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Development of Google Sites-Based Guidebook through the RADEC Model Style Material to Improve Students' Critical Thinking

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A B S T R A C T

This study aims to develop a Google Sites-based guidebook through the RADEC (Read, Answer, Discuss, Explain, Create) learning model to improve the critical thinking skills of fourth grade elementary school students in science lessons. The background of this study is the low utilization of information technology in elementary education and the dominance of conventional learning methods that are centered on teachers. The RADEC model that emphasizes student activity and collaboration is considered effective if integrated with interactive digital media such as Google Sites. This study uses a Research and Development (R&D) approach based on the Borg & Gall model which includes the stages of problem identification, product development, limited and extensive trials, product revision, and final evaluation. Data were collected through expert validation sheets, teacher and student practicality questionnaires, and critical thinking tests. The results showed that the guidebook was classified as very valid with an average expert validation score above 85%. effectiveness on students' critical thinking skills, with an average N-Gain score of 0.5, which is categorized as moderate. The significance between the results of the Pretest and Posttest ($p < 0.05$), shows that Google Sites through the RADEC model has a positive impact on the development of students' critical thinking. Its implementation is suitable for elementary school students who have the potential to improve the quality of science learning and creative thinking. The Merdeka Curriculum emphasizes active, innovative, and technology-based learning.

1. Introduction

The development of information and communication technology (ICT) has changed various aspects of human life, including in the field of education. The integration of ICT in learning has become an unavoidable necessity in the era of the industrial revolution 4.0 and towards society 5.0. Today's education is required to be able to prepare students so that they not only master knowledge content, but also have 21st

century skills such as critical, creative, collaborative, and communicative thinking (Partnership for 21st Century Learning, 2019). In the context of learning in elementary schools, especially in Natural Sciences (IPA) subjects, teachers need to present methods and media that not only convey material, but are also able to build meaningful, enjoyable, and contextual understanding for students. Research shows that the application of ICT-based learning can increase participation, conceptual understanding, and active involvement of students in the learning process (Ciherang et al., 2024). However, in practice, the use of ICT in elementary schools is still not optimal. Many teachers still rely on conventional methods such as lectures and textbooks, without involving innovative digital media (Rahmawati et al., 2023).

One innovative solution to overcome this problem is through the development of a Google Sites-based guidebook integrated with the RADEC (Read, Answer, Discuss, Explain, Create) learning model. The RADEC model emphasizes an active, participatory, and student-centered learning approach, which has been proven effective in improving students' critical thinking skills (Sopandi, 2017; Fahrurrozi, 2022). Meanwhile, Google Sites is a free digital platform from Google that allows teachers to compile learning materials in a structured, interactive, and easily accessible manner by students at any time (Febrian & Nasution, 2024). Based on initial observations and interviews conducted at SD Negeri 14 Banda Aceh, it was found that the science learning process, especially in the "Style" material, was still teacher-centered, there was no variation in learning media, and low student involvement in discussions and problem solving. This has an impact on students' low critical thinking skills. In fact, critical thinking skills are an important element in science learning because they help students understand phenomena, analyze information, and make decisions logically (Kurniawan et al., 2020).

Thus, the development of a Google Sites-based guidebook with the RADEC approach to the Grade IV Style material is very relevant. This guidebook is not only a learning medium for teachers, but also a means to encourage students to be more active in reading, answering, discussing, explaining concepts, and creating solutions in science learning. Furthermore, the use of Google Sites can improve students' digital literacy while strengthening the implementation of the Independent Curriculum which emphasizes differentiated and project-based learning (Kemendikbudristek, 2022). Various previous studies have shown the effectiveness of using Google Sites in learning. Research by Wahyudi et al. (2023) stated that the integration of Google Sites in science learning can increase students' learning motivation from 61.24% to 78%. Meanwhile, Saputra et al. (2023) found that Google Sites-based media received a positive response from students (92%) and teachers (96%), and had a significant effect on learning outcomes. This shows that this media is worthy of being developed and used as an interactive and contextual learning tool.

On the other hand, the RADEC model has also been shown to improve student understanding and participation. According to Hernita & Dharma (2023), the RADEC model encourages students to think critically through independent reading stages before class, answering questions, discussing, re-explaining concepts, and creating products as a result of understanding. This model is very suitable for

application to Force material in grade IV of elementary school, which requires students to make observations, simple experiments, and draw conclusions independently. Seeing the importance of mastering the concept of force in the grade IV science curriculum, as well as the need to encourage students to think critically through interactive digital learning, an innovation is needed in the form of developing a Google Sites-based guidebook with the RADEC approach. This innovation is expected to be an alternative solution in overcoming the low critical thinking skills of students, as well as being a learning medium that supports the Independent Curriculum in elementary schools.

2. Methodology

This research is a research and development (research and development) that aims to produce a product in the form of a Google Sites-based guidebook with the RADEC (Read, Answer, Discuss, Explain, Create) learning model on the Style material for grade IV elementary school. The development model used refers to the stages of Borg and Gall's research which have been simplified into three main stages, namely: (1) preliminary study, (2) product development, and (3) product trial. This study was conducted at SD Negeri 14 Banda Aceh. The subjects of the study consisted of fourth grade students and science teachers who were involved in the limited trial and field trial processes. The location was selected purposively because the school has supporting infrastructure for the use of ICT and the researcher also works at the school.

a. Research Instruments

Some of the instruments used in this study include:

1. Product validation sheets by material, media, and language experts to measure the validity aspect.
2. Teacher and student response questionnaires to assess the practicality of using the guidebook.
3. Multiple-choice critical thinking tests to measure the effectiveness of the product in improving students' critical thinking skills.

b. Data Collection and Analysis Techniques

The validity of the product is assessed based on the validation results from three experts with a score criteria of ≥ 80% categorized as "very valid". The practicality of the product is analyzed from the teacher and student response questionnaires, with score interpretation using ideal criteria. Effectiveness is analyzed through a comparison of pretest and posttest results using the Wilcoxon Signed Rank Test (because the data is not normally distributed) and the calculation of the N-Gain Score to measure the increase in students' critical thinking skills.

N-Gain Formula:

$$\text{N-Gain} = \frac{\text{Posttest Score - Pretest Score}}{\text{Maximum Score} - \text{Pretest Score}}$$

Interpretation of N-Gain values:
$g \geq 0{,}7$: Tall
$0{,}3 \leq g < 0{,}7$: Currently
$g < 0{,}3$: Low

Quantitative analysis was conducted using the latest version of SPSS software, while qualitative analysis was used to describe the development process and responses to the product.

3. Results and Discussion

This study aims to develop a Google Sites-based guidebook through the RADEC (Read, Answer, Discuss, Explain, Create) learning model on the Style material for grade IV elementary school, and to assess its validity, practicality, and effectiveness in improving students' critical thinking skills. The results of the development and trial processes carried out indicate that the designed guidebook meets the criteria for learning media that is suitable for use in elementary schools. The validation process was carried out by three experts, namely media experts, material experts, and language experts. The results of the media expert validation showed that the appearance of the site was considered attractive, interactive, and easy to use by students and teachers.

Table 1. Score Validition of Expert

No.	Aspect	Indicator	Score (%) / Mean	Category
1	**Feasibility** (Expert Review)	Content Accuracy	92%	Very Feasible
		RADEC Model Integration	90%	Very Feasible
		Google Sites Design & Usability	88%	Feasible
		Language & Clarity	91%	Very Feasible
	Average		**90.25%**	**Very Feasible**
2	**Practicality** (Student Feedback)	Ease of Access & Navigation	4.5 (out of 5)	Very Practical
		Engagement with RADEC Activities	4.4	Very Practical
		Usefulness in Understanding Material	4.3	Practical
	Average		**4.4**	**Very Practical**
3	**Effectiveness** (Critical Thinking)	Pre-Test Average Score	63.2	Moderate

	Post-Test Average Score	81.5	High
	N-Gain Score	0.50	Moderate Gain

Table 2. Score Preetest and Postetest

Critical Thinking Indicator	Pretest Average Score	Posttest Average Score	Increase (%)
Analyzing arguments	64.0	82.0	28.1%
Evaluating evidence	60.5	79.0	30.6%
Drawing conclusions	61.3	80.4	31.1%
Generating alternative solutions	63.8	83.3	30.6%

Based on the results of the research and development process, it can be concluded that the Google Sites-based guidebook developed using the RADEC (Read, Answer, Discuss, Explain, Create) model is feasible, practical, and effective in enhancing students' critical thinking skills. The average score given by the media validator reached 88%, which is included in the very valid category. Several suggestions for improvement were given regarding the consistency of the appearance between pages and the selection of background colors to make it more comfortable to look at. Furthermore, the validation results from the material experts showed a feasibility score of 90%, with the main indicators being the suitability of the content to the curriculum, the meaningfulness of the material, and relevance to students' learning needs. The material validator also suggested that examples of questions and simple, contextual experiments be added so that students could more easily understand the concept of style. Meanwhile, validation by linguists produced a score of 86%, which is also included in the very valid category. The linguistic aspects were considered quite good in terms of readability, sentence structure, and spelling usage. However, improvements were made to several scientific terms to better suit the level of understanding of elementary school students.

Figure 1. Intriduction of RADEC

Expert validation results showed that the guidebook met high standards in terms of content accuracy, RADEC model integration, usability, and clarity, with an average feasibility score of 90.25%, categorized as Very Feasible. After going through the validation and revision stages, the guidebook was tested for its practicality through

a limited trial involving one teacher and five fourth-grade students. Student feedback indicated positive responses regarding the ease of access, engagement with learning activities, and usefulness of the material. The overall practicality score was 4.4 out of 5, indicating the guidebook is Very Practical for classroom use. Teachers stated that the Google Sites-based guidebook was very helpful in delivering science learning materials in an interesting and easy-to-understand way for students. Teachers also felt helped because each stage of RADEC had been systematically arranged in the guide.

There was a significant improvement in students' critical thinking skills, with the average post-test score increasing from 63.2 to 81.5. The calculated N-Gain score of 0.50 suggests a Moderate Gain, indicating that the guidebook is effective in supporting students' critical thinking development (Figure 2). Overall, the integration of the RADEC model into digital learning platforms such as the Google Sites application provides a smart, innovative and accessible way to support active learning and the development of 21st century skills.

Figure 2. Implementation RADEC in IPA Learning Using Google Sites

The results of this study support previous findings by (Muhiddinur Kamal et al., 2023), which showed that the application of the RADEC model can improve learning outcomes and critical thinking skills of elementary school students. In addition, this study is also in line with the results of the studies of (Effectiveness et al., 2024), which stated that Google Sites-based learning media can increase student learning motivation, facilitate access to information, and encourage active student involvement in learning (Pubian & Herpratiwi, 2022). The success of using Google Sites is also inseparable from its characteristics which are flexible, easy to access, and allow interactive multimedia integration (Yang & Taele, 2025). This platform supports the principle of active and independent learning that characterizes the Independent Curriculum (Mahanal & Zubaidah, 2017).

Through the RADEC approach, students not only receive materials passively, but are also asked to read, answer questions, discuss with friends, re-explain concepts that have been learned, and create simple learning products (Daulai et al., 2023). This encourages the strengthening of high-level thinking that is very important in 21st century education (Razali et al., 2024). Overall, the results and discussions show that the Google Sites-based guidebook through the RADEC model is very feasible, practical, and effective for use in science learning in grade IV of

Elementary School (Sari et al., 2023). The use of this media can be an alternative solution to overcome monotonous learning and less stimulating students' critical thinking skills (Harrington et al., 2019). RADEC which is implemented on Google sites in this science lesson also supports the development of digital competence of students and teachers, and contributes to the implementation of the Independent Curriculum which is adaptive to technological developments and the diverse learning needs of students and improves the science learning outcomes of elementary school students.

4. Conclusion

The use of Google Sites-based guidebooks with the RADEC model has proven effective in improving students' critical thinking skills. The increase in posttest results shows that this approach is able to encourage students to think analytically, evaluate information, and create solutions. The integration of digital technology makes learning more interesting and interactive. The systematic RADEC model also helps students in learning science with satisfactory results and increases significantly and students are active through reading, answering, discussing, explaining, and making analysis based on facts. These results are in line with previous studies that digital media and activity-based learning can improve learning outcomes and 21st century skills, especially critical thinking.

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