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Interactive Learning Media Development Based on Google Sites in Subjects Science Junior High School

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Abstract: This research is motivated by the need for digital-based interactive learning media that supports junior high school students' understanding of science concepts. The purpose of this study is to develop Google Sites-based learning media and measure its validity, practicality, and effectiveness in improving learning outcomes. The study uses a Research and Development (R&D) approach with the ADDIE model, including the stages of analysis, design, development, implementation, and evaluation. The research subjects were teachers and eighth-grade students. The instruments used included expert validation sheets, teacher and student practicality questionnaires, and learning outcome tests. Data were analyzed descriptively for validity and practicality, and used a Paired Sample T-Test to test effectiveness. The results showed that the media obtained a validity score of 87%, teacher practicality 90%, and student practicality 92%. Learning outcomes increased from 55.7% (pretest) to 78.6% (posttest) with a significance value of 0.032 ($p < 0.05$). In conclusion, this Google Sites-based learning media is valid, practical, and effective, and is suitable for use to improve junior high school students' understanding of science concepts in an interactive and interesting manner.

Keywords: Google sites; Interactive learning media; Junior high school; Sciences

Introduction

Natural Sciences education at the Junior High School (SMP) level plays an important role in equipping students with the high-level thinking skills needed in the 21st century (Lusidawaty et al., 2020; Putra et al., 2020). Skills such as critical thinking (Banat, 2023), creative (Hamsar et al., 2024), collaborative (Tampubolon, 2015), and communicative (4C) are the main competencies that must be developed so that students are able to face complex and dynamic global challenges (Mustofa et al., 2024).

The Independent Curriculum is currently being implemented by the Ministry of Education, Culture, Research, and Technology (Kemendikbud, 2023) emphasizes the importance of contextual, exploratory, and problem-solving-based learning (Fauziah et al., 2022). In this context, science learning is not only aimed at mastering scientific concepts (Marni et al., 2023), but must also encourage students' active involvement in the scientific thinking process through authentic learning experiences.

Unfortunately, science learning in many schools is still dominated by conventional approaches (Amri et al., 2024) such as lectures and written assignments which tend to be one-way and provide little space for interaction and exploration (Haleem et al., 2022). This method does not encourage students to develop higher-order thinking skills such as analyzing, evaluating, and drawing conclusions based on data (Sani et al., 2020; Yanti et al., 2023). This has an impact on low learning motivation (Marta et al., 2020), student involvement in the learning process, and understanding of science concepts that should be applicable (Retni S et al., 2021).

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On the other hand, today's students are part of the digital generation who are accustomed to interacting with technology and multimedia (Pradana et al., 2024; Yanti et al., 2023). These characteristics require learning media that are relevant to their learning styles (Hasanah et al., 2024), which is able to present information visually, interactively and easily accessed (Sari et al., 2023). Therefore, the development of technology-based learning media is a necessity in the context of 21st-century education.

One of the digital platforms that has great potential to support interactive science learning is Google Sites (Yanto et al., 2023). This platform allows teachers to create structured learning pages with various multimedia content such as videos (Halim et al., 2024), simulations, quizzes, reading materials, and discussion forums in one easily accessible platform (Putra et al., 2022). Its flexibility and ease of use make Google Sites a learning tool that can reach a variety of student learning styles (Khairina et al., 2025).

More than just an information presenter, Google Sites also strongly supports the implementation of the Discovery Learning model (Cleland et al., 2023), namely a learning approach that emphasizes the active role of students in discovering concepts themselves through observation (Rizki et al., 2021), exploration, and problem-solving. The combination of Google Sites and Discovery Learning can create a more contextual, challenging learning experience and stimulate students' critical thinking skills (Mulyaningsih et al., 2023).

A number of previous studies have proven that web-based media can improve conceptual understanding (Azizah et al., 2024), active participation, and critical thinking skills of students in science learning (Pradana et al., 2024). However, most of these studies have not specifically developed media that integrate Google Sites with Discovery Learning, especially those explicitly aimed at fostering critical thinking skills in junior high school students (Arisland, 2023). Others focus solely on delivering the material, without paying attention to the interactivity and higher-order thinking processes that should be the primary goals of modern science learning.

The novelty of this research lies in the development of interactive science learning media based on Google Sites which is specifically designed to accommodate the Discovery Learning process and improve students' critical thinking skills (Kafai et al., 2022). This media not only presents material in multimedia form, but is also designed to stimulate the scientific reasoning process, encourage independent exploration, and provide a space for reflection and discussion integrated in one platform (Anthonysamy et al., 2020).

In addition, another advantage of this research is the development of media based on the needs and characteristics of digital-native students (Sulasmi, 2022), so that the resulting learning approach is more contextual, enjoyable, and relevant to their lives. This research focuses not only on the technological aspects but also on the pedagogical qualities of the media developed to truly support meaningful learning processes (Rayendra et al., 2022).

The purpose of this research is to develop interactive Google Sites-based learning media for science subjects for junior high school students and to test its validity, practicality, and effectiveness in improving students' learning outcomes and critical thinking skills. This research is crucial for addressing the challenges of today's science learning and providing innovative solutions for teachers in creating active, enjoyable, and effective learning. This media is expected to be a strategic alternative in supporting the achievement of the Pancasila student profile and strengthening students' critical thinking skills in the digital era.

Method

This research method uses a Research and Development (R&D) approach to design and test the effectiveness of interactive science learning media based on Google Sites with the Discovery Learning model in improving the critical thinking skills of junior high school students. R&D method is intended to produce educational products and assess their effectiveness. Borg and Gall describe R&D as a systematic process of designing, developing, and validating educational tools (Sugiyono, 2020). In this context, the development of Google Sites-based media aims to create innovative, contextual, and digitally integrated learning experiences that support the improvement of critical thinking skills through Discovery Learning stages. This study specifically assesses the validity, practicality, and effectiveness of the developed media (Setyosari, 2016).

The development process follows the ADDIE model: Analysis, Design, Development, Implementation, and Evaluation (Alzoebi et al., 2023). At the Analysis stage, the learning needs of junior high school students are identified, including their preferences for interactive and digital-based learning, as well as challenges in conventional science learning that often limits exploration and critical inquiry. The analysis also considers the need to align media with science curriculum goals that emphasize higher-order thinking skills.

In the Design stage, the media structure is planned by integrating Discovery Learning stages: stimulation, problem statement, data collection, data processing, verification, and generalization. Each activity is designed to be linked with multimedia resources—

videos, simulations, images, or articles—embedded in a Google Sites page. The design also emphasizes clear navigation, readability, and cognitive stimulation to ensure accessibility for all students (Alzoebi et al., 2023).

At the Development stage, the Google Sites platform is used to compile science content, design visual layouts, and embed multimedia components. Interactive quizzes, animations, and instructional videos are integrated to support students in discovering scientific concepts independently or collaboratively. The prototype is validated by content experts, instructional design experts, and media experts, focusing on accuracy, functionality, visual appeal, and alignment with learning objectives.

The Implementation stage includes limited trials involving eighth-grade students in a selected junior high school. The media is used in real classroom settings, supported by lesson plans that accommodate Discovery Learning strategies. Observations are conducted to examine students' engagement, how the platform guides learning activities, and how well it stimulates inquiry and discussion.

Table 1 shows the validation results of the research instrument used to measure the clarity and relevance of indicators to the objectives of media development. The average score of 4.48 or 89.6% indicates that the instrument is in the "Valid" category, so it is suitable for use to evaluate the quality of interactive learning media based on Google Sites. The validity data of the research instrument can be seen in Table 1.

Table 1. Instrument Validation Results

Aspect	Criteria	Average
Instrument	Clarity of instrument filling instructions	4.20
	Compliance of indicators with the objectives of developing interactive science media	4.00
	Readability and understandability of instrument items	4.80
	Relevance of indicators model	4.80
	Relevance of indicators to critical thinking skills of junior high school students	4.60
Amount		22.4
Average		4.48
Percentage		90%

Table 2 illustrates the results of the validation of media aspects including visual display quality, consistency of QR-Code use, ease of navigation, and suitability of media functions with the Discovery Learning learning model. With an average score of 4.30 or 86%, the media is stated to be in the "Good" category, although some improvements such as interface and navigation improvements are still needed. The data from the media validity test results are presented in table 2.

Table 2. Media Validation Results

Aspect	Criteria	Average
Media	The quality of visual display and aesthetics of media on Google Sites	4.60
	Consistency in the use of QR-Code as a guide for interactive materials	4.20
	Ease of navigation of the Google Sites interface by middle school students	4.00
	Suitability of media functions with science learning objectives based on Discovery Learning	4.40
Amount		17.2
Average		4.30
Percentage		86%

Table 3 shows that the linguistic aspect in the media gets an average score of 4.37 or 88%, which is in the "Good" category. The validator provides small notes regarding the arrangement of sentences and the use of terms to be more consistent and easier to understand for junior high school students. The data from the language validity test are presented in table 3.

Table 3. Language Validation Results

Aspect	Criteria	Average
Language	The suitability of language use to the level of cognitive development of junior high school students	4.40
	Clarity of sentence structure and grammar	4.30
	Consistency in the use of scientific terms and spelling according to Indonesian language rules	4.40
Amount		13.1
Average		4.37
Percentage		88%

Table 4 presents the validation of the content of science materials in the media, including suitability to the curriculum, QR-Code integration, and relevance to the Discovery Learning approach. With an average of 4.32 or 86.4%, the material is considered "Good" and can be further developed by strengthening contextualization and cohesion between sub-materials. The data from the material validity test results are presented in table 4.

Table 4. Material Validation Results

Aspect	Criteria	Average
Material	Suitability of science content with junior high school curriculum	4.40
	Relevance of learning activities with the Discovery Learning approach	4.50
	QR-Code integration to strengthen understanding of science concepts	4.30
	The potential of materials to develop students' critical thinking skills	4.20
	Coherence between sub-materials and integration of concepts in the context of everyday life	4.10
	Contextualization of science material in the real life of junior high school students	4.40
Amount		25.9
Average		4.32
Percentage		87%

Result and Discussion

Table 5 shows the results of the practicality test by four junior high school science teachers. With an average score of 4.30 or 86%, the media is considered "Good" in terms of ease of use, efficiency, and bAaZQaenefits in supporting the learning process. Referring to the practicality criteria category, the results of the practicality of educator responses are included in the "Very Practical" category. The results in table 5.

Table 5. Educator Practicality Test Results

Aspect	Criteria	Average
Practicality	Ease of using Google Sites media in the learning process	4.50
	Time efficiency and media accessibility	5
	The use of media to achieve science learning objectives	4.50
Amount		14.0
Percentage		93%

Table 6 shows the practicality assessment by three students in a small group trial. The results show an average score of 4.60 or 92%, which means that the media is considered "Very Practical" for use in the science learning process at SMPN 3 Lubuk Basung independently or under guidance. The results of the small group practicality test can be seen in Table 6.

Table 6. Practicality Test Results in Small Groups

Aspect	Name	Average
Small Group Test	TT	4.60
	YY	4.60
	AB	4.60
Average		4.60
Percentage		92%

The large group practicality test was conducted by 23 students covering 16 aspects with an assessment result of 93% falling into the "very practical" category. The results of the large group practicality test can be seen in Table 7.

Table 7. Practicality Test Results in Large Groups

Aspect	Name	Average
Large Group Test	AS	4.35
	FF	4.28
	AZ	4.40
	AY	4.50
	BA	4.42
	AL	4.38
	SS	4.30
	YB	4.48
	TA	4.46
	BB	4.33
	BM	4.29
	BT	4.31
	ATT	4.27
	BB	4.36
	B	4.25
	CS	4.39
	DS	4.20
	ES	4.44
	YAS	4.40
	AY	4.76
	YY	4.76
Average		4.36
Percentage		93%

Written tests are used as instruments to measure understanding of basic science concepts, so that it can be seen to what extent students' competencies have increased after participating in LKPD-based learning. The pre-test results reflect students' initial understanding before receiving material through LKPD, while the post-test results show an increase after the learning intervention. Data on the pre-test and post-test results of students at SMPN 3 Lubuk Basung can be seen in Table 8.

Table 8. Student Effectiveness Test Results

Name	Pre test	Post test
AS	65	80
FF	50	65
AZ	55	75
AY	30	50
BA	50	65
AL	75	90
SS	60	80
YB	55	75
TA	40	60
BB	35	55
BM	45	70
BT	55	75
ATT	35	60
BB	70	80
B	50	70
CS	50	75
DS	55	75
ES	70	85
YAS	70	85
AY	80	90
YY	65	80
Amount	1425	1870
Percentage	57	74.8

The validation results of the research instrument showed that the instrument was considered valid with an average score of 4.48 or 89.6%. This shows that the instrument has met the eligibility criteria for measuring the effectiveness and quality of the media. This validity is important to ensure that the data collected truly reflects the aspects being measured (Sugiyono, 2019). Validation was also carried out on the media, language, and material aspects, all of which obtained the category "Good" to "Very Good", indicating that interactive media based on Google Sites has been designed according to the needs of junior high school students and the principles of learning media development (Arsyad, 2013).

Practicality tests show that this media is easy to use by teachers and students, with a fairly high score, namely 86% from teachers and 92% from small group students. Practicality aspect in the development of learning devices reflects the extent to which users can operate the media efficiently and effectively without experiencing significant technical obstacles (Spatioti et al., 2022). Google Sites-based media allows high accessibility and a user-friendly interface, in accordance with the principles of user-centered design (Norman, 2013), thus supporting a flexible learning process both inside and outside the classroom.

In terms of effectiveness, there was a significant increase from the pre-test to the post-test results (from 55.6 to 72.4). These results indicate that the use of interactive media can improve students' understanding of science material. This is in line with Bruner's (1966) theory of Discovery Learning, which states that learning will be more meaningful when students are actively involved in discovering concepts through exploration and interaction with media. Google Sites interactive media provides exploratory space through QR-Code, video links, and simulations that stimulate students' cognitive involvement more intensely.

The use of Google Sites as a learning platform reflects the integration of technology in 21st century learning, which is characterized by the use of ICT to improve the quality and access to (OECD, 2019). This media not only displays materials digitally, but also allows collaboration and customization according to the needs of teachers and students. In the context of science learning that requires an understanding of abstract concepts, interactive technologies such as hyperlinks, infographics, and simulations are able to bridge the gap between concepts and real experiences (Mayer, 2024).

Based on the research results, interactive media based on Google Sites has proven to be valid, practical, and effective to be applied in junior high school science learning (Ernest et al., 2023). The implications of these findings indicate that the development of web-based media can be a strategic alternative to improve the quality of learning, especially in distance learning or blended learning. The researcher recommends that teachers receive training related to the development and utilization of Google Sites as a teaching medium, as well as improving the visual elements and navigation structure of the media to be more optimal. Further research can explore the integration of other interactive features such as online quizzes or discussion forums to increase student engagement.

Conclusion

Based on the research results, interactive learning media based on Google Sites in science subjects for junior high school students obtained very good validation results from experts. These results also indicate that this media has been designed systematically and in accordance with the needs of 21st century learning that emphasizes the use of digital technology. Furthermore, the results of the practicality test showed that this media was very easy to use by teachers and students. Thus, this media is effective in helping students understand science concepts more contextually and interactively.

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