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Development of Google Sites–Based Multimedia for Social Science Learning to Improve Fifth-Grade Computational Thinking Skills

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Abstract: This research is motivated by the limited use of interactive multimedia in science learning in elementary schools, resulting in suboptimal student engagement and the development of computational thinking skills. The textbook-dominated learning process results in students being less active and having difficulty understanding concepts in depth. Therefore, the use of interactive multimedia based on Google Sites is expected to increase student motivation, understanding, and active participation. The purpose of this research is to develop interactive multimedia based on Google Sites in fifth-grade science learning in elementary schools that is highly valid, practical, and effective in improving students' computational thinking skills. The method used was Research and Development (R&D) with the ADDIE model, which includes analysis, design, development, implementation, and evaluation. The research subjects consisted of fifth-grade teachers and students at SDN 11 Lubuk Buaya and SDN Percobaan in Padang City, West Sumatra. Data were collected through observation, interviews, questionnaires, and computational thinking tests. Data analysis techniques included validity, practicality, and effectiveness tests. The practicality test was conducted in class VB at SDN 11 Lubuk Buaya with 17 students and class VB at SDN Percobaan with 24 students, and 2 class teachers in each class. The effectiveness test was conducted in class VA at SDN Percobaan with 23 students as the control class and class VB as the experimental class. The validation results showed a score of 90% from the material experts, 93% from the language experts, and 81% from the design experts, categorizing it as very valid. The practicality test obtained a score of 95% from the teachers and 92% from the students, categorizing it as very practical. The effectiveness test showed that the experimental class achieved an average score of 87.44 (effective), while the control class achieved 58.88 (moderately effective). Thus, the Google Site-based interactive multimedia was declared very valid, very practical, and effective as an alternative learning medium for science studies in elementary schools.

Keywords: Computational thinking; Google site; Interactive multimedia; Social science

Introduction

Education is a crucial pillar in national development, as stipulated in Law Number 20 of 2003 concerning the National Education System. It emphasizes that education aims to develop students' potential to become individuals who are faithful, virtuous, capable, creative, independent, and democratic and responsible citizens. This goal aligns with the demands of the 21st century, where students are required to master not only basic knowledge but also critical thinking, creativity, communication, and collaborative skills, which are essential for facing changing times. This demonstrates that a nation's progress depends heavily on the quality of its education system.

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Education fundamentally plays a crucial role, including within the school setting, where the learning process takes place. The learning process is an inseparable part of education itself, as the quality of student learning outcomes is significantly influenced by how it is designed and implemented. If we desire good learning outcomes, we must also ensure that the learning process runs smoothly and meets students' needs (Andriani et al., 2023). Therefore, education can be viewed as a key pillar in developing superior and competitive human resources.

Accordingly, in the era of globalization and the Industrial Revolution 4.0, education is not only required to transfer knowledge but also to equip students with 21st-century skills, such as critical thinking, creativity, communication, collaboration, and digital literacy (Januarti et al., 2024; Kalyani, 2024; Susilawati et al., 2023). One important skill receiving attention in this context is computational thinking, namely the ability to solve problems systematically, logically, and efficiently (Kartini et al., 2019; Muliyadi et al., 2026; Zhu et al., 2024). This skill helps students develop a systematic and logical mindset in solving problems, both in subjects like mathematics and science and in everyday life.

The Ministry of Education, Culture, Research, and Technology responds to this need by implementing the Independent Curriculum. This curriculum emphasizes competency- and character-oriented learning through a flexible, differentiated, and contextual approach (Lubis et al., 2024). In the Independent Curriculum, students are encouraged to be active, reflective learners, capable of facing real-world challenges. Learning is no longer teacher-centered, but rather allows for exploration, collaboration, and problem-solving (Doyan et al., 2020; Marhamah et al., 2024). Therefore, the use of innovative and interactive learning media is crucial.

One strategy to support meaningful learning is the use of interactive multimedia. According to Suarmita et al. (2025), interactive multimedia is a combination of visual, audio, and interactive elements designed to increase student engagement and understanding. Unlike conventional learning media such as images or videos, which are one-way, interactive multimedia presents content more dynamically and allows for direct interaction between students and the material. The combination of visual, audio, and text elements, along with interactive features such as quizzes, free navigation, and simulations, can enhance active participation and meaningful student understanding (Khasanah et al., 2019; Munandar et al., 2024; Raibowo et al., 2021). This media has been proven to facilitate various learning styles and strengthen the internalization of concepts, especially for elementary school-aged children. Various studies have shown that interactive multimedia can improve students' learning motivation, memory, and critical thinking skills (Rahmawati et al., 2021).

Google Sites, an easily accessible and usable technology, is one platform that supports the development of interactive multimedia. Google Sites allows teachers to create interactive learning sites that integrate various components such as text, images, videos, simulations, and quizzes. Other advantages include its free nature, user-friendliness, and accessibility across multiple devices (Efendi et al., 2024). The use of Google Sites also aligns with digital literacy and the spirit of independent learning because it facilitates flexible and collaborative independent learning. Research by Gusriani et al. (2025) shows that Google Sites-based media can significantly increase student engagement and learning outcomes.

At the elementary school level, one subject with significant potential for developing students' thinking skills is Natural and Social Sciences (IPAS). IPAS is an integrative subject in the Independent Curriculum, combining scientific and social approaches to understand natural phenomena and social life. IPAS learning encourages students to observe, ask questions, collect data, and draw conclusions (Mawadati et al., 2023). Therefore, it is an appropriate vehicle for developing computational thinking skills.

However, several studies indicate several problems, including low computational thinking skills. Studies indicate that elementary school students' computational thinking skills are still low, particularly in the context of solving IPAS problems that require systematic analysis (Ahmad et al., 2024). Conventional learning tends to under-develop these skills because it focuses on memorization. Research by Hardiningrum (2022) found that the use of learning media in elementary schools is still limited to textbooks and simple teaching aids, resulting in less student interest. However, interactive multimedia has been shown to increase student engagement and critical thinking skills (Aziz, 2023).

Although Google Sites has been used for social studies and science learning, its integration with the computational thinking approach in science is still rarely explored (S. Wahyuningsih et al., 2025). This platform offers the flexibility of presenting text-based materials, visuals, and interactive simulations, suitable for practicing computational thinking (Thohir et al., 2024).

Based on a preliminary study conducted at SD Negeri 21 Sungai Bangek with 28 students, SD Negeri 16 Tanjung Aur with 28 students, and SD Negeri 11 Lubuk Buaya with 29 students from February 13-18, 2025, through observations and interviews with fifth-grade teachers at each school, the teachers stated that the comprehensive use of interactive multimedia has not been optimal, primarily due to limited skills and time for

media development. Furthermore, teachers stated that fifth-grade students generally still have difficulty understanding science material in depth and are not yet accustomed to applying systematic problem-solving strategies. Furthermore, a teacher at SDN 21 Sungai Bangek stated that despite using videos and images to assist with explanations, students were still less active because the material was not presented interactively. A teacher at SDN 16 Tanjung Aur conveyed the need for interactive multimedia learning media so that students could actively participate in learning to the fullest, but was hampered by limited ability to develop it. Meanwhile, a teacher at SDN 11 Lubuk Buaya stated that students often seemed less focused if the media used did not involve direct activities. Teachers generally welcomed the development of digital learning media that were practical, easily modified, and appropriate to the local context.

The researchers then conducted a learning media needs analysis using questionnaires administered to teachers and students. Based on the results of the learning media needs analysis at the three elementary schools, it was found that students still tended to disagree (72%) with learning that only used textbooks without additional learning media. This indicates a need for a variety of more innovative media. Conversely, the majority of students strongly agreed and approved of the use of interactive learning media. This is evident from the average response to questions 2 through 7, where the percentages of Strongly Agree (SS) and Agree (S) dominated, reaching 99% for the statement about the enjoyment of learning with interactive media, and 100% for the statement about interactive media making learning interesting, aiding understanding of the material, and motivating active student participation. Furthermore, 97% of students also agreed that interactive learning media helped them develop their technology and digital literacy skills, and 98% stated that these media made learning more enjoyable.

Thus, it can be concluded that the observation results indicate a real need for the development of interactive learning media. This media is seen as capable of increasing students' motivation, engagement, understanding, and systematic problem-solving skills in learning, while also providing a solution to the limitations of using textbooks as the sole learning resource.

Thus, the development of interactive multimedia based on Google Sites in science learning is a promising alternative to help students understand concepts more meaningfully and contextually, while simultaneously fostering computational thinking skills (Waritsman et al., 2024). This media is expected to support teachers in delivering material innovatively and encourage students to learn actively, independently, and reflectively.

Based on the description above, the researcher is interested in conducting a study entitled "Development of Interactive Multimedia Based on Google Sites in Science Learning to Improve Computational Thinking Skills in Fifth Grade Elementary School Students." This study is a modification of previous research, as previous research has not examined how the use of interactive multimedia based on Google Sites can improve computational thinking skills.

Although various previous studies have examined the use of interactive multimedia and digital platforms in elementary school learning, most have focused on improving general cognitive learning outcomes, motivation, or student engagement. These studies generally have not explicitly linked the development of learning media to strengthening computational thinking skills, particularly in the context of science subjects in the Independent Curriculum.

The novelty of this research lies in the systematic and planned integration of Google Sites-based interactive multimedia with the Computational Thinking (CT) framework in fifth-grade elementary school science lessons. Beyond simply using Google Sites as a medium for presenting material, this study intentionally designed content, activities, and learning interactions that accommodate the four main elements of computational thinking: decomposition, pattern recognition, abstraction, and algorithms, which are integrated directly into the science learning flow.

Furthermore, this research presents novelty in terms of the contextualization of the material. The interactive multimedia developed is not generic, but rather based on the students' local cultural and environmental context, specifically the economic activities of the community in the Pantai Padang (Taplau) area. This integration of local context has not been widely found in research on Google Sites-based multimedia development, particularly those related to strengthening computational thinking. Thus, media serves not only as a means of knowledge transfer but also as a meaningful learning vehicle that is close to students' real-life experiences.

Another novelty is the research's focus on phase C of the Independent Curriculum, where students are at a strategic stage of cognitive development, beginning to be trained in systematic and logical thinking. This study modifies and expands on previous research by positioning computational thinking as the primary objective of media development, rather than simply a byproduct of technology use.

This research is important because it is based on several academic and practical considerations. First, the low Computational Thinking skills of elementary school

students, particularly in science learning, are a real problem identified through various research findings and reinforced by preliminary field studies. Science learning, which should train students to think systematically and analytically, is still dominated by conventional approaches oriented toward memorization, thus under-supporting the development of higher-order thinking skills.

Second, the demands of the Independent Curriculum emphasize student-centered, contextual learning, and 21st-century competency-oriented learning. However, implementation in the field demonstrates a gap between curriculum demands and teacher readiness, particularly in developing interactive and meaningful digital learning media. Therefore, a learning media model is needed that is practical, easy to develop, and relevant to teacher needs and student characteristics.

Third, Google Sites has great potential but has not been optimally utilized as an interactive learning medium integrated with strategies to strengthen Computational Thinking. This platform is relatively easy to use, free, and flexible, making it highly potential for adoption by elementary school teachers. However, without appropriate pedagogical design, Google Sites risks becoming merely a passive medium for presenting material. This research addresses this need by presenting a multimedia design that is not only informative but also trains students' thinking processes systematically.

Fourth, from a pedagogical perspective, the development of interactive multimedia based on local contexts is believed to improve conceptual understanding, learning motivation, and active student engagement. When students learn through examples close to everyday life, the internalization of concepts becomes stronger and more meaningful, while also supporting the formation of character and social values.

Therefore, this research is important because it not only provides solutions to the challenges of science learning in elementary schools but also contributes to the development of digital learning media models that align with the Independent Curriculum, support 21st-century skills, and strengthen students' computational thinking abilities from an early age.

Method

This research is a research and development (R&D) approach. Research and Development (R&D) is a process that requires procedures to create a product with the aim of increasing its effectiveness (Sugiyono, 2020). Similarly, according to Rahman (2024), a development method is a structured and systematic approach to creating new knowledge, solving problems, or developing products, processes, or services. In this development research, the researcher used the ADDIE model. The ADDIE development model was first used by Branch (2009) to develop learning designs. ADDIE is an extension of Analysis, Design, Development, Implementation, and Evaluation (Sugiyono, 2020).

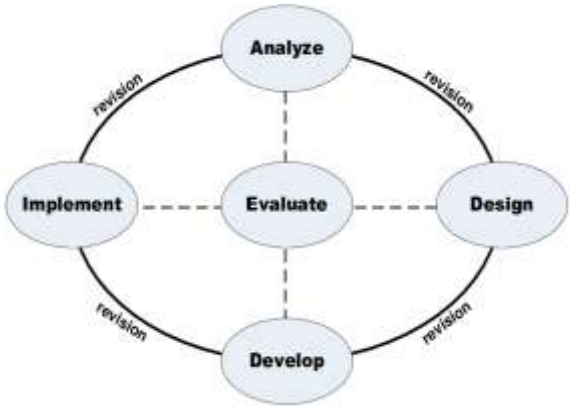

Figure 1. ADDIE model

The types of data used in this development research are quantitative and qualitative. Qualitative data were obtained from the product validity stage in the form of suggestions, input, responses, and comments from material validators, language validators, and media validators regarding the interactive multimedia being developed. Meanwhile, quantitative data was obtained from the results of validity questionnaire calculations administered by material validators, language validators, media validators, class teachers, and student response questionnaires.

The subjects of the development research were as follows: 1) expert validators (material experts, language experts, and media experts); 2) fifth-grade students, namely the trial class at SD Negeri 11 Lubuk Buaya, consisting of 17 students; 3) the experimental class at SDN Peercobaan Kota Padang, consisting of class VB (trial) consisting of 24 students; and 4) the control class, class VA consisting of 23 students. The researcher used interactive multimedia based on Google Sites as the research object.

Data collection was conducted using several instruments: (1) interview guidelines and observation sheets during the needs analysis phase; (2) validation sheets for media and content during the development phase; (3) student response questionnaires and teacher feedback forms during the implementation phase; and (4) learning outcome tests (pretest and posttest) to evaluate the effectiveness of interactive multimedia. The interactive multimedia was developed using Google Sites with embedded coding to enhance interactivity and enhance its appeal. This product can be used on mobile phones and PCs with an internet connection.

Result and Discussion

Analysis Phase

The analysis phase is the initial stage in developing the ADDIE model, which aims to identify learning needs and conditions in the field. This phase includes curriculum analysis, teacher and student needs analysis, and material analysis as the basis for developing interactive multimedia. This analysis is crucial to ensure that the developed product aligns with curriculum requirements, user characteristics, and the actual needs of the science and studies learning process in elementary schools.

The curriculum analysis was conducted by reviewing the Learning Outcomes (CP) for fifth-grade science and studies phase C in the Independent Curriculum. Based on these learning outcomes, learning objectives and indicators to be achieved by students were formulated. These formulated learning objectives served as the basis for determining the material to be developed into interactive multimedia based on Google Sites, particularly the element of understanding science and studies, which encompasses various contextual concepts in students' daily lives.

Next, teacher and student needs analysis was conducted through classroom observations, interviews with fifth-grade teachers, and questionnaires distributed to students at SD Negeri 21 Sungai Bangek, SD Negeri 16 Tanjung Aur, and SD Negeri 11 Lubuk Buaya. The analysis results indicated that the use of interactive multimedia in science and studies learning is still suboptimal. Teachers generally still use conventional media such as textbooks, images, and simple videos, which are not capable of creating active and meaningful learning interactions. Limited time and competence in digital media development are major obstacles for teachers.

The results of a student needs questionnaire showed that learning based solely on textbooks was considered less engaging and less conducive to in-depth understanding of the material. Conversely, students responded very positively to the use of interactive learning media, as they were considered more engaging, increased learning motivation, facilitated understanding of the material, and encouraged active engagement and the development of digital literacy. These findings indicate a real need for interactive, practical learning media that are tailored to the characteristics of elementary school students.

Based on the results of the curriculum and needs analysis, the material selected for the development of interactive multimedia based on Google Sites was Economic Activities in Chapter 2 "Majulah Daerahku" (Advancing My Region) for fifth grade, semester 1. This material was chosen because it is directly related to the students' environment and allows students to understand economic concepts through contextual examples. Presenting the material in interactive multimedia is expected to help improve conceptual understanding, learning engagement, and the overall quality of science learning.

Design Phase

The design stage was conducted to ensure the developed learning media aligned with the material, student characteristics, and the applicable curriculum, so that it could be used effectively in the learning process. Furthermore, this stage aimed to produce an initial product outline in the form of media design, material presentation flow, and learning support components before entering the development stage.

In the design stage, researchers carried out two main activities: instrument development and interactive multimedia design. Instrument development was carried out to support the research and development process and to obtain accurate data regarding the media's quality. The instruments prepared included a validity questionnaire to assess the feasibility of interactive multimedia, a practicality questionnaire to determine the level of ease of use of the media by teachers and students, and a computational thinking test used to measure the effectiveness of interactive multimedia in improving the activities and learning outcomes of fifth-grade elementary school students.

Next, researchers designed the interactive multimedia to be developed. This activity began with a curriculum analysis through a review of Learning Outcomes (CP) and Learning Objectives (TP), which had actually been conducted during the definition stage. Based on the results of this analysis, researchers determined the title of the Google Sites-based learning media, "Majulah Daerahku." The design stage also includes the design of the media display, including the main menu, such as Instructions, Learning Objectives, Materials, Quizzes, Evaluations, and Author Profiles. This learning media was developed using Google Sites and can be accessed through the Usmaulidar interactive multimedia link.

Development Phase

After the planning stage, all designed materials were then developed into interactive multimedia media. This development stage aims to produce a final form of interactive multimedia that is suitable for use after undergoing a process of refinement based on suggestions and input from experts. At this stage, validity testing was conducted to assess the product's feasibility and trials to determine its practicality. The validation results by expert validators on the development of interactive multimedia based on Google

Sites for the Science subject in Elementary Schools can be summarized in the following validity summary table:

Table 1. Validation Results Summary

Assessment Aspect	Validity Value %	Category
material	90%	very valid
language	93%	very valid
media/design	81%	very valid

Source: Primary data (2025)

The results of the validity carried out by the material, language and design validators show that the interactive multimedia developed using Google Site for the topic "Majulah Daerahku" obtained an average score of 88%, categorized as "very valid", and thus can be continued to the next product trial stage.

Implementation Phase

After the Google Sites-based learning media was declared valid based on expert assessments, the next stage was the implementation phase. The implementation phase is a crucial step in testing the practicality of the Google Sites-based learning media developed for science lessons in fifth-grade elementary schools. The implementation of this product was carried out in two schools: grade 6 at SDN 11 Lubuk Buaya and grade 7 at SDN Pengalaman Kota Padang.

The following table summarizes the results of the practicality tests conducted by each teacher in fifth-grade classes at SDN 11 Lubuk Buaya and SD Pengalaman Kota Padang.

Table 2. Summary of Teacher Practicality Test Results

No	Teacher Classroom	Total	Percentage (%)
1	VB SD N 11 Lubuk Buaya	70	93.3333333
2	VB SD N Percobaan	73	97.3333333
Total		143	190.666667
Average		71.5	95.3333333
Category			very practical

Source: Primary Data (2025)

Based on the table, it can be seen that the average practicality score obtained The teacher's practicality assessment of the use of Google Sites-based interactive multimedia in elementary school science subjects was 95%, categorized as very practical. The results of the teacher's practicality assessment of the use of Google Sites-based interactive multimedia in elementary school science subjects demonstrated a very practical criterion. This indicates that the research product, Google Sites-based interactive multimedia, is very easy to use, useful, and efficient in supporting the science learning process in fifth grade elementary school.

A summary of the student practicality assessment results is presented in the following table.

Table 3. Summary of Student Practicality Test Results

No	School	Total	Score
1.	Class VB SD N Percobaan Kota Padang	1425	91%
2.	Class VB SD N 11 Lubuk Buaya	1056	95%
average practicality			93%
category			very practical

Source: Primary Data (2025

Based on the table above, the average practicality level obtained by students was 93%, categorized as very practical. These results indicate that Google Sites-based interactive multimedia for fifth-grade elementary school science has a very high level of practicality. Therefore, the developed learning media is considered easy to use, engaging, and suitable for implementation in the learning process.

Evaluation Phase

After the practicality test was completed, the study continued with an effectiveness test to determine the effect of using Google Sites-based interactive multimedia on fifth-grade elementary school students' science learning outcomes. Data were obtained from pretest and posttest scores administered before and after the learning process. The effectiveness test was conducted face-to-face in three stages: a pretest to determine students' initial abilities, the implementation of the learning (the experimental class used Google Sites-based interactive multimedia and the control class did not), and a posttest to measure learning outcomes after the treatment. The pretest and posttest results were then analyzed to determine the effectiveness of the developed interactive multimedia, as presented in the effectiveness test results table.

The following presents the results of the effectiveness test using Google Sites-based interactive multimedia in fifth-grade elementary school science.

Table 4. Summary of Effectiveness Test Results

Class	Pretest Average	Posttest Average	Average N-gain Score	Category	Average N-gain Score (%)	Category
Control	51.57	80.26	0.59	medium	58.88	quite effective
Experiment	50.00	94.00	0.87	high	87.44	effective

Source: Primary Data (2025)

Based on the data in the table, the results of the N-gain test calculation show that the experimental class using Google Sites-based interactive multimedia obtained an average N-gain of 0.88, which is categorized

as high. When viewed from the percentage, the average N-gain of the experimental class reached 87.80%, which is included in the effective category. Meanwhile, the control class implementing conventional learning obtained an average N-gain of 0.59, which is categorized as medium. The average percentage of N-gain in the control class was 58.88%, so it is in the fairly effective category.

Table 5. Normality Test

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	statistic	df	sig.	statistic	df	sig.
prestest control	.116	23	.200*	.975	23	.805
posttest control	.181	23	.048	.933	23	.128
new pretest experiment	.149	23	.200*	.946	23	.243
new posttest experiment	.220	23	.005	.924	23	.079

*. this is a lower bound of the true significance.
a. lilliefors significance correction

Based on the SPSS output results in the Tests of Normality table, the significance values obtained for all variables (Pretest and Posttest for both the control and experimental classes) show numbers greater than 0.05. For example, the Sig. value for Shapiro-Wilk in the Control Pretest is 0.805 and the New Experiment Posttest is 0.079. Since all Sig. values are > 0.05, it can be concluded that the data is normally distributed.

Table 6. Homogeneity Test

Test of Homogeneity of Variances					
		Levene Statistic	df1	df2	Sig.
Results	Based on Mean	8.275	3	90	.000
	Based on Median	6.771	3	90	.000
	Based on Median and with adjusted df	6.771	3	63.067	.000
	Based on trimmed mean	7.888	3	90	.000

Next, a homogeneity test was conducted to determine whether the data variances from the two classes were uniform. The test was conducted using Levene's Test. Based on the Test of Homogeneity of Variances table, a significance value (Sig.) of 0.000 was obtained in the Based on Mean row. Because the significance value is less than 0.05 (0.000 < 0.05), the data is declared inhomogeneous. This will affect the decision-making row in the next t-test, where the researcher will refer to the Equal variances not assumed row.

Table 7. T-test

Independent Samples Test										
		levene's test for equality of variances		t-test for equality of means						
									95% confidence interval of the difference	
		f	sig.	t	df	sig. (2-tailed)	mean difference	std. error difference	lower	upper
Results	equal variances assumed	4.886	.032	-7.590	44	.000	-28.696	3.781	-36.315	-21.076
	equal variances not assumed			-7.590	35.016	.000	-28.696	3.781	-36.370	-21.021

A t-test was conducted using SPSS software with a significance level of α = 0.05 to measure the effect of using Google Sites-based interactive multimedia on student learning outcomes. Based on the Independent Samples Test table, in the t-test for Equality of Means section (the Equal variances not assumed row), the Sig. (2-tailed) value was 0.000. Since the Sig. (2-tailed) value is <0.05, it can be concluded that there is a significant difference in average learning outcomes between the experimental class using Google Sites-based interactive multimedia and the control class. This difference in average values indicates that the media is effective in improving student learning outcomes.

Through the series of statistical tests above, it can be concluded that the implementation of Google Sites-based interactive multimedia in the social studies subject in fifth grade elementary school has proven effective and is suitable for use as a learning medium to significantly improve student learning outcomes.

Discussion

This research aims to produce a product. The product developed in this study is interactive multimedia based on Google Sites for fifth-grade elementary school science learning in Chapter 2, "Majulah Daerahku" (Advance My Region). The development of interactive multimedia based on Google Sites for fifth-grade elementary school science learning was conducted using the ADDIE development model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation.

In the Analysis stage, the researcher analyzed needs, curriculum, and student characteristics. Observations and interviews indicate that the use of interactive multimedia in science learning is not optimal because learning is still dominated by textbooks and simple media. As a result, students tend to be less active and experience difficulty understanding the material in depth and applying systematic problem-solving.

This research aligns with Arsyad's (2020) findings, which state that the use of insufficiently varied learning media can decrease learning interest and limit students' cognitive activity in understanding concepts in depth. Furthermore, Trianto (2019) stated that learning that does not provide opportunities for students to actively engage in the process of discovering and solving problems tends to make it difficult for them to apply knowledge systematically. This situation indicates that the dominance of conventional methods without the support of innovative learning media can negatively impact students' engagement and problem-solving abilities.

In the second stage, the Design stage, researchers developed a plan for the learning media to be developed, including storyboards, flowcharts, and the development of learning content consisting of text, images, audio, and video. The media design was tailored to the characteristics of elementary school students and adhered to the principles of multimedia theory to support the learning process more effectively.

Validation results indicate that the developed interactive multimedia based on Google Sites has a very high level of validity. Validation by subject matter experts yielded an average score of 90%, categorized as very valid, indicating that the science and science learning materials and activities were appropriate and capable of accommodating the development of students' computational thinking skills. For the media aspect, a score of 81% was obtained, categorized as very valid, indicating that the media's display, navigation, and interactive features supported systematic thinking and problem-solving processes. Meanwhile, validation for the language aspect yielded a score of 93%, indicating that the language used was communicative, clear, and easy to understand, helping students follow the flow of thought and structured problem-solving steps.

Based on the validity results, the development of interactive multimedia based on Google Sites in science learning to improve fifth-grade elementary school students' computational thinking skills is categorized as very valid and can be used in the learning process. This is supported by previous research. Research by Afni (2024) indicates that the interactive multimedia development is highly feasible, based on validator assessments of 92% material validity, 92% language validity, and 91% media validity. Furthermore, research by Wahyuningsih et al. (2023) indicates that the developed Google Sites-based interactive multimedia is valid, with validator scores of 91% material validity, 90% language validity, and 92% media validity.

During the validation process, several revisions were made to improve the quality of the learning multimedia in supporting computational thinking skills. These revisions included supplementing the material to better align with learning objectives, adding learning videos that show examples of step-by-step problem solving, and improving evaluation questions that require students to analyze problems, recognize patterns, and develop solutions sequentially. Furthermore, the writing was reorganized by adding spaces after numbering, aligning the text layout (left-aligned), and enhancing the visuals through selecting images relevant to the context of the science and computational thinking material and activities. Improvements to background colors and fonts were also made to ensure students' comfort and focus during the learning process.

Language revisions included improvements in capitalization, clarity of sentences, and simplification of instructions for computational thinking-based activities and questions, enabling students to understand the stages of thinking and problem-solving steps more systematically. This resulted in more communicative, structured, and appropriate learning media for elementary school students.

This description aligns with Arsyad's (2020) opinion, which states that learning media with clear visual displays, communicative language, and audiovisual support can increase student attention, motivation, and understanding. Furthermore, Mayer (2021), using multimedia learning theory, emphasized that the systematic integration of text, images, and videos can help students develop a deeper understanding of concepts, including practicing logical thinking and problem-solving skills, which are at the core of computational thinking.

The refinement of Google Sites-based interactive multimedia through the revision process also resulted in improved navigation clarity and systematic presentation

of the material. The organized menu structure, separation of material and video displays, and the provision of user guides make it easier for students to follow the computational thinking-based learning process, from understanding problems to finding solutions independently. This aligns with research by Wulandari et al. (2021), which states that digital learning media with clear navigation and a well-structured structure can increase learning effectiveness and support student learning independence.

Furthermore, the addition of instructional videos and interactive activities was deemed effective in increasing student active engagement in science learning. Videos and problem-based questions serve as a means of reinforcing concepts and practicing computational thinking because they present problems contextually and encourage students to think critically, logically, and structured. This finding aligns with research by Rahmawati et al. (2022), which found that interactive audiovisual media can increase students' motivation, engagement, and higher-order thinking skills.

Based on assessments by subject matter experts, media experts, and language experts, the developed Google Sites-based interactive multimedia was categorized as highly valid and suitable for use as a science learning medium in fifth-grade elementary schools. The revisions were proven to improve the quality of the media not only in terms of content, presentation, and language, but also in supporting the development of students' computational thinking skills. Therefore, this Google Sites-based interactive multimedia is relevant as a 21st-century learning medium that encourages active engagement, conceptual understanding, independent learning, and computational thinking skills in elementary school students.

The practicality of developing Google Sites-based interactive multimedia was carried out during the Implementation stage. At this stage, teachers and students were provided with media usage guidelines before and during the science and science learning process to ensure optimal utilization. The practicality of Google Sites-based interactive multimedia was measured using a questionnaire completed by both teachers and students. The teacher practicality test questionnaire covered several aspects, including media appearance, ease of use, material suitability, and language suitability.

Based on the results of the teacher practicality test, an average score of 95% was obtained, categorizing it as very practical. Meanwhile, the student practicality test questionnaire averaged 92%, also categorizing it as very practical. These results indicate that Google Sites-based interactive multimedia is easy to use, engaging, and supports the smoothness of the science and science learning process from both teacher and student perspectives. The aspects assessed in this practicality test indicate that Google Sites-based learning media is practical to implement and capable of supporting science and science learning oriented toward developing fifth-grade elementary school students' computational thinking skills.

The findings of this study align with Wahyuningsih's (2025) study, which found that teachers rated 95.72% practicality and students rated 88.63% very practical. Furthermore, Sakinah et al. (2025) research revealed that the teachers' practicality test averaged 94.69%, which falls into the very practical category. Meanwhile, the students' practicality questionnaire averaged 86.15%, also in the very practical category.

Furthermore, Lestari et al. (2023) stated that Google Sites-based learning media has a high level of practicality because it is easily accessible, flexible to use, and able to increase student active engagement in science learning. Furthermore, research by Rahman et al. (2022) revealed that the use of interactive digital media in science/social studies learning can help students develop logical, systematic, and problem-solving skills, which are key components of computational thinking. Interactively designed digital media also facilitates teachers' learning management and helps students understand concepts in a more structured manner. Based on the results of the practicality test and support from previous research, it can be concluded that the developed Google Sites-based interactive multimedia has a very high level of practicality. This media is easy to use, effectively supports science and natural science learning, and is able to increase the active involvement and computational thinking skills of fifth-grade elementary school students. Thus, Google Sites-based interactive multimedia is suitable for use as a practical and relevant science and natural science learning medium to meet the demands of 21st-century learning.

Conclusion

Based on the results of the research and development conducted, interactive multimedia developed using Google Site is very valid, practical, and effective for use in science learning to improve the computational thinking skills of fifth grade elementary school students. The validation results of material experts obtained a score of 90%, language experts obtained a score of 93% and media experts obtained a score of 81% in the very valid category. The results of the practicality test showed that the learning media obtained an average score of 93% from students and 95% from teachers with a very practical category. The results of the N-Gain calculation showed a value of 0.87 or

87.44% with a high category. In addition, student learning outcomes experienced a significant increase, indicated by an average pretest score of 50.00 and a posttest of 94.00. The results of the analysis using the independent t-test showed a significance value (Sig. 2-tailed) of 0.000 <0.05, which means there is a significant difference in the average learning outcomes between the experimental class and the control class. Thus, interactive multimedia based on Google Sites has proven to be effective in using in science learning and has contributed to improving the computational thinking skills of fifth grade elementary school students.

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