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Integrating Minangkabau Cultural Elements in Educational Games: A Mix-Methods Study for Science Learning Engagement

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ABSTRACT

Purpose – Science learning often struggles to boost student engagement and understanding. Educational games offer an innovative approach, but they often overlook local cultural contexts, reducing their relevance for students. This study examines the views of science educators on the use of Edu Game Adventure based on Minangkabau culture in science learning.

Method – This study uses a mixed-method approach with questionnaires distributed to 50 science teachers and lecturers in West Sumatra. Quantitative data were analyzed using descriptive and inferential statistics, while qualitative analysis focused on open-ended responses. The purposive sampling ensures diverse perspectives on the integration of local cultures in science learning, providing a deeper understanding of practitioners' views across different educational levels and experiences.

Findings – The results indicate that most practitioners view the integration of Minangkabau culture in educational games positively. 80% believe it boosts student interest in science, 75% say it promotes cultural diversity and local values, 65% feel it encourages active involvement, and 70% think it broadens perspectives on cultural diversity. These findings suggest that integrating Minangkabau culture enhances student engagement and understanding, providing valuable insights for designing culturally relevant learning tools.

Research Implications – The study's results offer practical guidance for curriculum developers and educators to integrate local culture into engaging, meaningful learning designs, highlighting the importance of culturally relevant content to enhance teaching effectiveness.

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Introduction

Science learning approaches in schools often face major challenges in increasing student interest and engagement. One of the main problems is students' lack of interest in science subjects, which are often considered difficult and boring (Manuel & Sutanto, 2021; Siagian, 2022) Traditional teaching methods that are monotonous and less interactive further exacerbate students' unenthusiasm for learning science. This lack of interest not only has an impact on student learning outcomes but also on the development of critical and creative thinking skills (Ahdan et al., 2019) Students also often have difficulty understanding abstract science concepts because of their indirectly visible nature. These difficulties can lead to frustration and loss of motivation to learn, as well as hinder students' ability to apply science knowledge in real contexts (Buckingham, 2022; Zakirman et al., 2023)

To address these challenges, innovative and interactive learning approaches need to be implemented to increase students' interest and engagement in science. One promising approach is the use of educational games, which can provide a fun and engaging learning experience (Maulidah & Santoso, 2012; Pratama et al., 2019) However, it is important to ensure that these games are relevant to the student's cultural context to improve the student's connection to the learning material. The use of educational games in education has increased significantly, offering a dynamic and fun approach by combining challenges, competitions, and rewards (Jannah & Haryadi, 2020; Mukarromah & Agustina, 2021) This is especially important for subjects that are often considered difficult, such as science, as it can increase student motivation and engagement in learning. The main advantage of educational games is their ability to increase student motivation and their engagement in learning (Hidayatulloh et al., 2020; Wati & Istiqomah, 2019) Students tend to be more actively involved when engaging in games, which can also help them develop important skills such as problem-solving and critical thinking (Yu et al., 2020).

The integration of local culture in education plays an important role in creating relevant learning contexts (Mayasari, 2017) The use of Minangkabau cultural elements in educational games can make science learning more contextual for students in West Sumatra. This helps students relate science concepts to their own cultural experiences, increasing their understanding and motivation towards the learning material (Susanti et al., 2024) In addition to increasing the relevance of learning, local cultural integration can also strengthen students' identities and increase appreciation for their cultural heritage (Syazali & Umar, 2022) Educational games that include folklore or symbols of Minangkabau culture can make students feel more connected to science learning materials, thereby increasing their engagement and understanding (Basuki et al., 2019; Dwipayana et al., 2020) The integration of Minangkabau culture in educational games for science learning is a promising innovation to make learning more interesting and relevant

for students. By incorporating elements of local culture, educational games can create a more meaningful and contextual learning experience for students in West Sumatra (Muin & Utami, 2024)

Effective science learning requires not only knowledge transfer but also active involvement of students in the learning process (Bariyah & Pierewan, 2018; Dharmayana et al., 2012) Educational games that integrate local culture can help bridge the gap between traditional learning methods and the learning needs of current students (Kesuma et al., 2022; Ningsih et al., 2023) However, the development of educational games based on local culture is inseparable from several challenges. One of the main challenges is the lack of consideration of the local cultural context in game development. Many educational games are designed without considering students' cultural variations, reducing their relevance and effectiveness in increasing student interest and engagement (Kusuma, 2018; Mayasari, 2017)

The gap between the learning methods used and the learning styles of students is a major concern. Traditional methods do not always fit the learning needs of current students (Axmedova & Kenjayeva, 2021; Bayram, 2021) The integration of local culture in educational games is one way to ensure that science learning is more relevant and effective in the context of student culture (Dwipayana et al., 2020) The low involvement of students in science learning is also a major obstacle. Many students find science difficult and uninteresting, which results in low participation in the learning process (Syazali & Umar, 2022) To overcome this, it is necessary to develop a learning approach that can make science material more interesting and relevant for students (Freitas, 2018).

Research that explores the views of education practitioners on local culture-based educational games is still limited. For example, research conducted by Miluningtias & Shofiyah (2021) shows that android-based local wisdom integrated educational games can support students to more easily understand Physics concept material that is linked to local wisdom so that android-based local wisdom integrated educational games have an effect on the learning outcomes of grade VIII students of SMP Negeri 3 Sidoarjo (Miluningtias & Shofiyah, 2021) In addition, research conducted by Fitri & Rakimahwati (2021) also shows that the use of educational games based on local culture gives children fun when playing where the development of this game is based on the level of children's understanding and instilling concepts concretely so that it can increase children's interpersonal intelligence (Fitri & Rakimahwati, 2021). Research conducted by Safira et al (2023) also shows that through the implementation of local culture-based game media, children's abilities can be improved both from children's learning activities, and from the results of student learning tests (Safira et al., 2023) A deeper understanding of their views on this approach can provide valuable insights into developing and implementing effective educational games.

In the development of local culture-based educational games, clear guidelines and models are needed to ensure effective and meaningful integration (Panggayudi et al., 2017) Developers need to have a framework that can be followed to integrate local cultural elements consistently and relevant in educational games (Jayanti et al., 2024) This research offers innovations in science education by utilizing the local Minangkabau culture in educational games. This not only enriches the learning content but also increases student engagement through a more contextual and engaging learning experience.

Methods

This study uses a quantitative approach to collect and analyze data on the views of science education practitioners towards Minangkabau culture-based educational games in science learning. The quantitative approach was chosen because it can provide a clear and measurable picture of the respondents' perception of local cultural integration in the context of science education. By using structured questionnaires, the study was able to collect systematic and statistically testable data, making it possible to identify general patterns and variations in respondents' views. This approach also supports the generalization of research results within the framework of a specific population, namely science education practitioners in West Sumatra, so that the results can contribute more widely to the understanding of the application of local culture in science learning in Indonesia.

The population of this study consists of science education practitioners who teach in schools in West Sumatra, Indonesia. The selection of the sample was carried out purposively to ensure that the selected respondents had relevant experience or knowledge related to the use or potential use of Minangkabau culture-based educational games. By taking a sample of 50 science education practitioners, this study aims to get a representative picture of views from different levels of education and experiential backgrounds. This purposive approach also makes it possible to obtain adequate variation in respondents' responses, so that the results of the analysis can provide a deeper understanding of practitioners' various perspectives on the integration of local cultures in science learning.

The research process began with the development of a questionnaire specifically designed to measure the views of science education practitioners on the effectiveness, relevance, and potential of Minangkabau culture-based educational games in science learning. The questionnaire was then distributed to a sample of respondents via email and direct interviews at several schools. The data collection time was carried out over a period of two months to ensure that an adequate number and variety of respondents was achieved. The main instrument in this study is a structured questionnaire. The questionnaire was designed to measure the perception and opinion of science education

practitioners on the effectiveness, relevance, and potential of educational games based on Minangkabau culture in improving science learning. The data collected from the questionnaire was analyzed using descriptive statistical methods such as frequency, mean, and percentage to describe the distribution and general characteristics of the respondents' responses. With this procedure, this research is expected to make a meaningful contribution in supporting the further development of learning approaches that integrate local cultural elements in the context of science education

Result

The lack of learning about local culture, especially Minangkabau culture in schools, shows that efforts are still needed by all parties so that cultural values are not simply eroded with the times. The following can be seen the results of the analysis of the percentage of respondents to special lesson hours to learn about the local culture of the Minangkabau Culture in schools or institutions where they teach

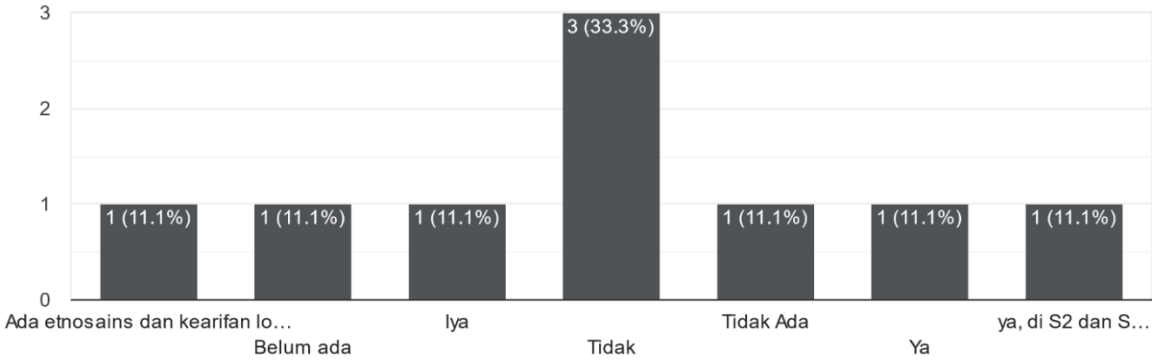

Figure 1. Percentage of respondents to special lesson hours to learn about the local culture of the Minangkabau Nation in schools or institutions where they teach

Based on figure 1, it can be understood that most of the time there are no special lesson hours to learn about local culture in schools. Meanwhile, the importance of learning Minangkabau culture is also an inseparable part of the educational value, especially for West Sumatran children. Several respondents gave their opinions related to this including; Because Minangkabau culture has begun to be forgotten by students, so that it is not eroded by the times so that the current generation still knows and knows this Minangkabau culture, in order to get to know the culture more closely, because indeed children today are lacking in manners, ethics and manners, so it is necessary to instill Minangkabau cultural values, especially we as Minang people who uphold the Basyandi Syara customs', Because the Minangkabau culture has a philosophy that regulates human life and life as a whole and is complicated, and the current generation needs to study the Minangkabau culture in order to be able to perpetuate the Minangkabau culture in the future.

Discussions

In the context of the integration of Minangkabau culture in educational games for science learning, the results of this study show that there is a great opportunity to improve the quality of science learning by utilizing local cultural heritage. The positive view of most respondents indicated that this approach can be effective in increasing students' interest, engagement, and understanding of science material (Al-Azawi et al., 2016). This is consistent with learning theories that emphasize the importance of relevant and meaningful context for students to motivate their learning (Lathifah et al., 2024; Wardana & Djamaluddin, 2021)

This study reveals that practitioners in the field of science education have a positive view of the use of educational games based on Minangkabau culture in science learning. Overall, the results of the percentage analysis related to this can be seen in Figure 2.

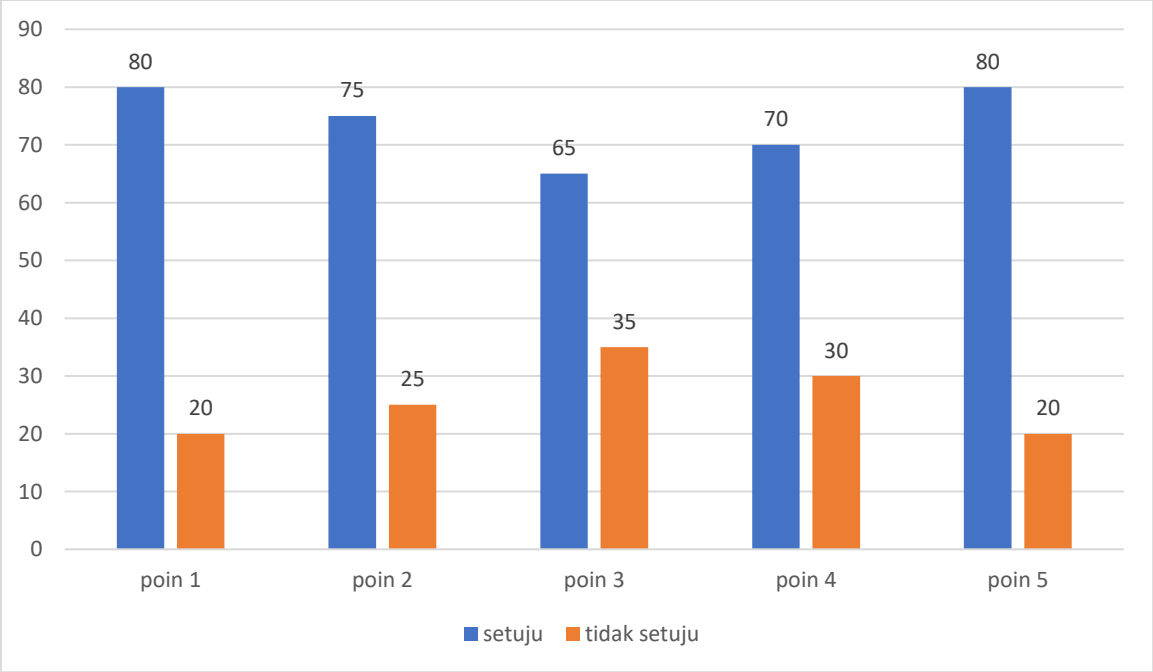

Figure 2. Percentage of respondents to the integration of Minangkabau cultural elements in educational games in science learning

Based on figure 2, as can be seen in point 1, the majority of respondents (80%) stated that the integration of Minangkabau cultural elements in educational games can increase students' interest in learning science. They consider that the use of local cultural elements not only improves students' understanding of science materials but also enriches their learning experience. In addition, in point 2 most respondents (75%) believe that this kind of educational game can promote cultural diversity and local values that are important for the formation of student identity. Meanwhile, in point 3, around 65% of respondents stated that the use of educational games based on Minangkabau culture encourages active involvement of students in the science learning process. They observed that students were more enthusiastic and engaged more intensively when the subject matter

was delivered through a cultural context they were familiar with. Furthermore, in point 4, most practitioners (70%) believe that this kind of educational game can broaden students' perspectives on cultural diversity, considering that Minangkabau is known for its unique cultural wealth and traditions.

However, at point 5, around 20% of respondents expressed concerns related to the use of educational games based on Minangkabau culture in the context of science learning. They argue that there is potential to simplify the complexity of science concepts in order to adapt to cultural contexts that are more familiar to students, which may be at the expense of conceptual rigor in learning. Some practitioners also highlighted the challenges of adapting science content that is in line with local cultural values without sacrificing the necessary scientific accuracy. The concerns expressed by a small number of practitioners regarding the potential simplicity of science concepts in an effort to accommodate cultural values demonstrate the importance of a careful approach in the design and implementation of these educational games. In response to these concerns, strategies can be developed to maintain scientific rigor while organically integrating cultural values. For example, the development of educational games should consider the use of cultural symbols as an analogy for complex scientific concepts, rather than as a substitute for a proper understanding of those concepts.

It is important to dig deeper into how the integration of Minangkabau culture in this educational game can support the development of students' overall cultural literacy. Science education centered on local culture can not only improve students' understanding of science but also promote a appreciation for cultural diversity (Abidin et al., 2018) This is in line with the goals of modern education which seeks to produce learners who are not only competent in academics but also sensitive to the social and cultural context in which they live (Arrohman & Lestari, 2023; Ismawati & Ramadhanti, 2022) In addition, learning strategies that use culture-based educational games can have the potential to be widely adapted in various educational contexts (Wati & Istiqomah, 2019)

The challenges faced in integrating cultural elements in science education should not be ignored. It is important to consider the sustainability and adaptability of these approaches in a variety of different educational contexts. Expanding the scope of this research to include more case studies and field experiences can help identify best practices and address potential barriers that may arise in the implementation of culture-based educational games (Constantinou et al., 2018; Syazali & Umar, 2022) An exploration of the impact of Minangkabau cultural integration on students' understanding in science learning reveals that the use of local cultural elements can significantly improve the understanding of complex science concepts. The study found that students tended to be more engaged and enthusiastic about learning when science content was presented in a context relevant to their culture. For example, the use of myths or cultural symbols in the

explanation of science concepts can help students to more easily understand material that may be difficult to understand in the abstract.

This research provides new insights into how local culture can be a valuable source in improving student learning outcomes (Erman, 2008; Panggayudi et al., 2017; Tâm et al., 2016) The integration of Minangkabau culture in science learning not only serves as an approach to maintain local cultural identity, but also as a strategy to stimulate students' interest and motivation towards learning. Through more meaningful and relevant learning experiences, students can develop critical skills and cultural literacy that are essential for a deep understanding of science (Bariyah & Pierewan, 2018; Nasution et al., 2022)

In the perspective of curriculum implementation, these findings suggest that the integration of local cultures in science learning can be an effective strategy to increase the relevance and attractiveness of subject matter (Noemí & Máximo, 2014; Shih & Hsu, 2016) By taking concrete examples from Minangkabau culture, educators can tailor their teaching strategies to better suit the social and cultural context in which students live, thereby encouraging more in-depth and sustainable learning. The results of this study underscore the importance of a contextual approach in science teaching in the era of globalization. By incorporating local cultural elements in science learning, educators can create a more inclusive and diverse learning environment, which is able to accommodate the needs of students from various cultural backgrounds (Mayasari, 2017) This not only increases students' participation in learning, but also broadens their view of the cultural richness owned by the Minangkabau people and Indonesia in general.

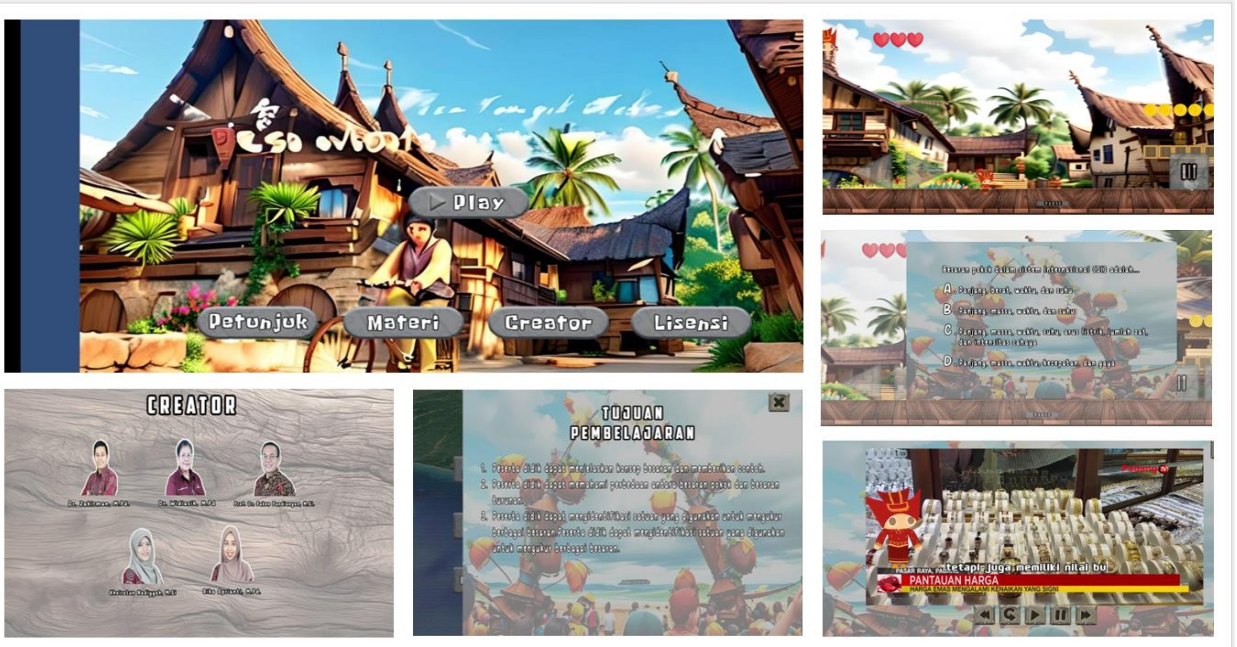

Figure 3. Edu-Game Adventure Design by Integrating Minangkabau Culture

Educational game developers need to develop strategies that integrate local culture in an authentic and meaningful (Vara, 2009; Walelang et al., 2015) This can be done by identifying the distinctive elements of Minangkabau culture that are relevant to the science content being taught. For example, the use of folklore or local traditions in game scenarios can help students understand science concepts in a more emotionally and cognitively connected way. Educators need to be given concrete guidance to integrate local culture in their science learning aids (Ningsih et al., 2023) This guide should include practical steps ranging from selecting the right cultural materials to using technology to enhance the learning experience. For example, virtual or augmented reality technology applications can be used to bring students into an immersive learning experience about Minangkabau culture while learning relevant science concepts (Anastasiadis et al., 2018). It is recommended that educational game developers and educators work closely with the local Minangkabau community to ensure that cultural integration is carried out respectfully and accurately. This collaboration can help in strengthening the relationship between the school and the local community, as well as promoting a deeper understanding of valuable cultural heritage.

The implications of the results of this study can provide practical guidance for curriculum developers and educators to integrate aspects of local culture in learning designs that are interesting and meaningful for students. It also illustrates the relevance of learning content that is tailored to the student's cultural background to improve the effectiveness of teaching and learning. It is important for developers and educators to continue to evaluate the effectiveness of local cultural integration in science learning (Fitri & Rakimahwati, 2021; Mayasari, 2017) This evaluation can be done through the reuse of questionnaires or other research methods to measure students' level of understanding, level of engagement, and attitude towards learning (Amory & Seagram, 2014). In this way, educational game developers and educators can continuously improve and adjust their approaches to achieve optimal learning outcomes. This research makes a significant contribution to the literature on science literacy by exploring how the integration of local culture, especially Minangkabau culture, can improve students' understanding of science concepts. By incorporating elements of local culture into educational play, students not only learn about science conventionally but also develop deeper emotional involvement (Marzuki, 2009; Parlika et al., 2018) The results of this study show that the use of stories, traditions, or cultural values in the context of science learning can help students build a deeper and more relevant understanding of the subject matter (Cheung & Ng, 2021).

In addition, this study also complements the literature on culture-based education by showing the potential for interdisciplinary integration between science and cultural aspects. This approach not only enriches the learning experience of students but also strengthens the relationship between formal education and the local cultural context (Mayasari, 2017) By integrating Minangkabau culture in educational games, educators can

teach science not only as a collection of facts but as part of a broader cultural narrative, thereby increasing the sense of relevance and meaning of learning for students (Syazali & Umar, 2022) The research also opens up new insights for curriculum and educational technology developers on how to incorporate an interdisciplinary approach in science teaching. The integration of local cultures not only adds a cultural dimension in the context of science learning but also stimulates creativity in the development of more diverse and dynamic learning materials (Muin & Utami, 2024; Susanti et al., 2024) Thus, the results of this research can inspire developers to develop more innovations in educational games that are able to embrace and utilize the richness of local culture to support students' science literacy holistically.

The contribution of this research is not only limited to the local context in Minangkabau but can also be applied more widely in the context of global education. The approach used in this study can serve as a model for curriculum developers and educators around the world to leverage local cultural heritage in improving inclusive and meaningful science education for all students, without sacrificing the accuracy of the science concepts taught. Thus, this research not only contributes to academic literature but also provides practical guidance for educators and developers of educational technology to improve students' science literacy through an integrated approach to local culture.

Conclusion

The results of this study show that the integration of Minangkabau cultural elements in educational games can be an innovative and effective approach in improving science learning among students. Based on data analysis shows 80% stated that the integration of Minangkabau cultural elements in educational games can increase students' interest in learning science, 75% believe that this kind of educational game can promote cultural diversity and local values that are important for the formation of student identity, 65% of respondents stated that the use of educational games based on Minangkabau culture encourages active involvement of students in the science learning process, also 70% believe that this kind of educational game can broaden students' perspectives on cultural diversity, considering that Minangkabau is known for its unique cultural wealth and traditions. These findings show that the integration of Minangkabau cultural elements in educational games is effective in increasing student understanding and engagement, as well as providing insights for developers and educators to better consider local culture in the design of learning tools. However, further research is needed to understand more deeply how local cultural values can be harmoniously integrated with complex scientific concepts. Thus, this study makes an important contribution to the development of science education that is more inclusive and relevant to the cultural reality of students in Indonesia.

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