feedback. This research confirms that the process of developing effective digital teaching materials is a cyclical and participatory process, involving continuous student feedback as an integral part of learning design.

E. References

Adnan, M., & Anwar, K. (2020). Online learning amid the COVID-19 pandemic: Students' perspectives. Journal of Pedagogical Sociology and Psychology, 2(1), 45-51.

Almarzooq, Z. I., Lopes, M., & Kochar, A. (2020). Virtual Learning During the COVID-19 Pandemic: A Disruptive Technology in Graduate Medical Education. Journal of the American College of Cardiology, 75(20), 2635-2638.

Haryanto, H., Ghufron, A., & Suyantiningsih, S. (2022). The Use of Google Sites as a Learning Media in Elementary School. Scientific Journal of Elementary Schools, 6(1), 158-166.

Purnama, S., Ulfah, M., & Machali, I. (2021). The Use of Google Sites in Online Learning for Elementary School Students. Journal of Islamic Education, 7(2), 145-158.

Branch, R. M. (2019). Instructional Design: The ADDIE Approach (2nd ed.). Springer.

Kurniawan, D., & Dewi, S. V. (2023). Developing and Validating Digital Teaching Materials: A Practical Framework. International Journal of Interactive Mobile Technologies (iJIM), 17(04), 4-19.

Nieveen, N., & Folmer, E. (2020). Formative Evaluation in Educational Design Research. In Educational Design Research (pp. 152-169). Routledge.

Yusuf, Q., Yusuf, Y. Q., Erdiana, N., & Pratama, A. R. (2020). Engaging with Edmodo to Teach English Writing of Narrative Texts to EFL Students. Problems of Education in the 21st Century, 78(3), 429-445.

Mayer, R. E. (2020). Multimedia Learning (3rd ed.). Cambridge University Press.

Ogegbo, A. A., & Tijani, A. A. (2023). Assessing Students' Perceptions of E-Learning Platforms Usability via the Technology Acceptance Model. Education and Information Technologies, 28, 2485–2504.

Sari, R. M., Sumarmo, U., & Juandi, D. (2022). Digital Game-Based Learning in Mathematics: A Systematic Literature Review. Journal of Mathematics and Mathematics Education, 12(2), 123-145.