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The Effectiveness of the Digital 5E Learning Model Integrated with Google Classroom on Science Learning Outcomes in Junior High School

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ABSTRACT

This study aims to analyze the effectiveness of implementing the 5E Learning Cycle model combined with the use of Google Classroom in improving students' learning outcomes in science education. The research method employed is a literature review, examining various relevant previous studies. The findings indicate that the application of the 5E Learning Cycle in Google Classroom-based learning enhances students' conceptual understanding, critical thinking skills, and learning motivation. Additionally, this approach provides a more interactive learning experience and fosters active student engagement in the learning process. The 5E Learning Cycle model, consisting of the phases of Engagement, Exploration, Explanation, Elaboration, and Evaluation, helps students systematically and comprehensively understand the subject matter. Google Classroom as an online learning platform has also been proven effective in increasing access to learning resources and facilitating collaboration between students and teachers. Therefore, the combination of these two approaches can serve as an innovative learning strategy to improve the quality of science education at the secondary school level.

Keywords: *5E Learning Cycle, Google Classroom, Science Learning*

1. INTRODUCTION

The integration of technology in education has significantly transformed learning paradigms, enhancing students' engagement and comprehension across various subjects. Science education, in particular, benefits greatly from student-centered learning models that foster critical thinking and scientific literacy. One such approach, the 5E Learning Model, which includes Engagement, Exploration, Explanation, Elaboration, and Evaluation, has been widely recognized for its effectiveness in improving students' scientific process skills and critical thinking abilities (Gazali, Hidayat, & Yuliati, 2015). However, the advent of digital learning tools has presented opportunities to further enhance the efficacy of this model through technology integration.

Google Classroom, as an e-learning platform, provides a structured digital learning environment that facilitates communication, resource sharing, and assessment. Studies have shown that the use of Google Classroom in various subjects, including mathematics and science, has positively influenced students' learning outcomes (Karimah, 2023; Kurniawan, 2016). Specifically, Google Classroom enhances student engagement by offering interactive learning experiences, timely feedback, and flexible access to learning materials (Rahman, 2021). Despite these benefits, limited research has explored the potential impact of integrating Google Classroom with the 5E Learning Model, particularly in junior high school science education.

The effectiveness of the 5E Learning Model in enhancing students' cognitive abilities and scientific argumentation skills has been widely examined (Milini, Supeno, & Nuha, 2022; Rahmawati, Handayanto, & Dasna, 2022). Additionally, previous studies have indicated that scaffolding techniques, such as diagram scaffolds, play a crucial role in helping students develop scientific explanations (Kirana, Supeno, & Maryani, 2018). However, there remains a gap in the literature regarding how digital platforms, particularly Google Classroom, can support and extend the cognitive benefits of the 5E Learning Model in science education. While some studies have explored the effectiveness of Google Classroom in improving student engagement and learning outcomes in general (Laili & Ibrohim, 2023), few have investigated its specific role in facilitating the learning cycle phases within the 5E framework.

Furthermore, existing research has primarily focused on individual components of the 5E Learning Model or the standalone impact of digital learning tools on science education. There is a lack of comprehensive studies that analyze the synergistic effect of combining the 5E Learning Model with Google Classroom in a structured and systematic manner. This study seeks

to fill this research gap by investigating the effectiveness of the Digital 5E Learning Model integrated with Google Classroom in improving science learning outcomes among junior high school students. The novelty of this research lies in its approach to leveraging digital platforms to enhance inquiry-based learning processes, thereby providing empirical evidence on the intersection of pedagogical models and educational technology in modern science education.

2. METHOD

This study employs a literature review methodology to analyze the effectiveness of the Digital 5E Learning Model integrated with Google Classroom in science education. The research follows a systematic approach consisting of several key stages:

Identification of Research Scope

The study begins by defining the research objectives and scope, focusing on the integration of the 5E Learning Model with Google Classroom in junior high school science education. Relevant keywords and search terms, such as "5E Learning Model," "Google Classroom in science education," and "digital learning in secondary education," are determined to ensure comprehensive literature retrieval.

Literature Search and Selection

A systematic search is conducted using academic databases such as Google Scholar, Scopus, Web of Science, and other reputable journal repositories. Inclusion criteria include peer-reviewed journal articles, conference papers, and dissertations published in the last ten years. Studies focusing on the effectiveness of the 5E Learning Model, the use of Google Classroom in science education, and digital learning strategies are prioritized. Exclusion criteria include studies unrelated to secondary education or those lacking empirical data.

Data Extraction and Categorization

Relevant studies are analyzed and categorized based on key themes, including:

The impact of the 5E Learning Model on student learning outcomes.

The role of Google Classroom in enhancing engagement and comprehension.

The integration of digital tools in inquiry-based science education.

Challenges and limitations of implementing digital learning models in science education.

Critical Analysis and Synthesis

The selected literature is critically reviewed to identify patterns, trends, and gaps in research. A comparative analysis is conducted to evaluate the strengths and weaknesses of previous studies. Special attention is given to how the 5E Learning Model and Google Classroom complement each other in promoting active learning and scientific inquiry.

Conclusion and Implications

The findings from the literature review are synthesized to provide a comprehensive understanding of the effectiveness of integrating the Digital 5E Learning Model with Google Classroom. The study highlights best practices, identifies areas requiring further research, and suggests recommendations for educators and policymakers.

By systematically reviewing existing literature, this study aims to provide empirical insights into how digital learning tools can enhance inquiry-based learning, particularly in junior high school science education.

3. RESULTS AND DISCUSSION

Results

This study synthesizes findings from various sources regarding the effectiveness of the Digital 5E Learning Model integrated with Google Classroom on science learning outcomes in junior high schools. The results are categorized based on the sources analyzed.

- **Rosita & Sartika (2022):** The integration of Google Classroom in junior high school science learning has facilitated interactive and engaging lessons. Students demonstrated improved comprehension and participation due to the structured digital learning environment.
- **Saepudin, Adytia, & Lhaksmana (2021):** The study highlights the effectiveness of Google Classroom in SMP Pajajaran 1 Bandung, where students experienced increased engagement and better learning outcomes compared to traditional methods. Teachers also reported enhanced classroom management and accessibility to learning materials.
- **Subagja (2020):** The use of Google Classroom during remote learning significantly influenced students' learning outcomes. The study found that students who actively engaged in digital classrooms showed better performance than those who relied on conventional learning methods.

- **Sudibjo (2019):** Research on the use of Google Classroom in science learning, specifically in optics material, indicated a positive impact on students' motivation and learning achievements. The interactive digital platform encouraged students to explore and analyze scientific concepts effectively.
- **Yustina & Supriyadi** (2020): During the COVID-19 pandemic, Google Classroom proved to be an essential tool in maintaining science education continuity. The study demonstrated that students adapted well to the digital platform and were able to achieve learning objectives despite the challenges of remote education.
- **Zulchaidar (2017):** The implementation of the 5E Learning Cycle model in junior high school science learning improved students' academic performance. The research emphasized that the structured approach of the 5E model fosters critical thinking and scientific reasoning skills.
- **These findings** collectively support the effectiveness of integrating the Digital 5E Learning Model with Google Classroom, demonstrating positive impacts on student engagement, comprehension, and academic performance in science education.

4. DISCUSSION

The integration of the 5E Learning Cycle model with Google Classroom represents a transformative approach in modern education, particularly in science learning. This pedagogical strategy capitalizes on the strengths of both constructivist learning principles and digital technology to enhance students' conceptual understanding, critical thinking, and engagement in the learning process.

The 5E Learning Cycle model-comprising Engage, Explore, Explain, Elaborate, and Evaluate-has been widely recognized for its effectiveness in fostering active learning. Gazali, Hidayat, and Yuliati (2015) highlight that this model significantly improves students' scientific process skills and critical thinking abilities, making it particularly relevant for subjects like science, where inquiry and experimentation are essential components. The model encourages students to construct knowledge through direct experiences and reflection, rather than passive reception of information.

The effectiveness of the 5E model is further reinforced by the findings of Lestari, Yuliati, and Suwono (2018), who examined students' representational abilities in learning heat transfer concepts. Their study indicates that integrating reflective self-assessment within the 5E framework allows students to develop a deeper conceptual understanding, as they continuously evaluate and refine their knowledge throughout the learning cycle.

In parallel, the use of Google Classroom as a digital learning platform has become increasingly prevalent, particularly in facilitating online and blended learning. According to Rahman (2021), Google Classroom enhances student engagement and learning outcomes in science education by providing a structured, interactive, and accessible environment. This platform enables teachers to efficiently manage learning resources, assignments, and assessments, which is crucial for maintaining continuity in learning, especially in remote settings.

A study by Karimah (2023) demonstrates that the adoption of Google Classroom significantly improves students' mathematical learning outcomes, underscoring the broader applicability of this platform across various disciplines. Similarly, Kurniawan (2016) finds that the structured and user-friendly interface of Google Classroom enhances students' motivation and self-directed learning, making it an effective tool for supporting independent inquiry-based learning approaches such as the 5E model.

The integration of the 5E Learning Cycle with Google Classroom creates a synergistic learning environment where students actively engage in discovery-based learning while leveraging digital tools for collaboration and assessment. According to Milini, Supeno, and Nuha (2022), the 5E model promotes scientific argumentation skills, which are further enhanced by the interactive discussion forums and feedback mechanisms available in Google Classroom. These features facilitate peer learning and teacher-student interactions, reinforcing the iterative nature of knowledge construction.

Furthermore, research by Laili and Ibrohim (2023) on the application of the 5E model in middle school science classrooms reveals that students demonstrate improved problem-solving skills and conceptual retention when digital tools are incorporated into the learning process. Google Classroom, in this context, acts as a bridge that connects in-class activities with extended learning opportunities, allowing students to engage with learning materials at their own pace.

The impact of this integration extends beyond cognitive benefits to motivational and affective dimensions of learning. Riska (2022) highlights that students exposed to the 5E model in combination with digital platforms exhibit higher motivation and participation levels, as they perceive learning as more interactive and student-centered. This aligns with findings from Sudibjo (2019), who observed increased student engagement when Google Classroom was utilized in science education, particularly in topics requiring visualization and experimentation.

Despite its advantages, the implementation of the 5E Learning Cycle within Google Classroom is not without challenges. A study by Subagja (2020) indicates that students may encounter difficulties in self-regulation and time management in an online learning environment, necessitating structured scaffolding from instructors. Kirana, Supeno, and Maryani (2018)

suggest that incorporating diagram scaffolds and guided inquiry within the 5E framework can mitigate these challenges by providing students with structured pathways for knowledge exploration.

Additionally, concerns related to digital literacy and accessibility must be addressed to maximize the benefits of this integration. Yustina and Supriyadi (2020) emphasize the importance of teacher training in digital pedagogy to ensure effective implementation. Instructors must be adept at designing interactive learning activities that align with the phases of the 5E model while leveraging the functionalities of Google Classroom to support differentiated instruction.

In conclusion, the integration of the 5E Learning Cycle with Google Classroom offers a powerful approach to enhancing science education by combining inquiry-based learning with digital interactivity. This combination fosters deeper conceptual understanding, critical thinking, and student engagement. However, successful implementation requires careful instructional design, scaffolding strategies, and ongoing professional development for educators to overcome potential challenges. Future research should explore the long-term impact of this integration on student learning outcomes across diverse educational contexts.

5. CONCLUSION

This study concludes that the integration of the 5E Learning Cycle model with Google Classroom effectively enhances students' learning outcomes, engagement, and scientific reasoning skills. The combination of structured inquiry-based learning and digital technology creates an interactive and student-centered learning environment that supports both motivation and critical thinking.

6. RECOMMENDATIONS

Future research should explore the long-term impact of this approach on students' academic performance and engagement. Educators are encouraged to optimize the use of Google Classroom by integrating various interactive learning strategies to enhance students' active participation and conceptual understanding.

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