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The Influence of Google Sites-Based Interactive Learning Media on Students' Digital Literacy Skills

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ABSTRACT

This study aims to describe the digital literacy skills of students taught using interactive learning media based on Google Sites, compare them with students taught using conventional methods, and analyze the effect of using this media on improving digital literacy skills. The research employed a quantitative approach with a quasi-experimental method and a nonequivalent control group design. The sample consisted of 68 tenth-grade students of SMAN 2 Pinrang, divided into an experimental class (n=34) and a control class (n=34). The instrument used was a digital literacy test with 26 items administered during the pretest and posttest stages. Data analysis was carried out using normality test, homogeneity test, and t-test. The results showed that the digital literacy skills of students in the experimental class were significantly improved compared to those in the control class. The t-test yielded a significant value of 0.021 < 0.05, indicating a significant effect of using Google Sites on improving digital literacy skills. Therefore, interactive learning media based on Google Sites is effective in enhancing students' digital literacy skills.

Keywords: Digital Literacy, Interactive Learning Media, Google Sites, Quasi-Experiment, Students

INTRODUCTION

The development of information and communication technology in the era of the Industrial Revolution 4.0 has brought fundamental changes to various aspects of life, including education. Digital transformation is driving a paradigm shift in learning from conventional patterns to technology-based learning that is more flexible, collaborative, and interactive. 21st-century learners are required to master not only basic reading, writing, and arithmetic skills but also digital literacy skills as a key competency to face global challenges (Etistika YW et al., 2020).

UNESCO (2018) emphasized digital literacy as a key 21st-century competency that students must possess to actively participate in a knowledge-based society. Digital literacy encompasses technical skills in operating devices, critical thinking skills, ethical awareness, digital security, and the use of technology for lifelong learning. This aligns with the 2018 OECD-PISA report, which showed that the majority of students still struggle to evaluate the credibility of online information, sort out fake news, and utilize technology productively (OECD, 2019).

In Indonesia, digital literacy challenges remain real. The 2022 National Digital Literacy Index Survey by the Ministry of Communication and Information Technology (Kominfo) recorded a score of 3.54 on a scale of 5, categorized as "moderate." Digital skills and digital

culture are relatively good, but digital security and ethics are relatively low (Heryani et al., 2022). This situation influences student behavior, who primarily use technology for entertainment and social interaction rather than meaningful learning (Setianingsih et al., 2022).

Education needs to respond by integrating digitally-based interactive learning media that not only deliver material but also encourage active participation and develop digital literacy skills. Interactive learning media has been proven to increase student engagement, hone critical thinking skills, and facilitate more contextual learning. This aligns with the concept of "Merdeka Belajar" (Freedom to Learn), which emphasizes student independence, creativity, and adaptation to technological developments (Sadiman et al., 2019).

One potential digital platform is Google Sites. This platform allows teachers to design integrated learning sites with text, images, videos, quizzes, and other learning resources. Google Sites is easily accessible, user-friendly, and supports both blended and project-based learning approaches. Previous research has proven its effectiveness: Batu Bara, Yulianti, & Sulistyowati (2022) reported a validation score above 90% with a student response rate of 94.5%; Ni'am et al. (2023) found an average post-test score of 89.14, higher than the pre-test score of 66.72; while Kusuma, Nugroho, & Aulana (2025) demonstrated a usability score of 78% and effectiveness in increasing student engagement.

However, the majority of research still focuses on academic aspects, learning outcomes, and motivation. Studies on the impact of Google Sites on students' digital literacy skills, particularly those related to ethics, security, digital culture, and critical thinking, are still limited. Yet, digital literacy skills are a key competency for navigating the global complexities of the 21st century.

Based on the description, this study is entitled "The Effect of Google Sites-Based Interactive Learning Media on Students' Digital Literacy Skills." This research is important because it has the potential to contribute to the development of innovative learning media while strengthening students' digital literacy skills according to the demands of the 21st century.

RESEARCH METHODS

This study used a quasi-experimental design with a nonequivalent control group. This design involved two classes: an experimental class that received treatment using interactive learning media based on Google Sites, and a control class that was taught using conventional methods. Before the treatment, both classes were given a pretest to measure initial digital literacy skills. After the learning, both classes were given a posttest to determine differences in learning outcomes.

The research population included all 10th grade students at the research location school, with a total of 238 students from four classes. The sample was selected using a purposive sampling technique based on certain criteria, resulting in two sample classes, namely X-3 and X-6, with 34 students each.

The research instrument was a digital literacy skills questionnaire compiled based on digital literacy indicators. This instrument serves to obtain relevant, valid, and reliable data. Validity testing was conducted in two stages: construct validity and empirical validity. Based on Gregory's analysis, the Construct Validity (VC) value was 1.00 (>0.75), thus the instrument was declared valid. The empirical validity test showed that of the 40 items, 26 were declared valid and were used in the study.

Data collection was conducted through initial observations, teacher interviews, and pretest and posttest questionnaires administered to both the experimental and control classes. The collected data were then analyzed using descriptive and inferential statistics. Statistical tests used included normality tests, homogeneity tests, and t-tests to determine differences in average digital literacy skill outcomes between the experimental and control classes. With this design, this study aimed to measure the effectiveness of Google Sites-based interactive learning media in improving students' digital literacy skills.

RESULTS AND DISCUSSION

Results

The research data was obtained through a digital literacy skills survey conducted on grade X students at SMA Negeri 2 Pinrang. The survey was conducted in the form of a pretest and posttest in two classes, namely class X 6 (experimental, 34 students) who used interactive learning media based on Google Sites, and class X 3 (control, 34 students) who used conventional learning media. The posttest was given after the learning was completed to measure the effect of using interactive learning media based on Google Sites on students' digital literacy skills consisting of 26 positive and negative statements, which had been previously tested.

The results of the descriptive analysis of digital literacy skills of class X 6 as an experimental class using interactive learning media based on Google sites, and class X 3 as a control class using conventional learning media at SMA Negeri 2 Pinrang, are presented as follows.

Table 1. Data Processing Frequency of Pretest Digital Literacy Skills of Grade X Students of SMA Negeri 2 Pinrang

Interval	Category	Experimental Class Frequency
96.9	Very high	3
91.4	Tall	2
86.0	Currently	19
80.0	Low	9
≤80.0	Very Low	1

Source: Research data (2025)

Based on the table above, the results of the descriptive statistical analysis for the digital literacy skills pretest data of grade X students at SMAN 2 Pinrang in the 2024/2025 academic year were obtained. The pretest scores in both classes showed relatively similar values, indicating that the research sample was homogeneous. This means that students from both classes had equivalent initial characteristics and abilities before being given the treatment.

The results of the descriptive analysis of the pretest data are presented in a frequency distribution table with five categories: very high, high, medium, low, and very low. This presentation aims to provide an overview of the digital literacy skills of students in grades X6 and X3. Further details can be seen in Tables 2 and 3.

Table 2. Statistical Data Processing of Digital Literacy Skills Pretest of Grade X Students of SMA Negeri 2 Pinrang

Statistics	Class	
	Experiment	Control
Number of Samples	34	34
Idel Score	130	130
Minimum Score	78	75
Maximum Score	103	101
Average Score	88.7	87.7
Standard Deviation	5.5	4.6
Variance	30.6	21.6

Source: Research data (2025)

Based on Table 2, the distribution of digital literacy skills of students in the experimental class shows that the majority are in the moderate category (63.3%), followed by the very high category (10%), high (6.7%), and only one student (3.3%) scored below 80.5. Based on the explanation above, before being given treatment, the majority of students in the experimental class had a moderate learning interest. Only 16.7% of students were classified as very high and high, while 66.6% were in the moderate, low, and very low categories.

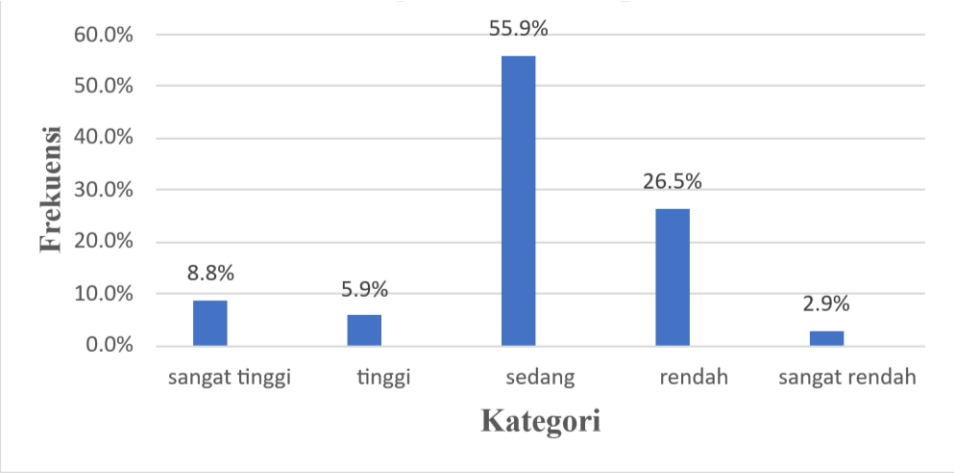

Figure 1. Graph of Categories and Frequency of Pre-test Data on Digital Literacy Skills of Experimental Class Students

Based on the diagram in Figure 1, the majority of students in the experimental class are in the medium category (55.9%). The percentage of students in the very high category is 8.8% and the high category is 5.9%. Meanwhile, 26.5% of students are in the low category, and only 2.9% are in the very low category.

Table 3. Distribution of Questionnaire Categories for Pretest Digital Literacy Skills of Control Class Students.

Interval	Category	Control Class Frequency
103.4	Very high	2
90.2	Tall	1
77.0	Currently	20
63.8	Low	10
≤ 63,8	Very Low	1

Source: Research data (2025)

The analysis results showed that before the intervention, the majority of students in the experimental class (53.3%) and the control class (58.8%) were in the moderate category. The percentage of students in the very high and high categories was relatively small in both classes, namely 16.7% in the experimental class and 8.8% in the control class, respectively. Conversely, the low and very low categories recorded quite large percentages, namely 30.0% in the experimental class and 32.3% in the control class. These findings indicate that the level of initial digital literacy skills of students in both classes was relatively equivalent before the intervention was given.

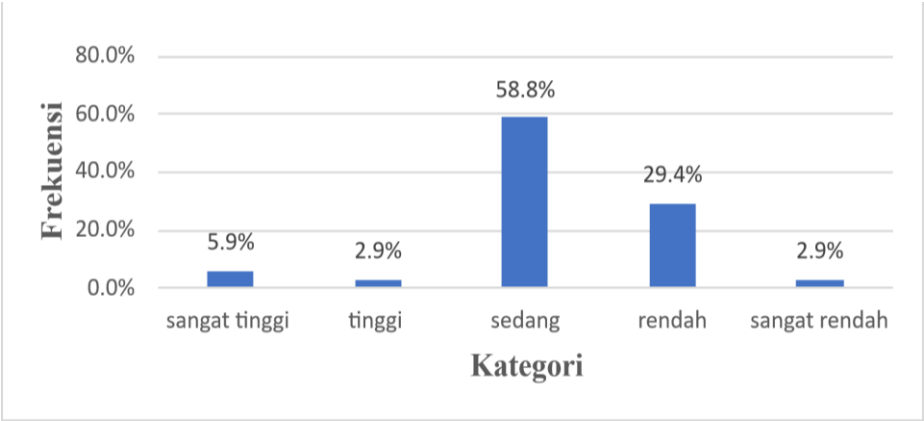

Figure 2. Graph of Categories and Frequency of Pretest Data on Digital Literacy Skills of Control Class Students.

Based on Figure 2, the percentage of students' interest in learning physics in the control class shows that 5.9% are in the very high category, 2.9% in the high category, 58.8% in the medium category, 29.4% in the low category, and 2.9% in the very low category. This condition indicates that before being given treatment, student engagement in learning was still highly dependent on the role of the teacher. This is supported by the data in Table 5 which shows that the number of participants with a high level of engagement in the control class significantly exceeds the number of participants in the experimental class.

Table 4. Percentage of Average Scores of Digital Literacy Skills Pretest Indicators

	Pretest	
Indicator	**Experiment**	**Control**
Search on the internet	85.7%	87.8%
Hypertext directional guide	80.0%	87.1%
Evaluation of content and information	79.6%	70.7%
Compilation of knowledge	76.1%	74.3%

Source: Research data (2025)

Table 5. Statistical Data Processing of Post-test Digital Literacy Skills of Grade X Students of SMA Negeri 2 Pinrang

	Class	
Statistics	**Experiment**	**Control**
Number of Samples	34	34
Idel Score	130	130
Minimum Score	108	102
Maximum Score	120	110
Average Score	116.6	108.1
Standard Deviation	2.8	2.2
Variance	7.9	4.7

Source: research data (2025)

The posttest analysis results showed that the digital literacy skills of students in the experimental class improved significantly compared to those in the control class. Although both classes experienced an increase in average scores after the learning process, the increase in the experimental class was higher. This indicates that the use of interactive learning media based on Google Sites can create a more interactive and engaging learning environment, thus encouraging students to be more active in searching for, managing, and utilizing digital information.

These findings align with Arsyad's (2019) opinion, which states that interactive learning media can increase students' motivation and interest in learning through the

presentation of varied, easily accessible materials and support the development of 21st-century skills. Thus, the implementation of Google Sites as a learning medium not only facilitates material delivery but also contributes to improving students' overall digital literacy skills. For more details, see Tables 6 and 7 below:

Table 7. Frequency Distribution of Post-test Categories of Digital Literacy Skills of Experimental Class X Students of SMAN 2 Pinrang.

Interval	Category	Experimental Class Frequency
120.8	Very high	18
118.0	Tall	8
115.2	Currently	5
112.4	Low	2
≤ 112,4	Very Low	1

Source: research data (2025)

Based on the table, the majority of students in the experimental class were in the very high (60.0%) and high (26.7%) categories, while only 16.7% were in the moderate category. Students in the low and very low categories were 6.7% and 3.3%, respectively. These findings indicate that after being given treatment in the form of interactive learning media based on Google Sites, students' digital literacy skills experienced a significant increase, especially in the very high and high categories.

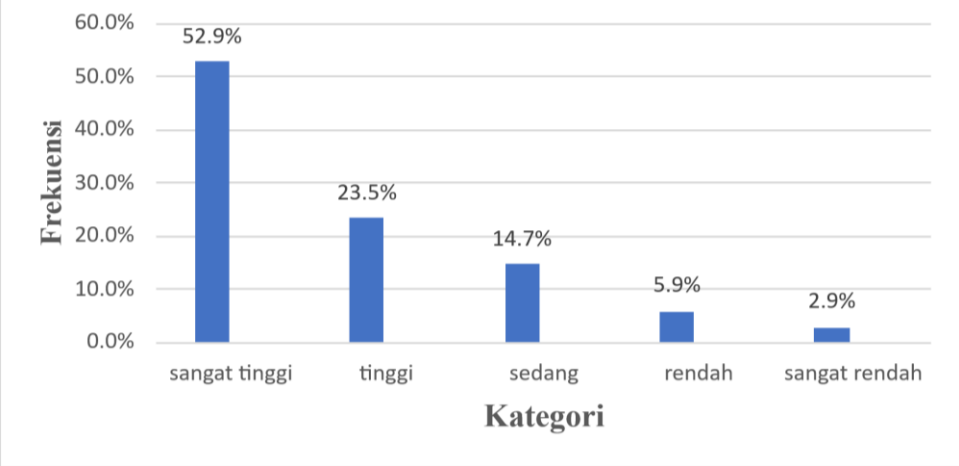

Figure 3. Graph of Categories and Frequency of Post-test Data on Digital Literacy Skills of Experimental Class Students

Based on the diagram, the majority of students in the experimental class were in the very high (52.9%) and high (23.5%) categories, while only 14.7% were in the medium category. Students in the low and very low categories were 5.9% and 2.9%, respectively. This

data shows that after being given treatment in the form of interactive learning media based on Google Sites, students' digital literacy skills increased significantly, with the largest proportion being in the very high and high categories.

Table 7 Frequency Distribution of Post-test Categories of Digital Literacy Skills of Control Class Students at SMAN 2 Pinrang

Interval	Category	Experimental Class Frequency
111.4	Very high	15
109.2	Tall	5
107.0	Currently	10
104.8	Low	3
≤ 104,8	Very Low	1

Source: research data (2025)

Based on Table 7, the percentage of interest in learning physics in the control class shows that out of 34 students, 15 were in the very high category with a score of 111.4. The high category with a score of 109.2 was achieved by 5 students, while 10 students were in the medium category with a score of 107.0. Meanwhile, the low category with a score of 104.8 was obtained by 3 students, and only 1 student was included in the very low category with a score below 104.8.

From this description, it can be concluded that there was an increase in scores in the very high and high categories of 66.7% after being given treatment in the form of conventional learning media. Meanwhile, 33.3% of students were in the medium, low, and very low categories.

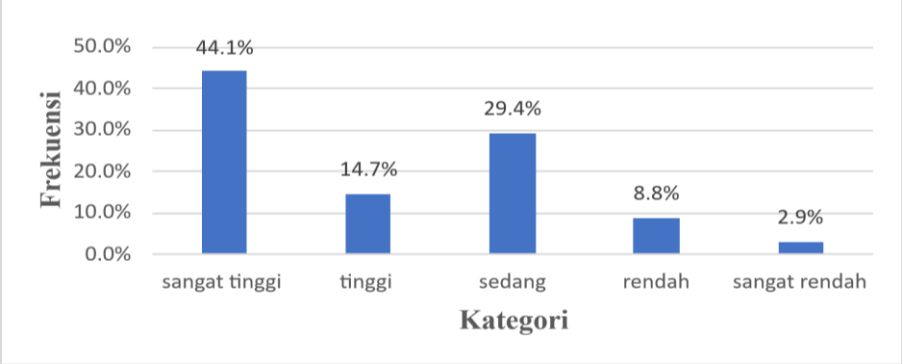

Figure 4. Graph of Categories and Frequency of Post-test Data on Digital Literacy Skills of Control Class Students

Based on Figure 4, the percentage of students' interest in learning physics in the control class shows that 44.1% are in the very high category, 14.7% in the high category, 29.4%

in the medium category, 8.8% in the low category, and 2.9% in the very low category. This finding indicates that although there was an increase in learning interest in the control class, the increase was not as large as in the experimental class that received treatment in the form of interactive learning media based on Google Sites. Based on the posttest questionnaire given to students in the experimental and control classes with four indicators of learning interest, the complete data can be seen in Table 8.

Table 8. Percentage of Average Scores of Digital Literacy Skills by Indicator

Indicator	Pretest	
	Experiment	Control
Search on the internet	88.0%	82.9%
Hypertext directional guide	91.8%	88.3%
Evaluation of content and information	93.0%	87.1%
Compilation of knowledge	95.2%	83.6%

Source: research data (2025)

Based on Table 8, the implementation of interactive learning media based on Google Sites has been proven to improve the digital literacy skills of students in the experimental class compared to the control class. Indicator achievements in the experimental class include internet searches (88.0%), hypertext directions (91.8%), content and information evaluation (93.0%), and knowledge organization (95.2%). Meanwhile, the control class's achievements were 82.9%, 88.3%, 87.1%, and 83.6%, respectively. Posttest data were analyzed using the Shapiro–Wilk test considering the sample size was less than 60 respondents.

Table 9. Results of Normality Test Analysis Using SPSS Application

	Digital Literacy Skills	Shapiro-Wilk Sig. Value
Posttest	Experimental class	0.889
	Control class	0.280

Source: research data (2025)

Based on Table 10, the posttest significance test (Sig.) results for the experimental and control groups showed a value >0.05. This indicates that the data is normally distributed, allowing for parametric statistical testing in the next analysis.

Table 10. Results of Homogeneity Test Analysis Using SPSS Application

Digital literacy skills	Sig.levenest Test Value
Posttest	0.220

Source: research data (2025)

Based on Table 10, the Levene's Test Sig. value of 0.220 (>0.05) indicates that the posttest data of the experimental and control classes have homogeneous variance. Thus, the

digital literacy skills of students in grades X 6 and X 3 at SMAN 2 Pinrang have a comparable level of uniformity.

Table 11. Results of Hypothesis Test Analysis Using SPSS Application

Digital literacy skills	Sig. Value (2-tailed) independent-sample T Test.
Posttest	0.021

Source: research data (2025)

The results of the hypothesis test using the SPSS application with Independent-Samples T-Test show that the Sig. (2-tailed) value at equal variances assumed is 0.021, which means it is smaller than 0.05. This indicates a significant difference in students' digital literacy skills after using interactive learning media based on Google Sites. Therefore, the null hypothesis (H_0) is rejected and the alternative hypothesis (H_a) is accepted. Thus, it can be concluded that interactive learning media based on Google Sites has a significant influence on students' digital literacy skills.

1. Discussion

The results of this study indicate that the use of interactive learning media based on Google Sites has a significant effect on improving the digital literacy skills of grade X students at SMAN 2 Pinrang. The average posttest score of the experimental class (116.6) was higher than that of the control class (108.1), with the t-test results showing a significance of 0.021 (<0.05). These findings confirm that Google Sites is effectively used in learning to improve students' digital literacy skills.

Theoretically, this improvement can be explained through Mayer's (2009) multimedia learning theory, which states that the use of various forms of representation (text, images, videos, animations) can strengthen students' cognitive processes. Google Sites, as a web-based learning platform, allows teachers to integrate various multimedia content that supports interactive learning, making it easier for students to understand, evaluate, and present information.

The results of this study are also consistent with the findings of Batu Bara, Yulianti, & Sulistyowati (2022) who stated that Google Sites-based learning media obtained a validation score above 90% with a positive student response reaching 94.5%. Ni'am et al. (2023) found that Google Sites-based learning improved science learning outcomes with a higher average post-test score than the pre-test. In line with this study, Kusuma, Nugroho, & Aulana (2025) also reported that Google Sites has a high level of usability and is effective in increasing student engagement. Thus, the results of this study strengthen the evidence that Google Sites not only influences academic outcomes but also digital literacy competencies.

Furthermore, this study emphasizes the importance of digital literacy as a 21st-century skill. UNESCO (2018) identifies digital literacy as a key competency encompassing technical skills, critical thinking, ethical awareness, and digital security. The OECD (2019) PISA report

also highlighted that the majority of students struggle to evaluate the credibility of online information. The study's findings indicate that learning with Google Sites allows students to better practice information retrieval, content comprehension, information evaluation, and knowledge organization. This is reflected in the increase in the average digital literacy indicator score in the experimental class, which reached over 90%.

From a practical perspective, implementing Google Sites provides a more interactive learning experience, encourages independence, and strengthens students' critical thinking skills. Teachers can design varied and flexible learning according to their needs, while students have the opportunity to independently explore relevant learning resources. This aligns with the concept of "Merdeka Belajar" (Freedom to Learn), which emphasizes creativity, collaboration, and technological adaptation (Sadiman et al., 2019). Therefore, the results of this study can serve as recommendations for educators to utilize Google Sites as an innovative teaching medium.

However, this study has several limitations. First, it involved only two classes with a limited sample size, so the results cannot be broadly generalized. Second, the research instrument was only a digital literacy test, so it did not include qualitative aspects such as in-depth interviews regarding students' learning experiences. Third, this study was conducted over a short period, so it cannot yet describe the long-term impact of Google Sites use on students' digital literacy development. Therefore, future research could expand the sample size, use mixed methods, and examine the long-term effectiveness of Google Sites use in learning.

Overall, the findings of this study confirm that interactive learning media based on Google Sites can significantly improve students' digital literacy skills. Practical implications: Teachers are advised to integrate Google Sites into their learning to foster students' digital skills, while education policymakers can consider developing teacher training programs in the development of web-based learning media. Thus, efforts to improve students' digital literacy can align with 21st-century demands and national education policy.

CONCLUSION

Based on the results of data analysis and discussion, the following conclusions can be put forward:

1. There is a significant difference in digital literacy skills between students who learn using interactive learning media based on Google Sites and students who use conventional learning methods.
2. Interactive learning media based on Google Sites has been proven to improve students' digital literacy skills, which include information search skills, content understanding, information evaluation, and knowledge organization.
3. The increase in digital literacy skills in the experimental class was higher than in the control class, with an average achievement of digital literacy indicators exceeding 90%, while the control class only reached 85%.

4. The implementation of Google Sites in learning provides an interactive learning experience, encourages independence, and fosters 21st-century skills, making it suitable for use as an alternative learning medium to support the Independent Learning program.

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