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Analysis of the Needs for Developing MI/SD Science Learning Design Based on Local Wisdom

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Abstract

This study aims to develop a science learning design based on local wisdom in MI/SD Gunungkidul by utilising the uniqueness of local culture and natural resource wealth, such as traditional agricultural practices, natural resource management, and local community lifestyles. This research uses a qualitative approach involving 17 teachers as the main source to obtain in-depth data about their experiences, challenges, and needs in implementing local wisdom-based learning. With semi-structured interview instruments and data analysis through three stages data reduction, data presentation, and conclusion, the study is guided by three problem formulations: (1) how local wisdom-based science learning is implemented in schools, (2) why such a design is important in Gunungkidul, and (3) what its impacts are. These problems directly align with the research objectives, which are to explore current implementation practices, analyse the urgency and contextual relevance of integrating local wisdom into science education, and evaluate its potential impact on science literacy, cultural and environmental preservation, and student creativity. The findings show varying levels of implementation, with some schools beginning integration despite challenges such as limited facilities and teacher readiness. Overall, the local wisdom-based science learning approach makes lessons more meaningful and relevant to students' lives.
Keywords: learning design; local wisdom; science learning; science literacy

Introduction

The analysis of the need for developing science learning designs based on local wisdom is very important to research in an effort to improve the quality of education. Local wisdom can become a relevant learning resource, making it easier for students to understand scientific concepts. (Rahmatih et al., 2020). To determine the needs in designing science education, a needs analysis can be conducted (Hendriyani et al., 2018). In elementary schools, science or natural sciences must be taught with the aim of equipping students to face the competitive challenges of the 21st century (Lathifah et al., 2024). However, science learning practices in various countries often neglect the social aspects of science education and encourage students to acquire the skills needed in society (Pratiwi et al., 2019). Thus, the design of science learning must be carefully crafted not-

only to transfer knowledge but also to equip students with critical, creative, and collaborative thinking skills relevant to challenges.

Local wisdom plays an important role as a contextual learning resource in science education, so that students do not only rely on facts or abstract concepts. Teachers need to be careful in choosing the appropriate learning approach, as this decision directly affects students' learning outcomes. The selection of the approach should be adjusted to the characteristics of the subject matter and the students, especially in science, which requires a more concrete understanding (Rahmatih et al., 2020). In Gunungkidul, local wisdom encompasses various elements such as farming culture, natural resource management, and an environmentally friendly lifestyle, which can support the science learning process.

Integrate local wisdom into the learning design so that students can relate scientific concepts to their real-world experiences. Studies show that the use of local traditions and resources significantly enhances students' motivation and understanding of science concepts (Suprapto et al., 2024). Science literacy, which focuses on the development of critical thinking skills, the application of scientific concepts, and making informed decisions, becomes important in this context. Although the implementation of science literacy in schools is quite challenging, teachers are still expected to train students to think critically with relevant models and teaching methods, and to teach science beyond just theory (Efendi & Barkara, 2021). To support the improvement of science literacy, learning should be linked to real contextual problems, using adequate learning tools (Enjelly & Fadilah, 2024). Other research also shows that students who learn with a local wisdom approach tend to experience an increase in science process skills and conceptual understanding (Risamasu & Pieter, 2024). However, the limitations of facilities and infrastructure often become obstacles in schools in conducting optimal science learning. The low participation of students in practical activities, which are important for linking scientific knowledge with real-world phenomena, negatively impacts their science literacy (Yusmar & Fadilah, 2023).

When local wisdom is integrated into the curriculum, education not only becomes more meaningful but also encourages the development of critical thinking skills and problem-solving abilities (Sabat et al., 2024). A contextual learning approach based on local wisdom allows students to understand science concepts through experiences that are

close to their daily lives, by connecting scientific knowledge with local traditions and practices that they are familiar with (Wibawa et al., 2024; Erman & Wakhidah, 2024). (Santoso et al., 2023) showed that local culture-based learning can increase student engagement and deepen understanding of science concepts. Research by Rahmawati et al. (2022) also found that the integration of local knowledge in science learning not only strengthens students' understanding of scientific concepts but also fosters concern for the environment. However, these studies predominantly focus on practical application in limited contexts and lack a structured analysis of the teachers' perspectives as the primary implementers. This research addresses that gap by systematically mapping teacher needs and challenges in integrating local wisdom into science learning, offering a comprehensive design tailored to the unique sociocultural and ecological characteristics of Gunungkidul. The novelty of this study lies in its dual focus: it positions itself not only as a pedagogical innovation rooted in local values but also as a strategic contribution to enhancing science literacy and environmental stewardship through culturally grounded education.

Research Methods

This research was conducted in Madrasah Ibtidaiyah (MI) and Sekolah Dasar (SD) in Gunungkidul because this area has a wealth of local wisdom that is very interesting and can be integrated into the design of science learning. Gunungkidul is known for its unique and diverse natural resource potential, such as beaches, karst caves, rivers, and hills, as well as the very unique local culture that can be used as a learning medium. It is highly relevant to utilise that local potential as teaching materials to explain science concepts. This research was conducted to identify the needs in developing a learning design based on local wisdom, especially in the context of science education at the MI and SD levels. This is done to improve the quality of contextual and regionally relevant learning.

This research was conducted using a qualitative approach. Qualitative research is a research method that uses narrative or explanation to describe every phenomenon, symptom and social situation using stories or words (Waruwu, 2023). There are two types of data, namely primary and secondary data. Primary data was collected through

interviews with teachers who teach science at MI and elementary schools in Gunungkidul. Meanwhile, secondary data was obtained from relevant literature studies, including journals and books related to the development of learning based on local wisdom and learning design theory. These two datasets are used to support a more comprehensive understanding of the needs and challenges faced in developing local wisdom-based teaching materials. It is hoped that this research can provide accurate and in-depth information regarding important aspects of developing science learning design in Gunungkidul.

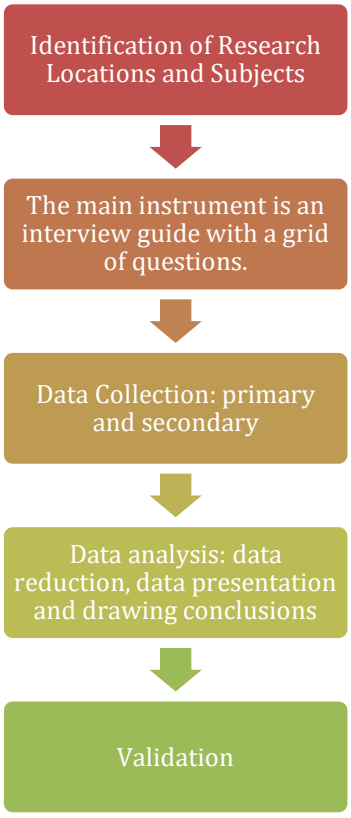

Figure 1
Research Procedures
Source: (Salmaa, 2023)

The source of the research comes from the obtained data. In this context, the data sources include subjects that can be categorised as individuals or groups of people (Pujiati, 2024). The main data sources are selected through purposive sampling techniques, which involve the determination of samples based on specific considerations (Sugiyono, 2012). In addition to enriching and broadening the research perspective, secondary data were collected through a literature review. The literature review serves as a method to analyse issues using previously compiled written sources (Salmaa, 2023).

The primary data sources refer to 17 teachers who teach science subjects at MI and SD in Gunungkidul. The selection criteria are based on their teaching experience and their potential to integrate local wisdom into science learning. These sources are considered to understand the needs of students and the local challenges faced in the learning process. Then, secondary sources include studies on learning design, science, local wisdom, and previous related research. This literature plays an important role in supporting and comparing findings from interviews with teachers, making the analysis of the need for learning design development more in-depth and theoretically relevant.

The data collection technique was conducted through semi-structured interviews via Google Forms, which were administered to 17 science teachers in MI and SD in Gunungkidul. These interviews were conducted to explore teachers' experiences related to local wisdom-based science education, the challenges faced, and the needs in the development of science education design. Additionally, secondary data from literature was used to enrich the understanding of the concept of local wisdom-based learning. The literature used includes studies on the importance of integrating local wisdom into the education curriculum and learning design theory. The combination of primary data from interviews and secondary data from literature is expected to provide a comprehensive picture of the needs and potential for developing local wisdom-based science education design in Gunungkidul.

This study uses a descriptive qualitative approach to explore the needs in developing science learning designs based on local wisdom in MI/SD Gunungkidul. A sample of 17 teachers was selected using purposive sampling techniques. The sample selection criteria are teachers who actively teach science, have experience or interest in integrating local wisdom in learning, and are willing to participate in the study. Data were collected through semi-structured interviews with a grid covering three main topics listed in the table below. Data analysis was carried out using the interactive analysis model from Miles and Huberman (Saleh, 2017), which includes three stages: data reduction, data presentation, and drawing conclusions. The data reduction stage is carried out by coding, identifying themes, and grouping data according to the focus of the study. The reduced data is then presented in the form of tables and narratives to clarify the patterns of teacher needs. Drawing conclusions is done to formulate the main findings that can be used as a basis for developing science learning designs based on local wisdom.

Table 1
Interview Question Grid Table

Topic	Question
Implementation of Science Learning Based on Local Wisdom	What do you think about the implementation of local wisdom-based science learning in schools today?
The Importance of Developing Science Learning Design Based on Local Wisdom	Why do you feel it is important to develop a science learning design based on local wisdom in Gunungkidul?
The Impact of Developing Science Learning Based on Local Wisdom	What impact do you see if local wisdom-based science learning design can be developed well in Gunungkidul?

Source: Personal Document

Result

The results of this study reveal several important findings related to the analysis of needs and challenges faced by MI/SD class teachers in Gunungkidul in teaching science, especially based on local wisdom. These findings are based on data collected through a questionnaire. To address some of the challenges and needs faced by teachers, they also provide input on how to implement them in the field. The following is the source data from 17 teachers who have answered the list of questions related to the development of the required science learning design.

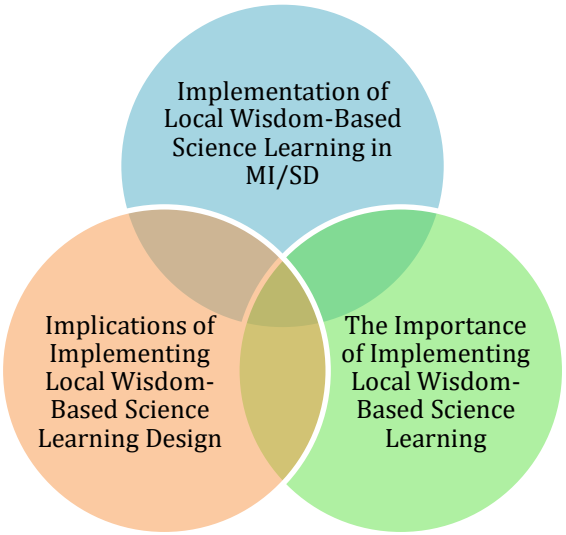

Figure 2
Discussion Results
Source: Personal Document

Implementation of Local Wisdom-Based Science Learning in MI/SD

Table 2
Implementation of Science Learning Based on Local Wisdom

Source	Data	Coding
P1, P4, P8, P13	Implementing science learning, but not yet optimal due to limited facilities and infrastructure.	Facilities and Infrastructure
P11, P17	The need for support, facilities and training to optimise teacher competency,	Teacher Training
P5, P10	Utilising the surrounding environment for learning (karst mountains)	Surrounding Environment
P6	Utilisation of medicinal plants used for traditional herbal medicine	Traditional Herbal Medicine
P8	Limited capacity of teacher human resources in its implementation	Teacher Ability

Source: Personal Document

The implementation of local wisdom-based science learning in seventeen schools currently shows varying levels of development. Most schools have started to implement this concept, although some are not yet optimal. Some teachers feel that local wisdom-based learning is important but has not been fully integrated into teaching and learning activities, especially due to limited supporting facilities and resources. Even so, some schools have started to try to use local resources in the surrounding environment as learning media.

The use of local wisdom in science learning can provide significant added value for students. By involving local elements such as medicinal plants, natural resources, and community traditions, students not only learn about science concepts, but also get to know more about the culture and potential of their area. This method makes learning more relevant and contextual, so that students can more easily understand the material being taught. In addition, local wisdom-based learning can also trigger students' interest in science lessons because they can immediately dive into an environment they are familiar with.

However, this implementation still faces challenges, such as a lack of training for teachers and the less-than-optimal utilisation of local potential in the curriculum. Some teachers are still oriented towards standard textbooks, and not many have explored local wisdom as a source of learning. Therefore, it is necessary to increase teacher capacity and provide better support so that science learning based on local wisdom can develop more widely and consistently in various schools.

The Importance of Implementing Local Wisdom-Based Science Learning

Table 3
The Importance of Local Wisdom-Based Science Learning

Source	Data	Coding
P1, P2, P3	Preserving the local wisdom of Gunungkidul in the form of culture and values	Values and Culture
P10, P12, P17	Context-based learning by observing and applying the knowledge gained	Contextual Learning
P6, P15,	Helping students understand the potential of the surrounding environment and relating it to science concepts.	Natural Potential
P9	Increasing the relevance of learning and students' awareness of local natural and cultural riches.	Environmental Care
P2, P11	Community involvement in the learning process can strengthen the relationship between schools and the community.	Community Relations
P8	Facilitate the achievement of learning objectives	Learning Objectives

Source: Personal Document

Based on the results of the analysis of the source's answers to the question of the importance of developing science learning designs based on local wisdom, some sources/teachers in Gunungkidul agreed that it is important to develop science learning designs based on local wisdom. They consider that local wisdom, which includes local traditions, culture, and practices, is an important asset that can be integrated with science materials. This will not only preserve local wisdom but also provide a relevant context for students in understanding science, so that learning becomes more interesting and meaningful.

In addition, the source also highlights that science learning based on local wisdom can improve students' understanding of their surroundings, including local potentials such as natural resources and traditional practices. This integration helps students relate science to everyday life, facilitates the learning process, and creates greater engagement in learning. Through the development of this design, students will become more familiar with and appreciate the richness of their area, which in turn can foster a stronger awareness of the environment and culture.

The development of learning designs based on local wisdom is also considered important because it can strengthen the relationship between schools and local communities. Several sources emphasise the importance of collaboration between

teachers, students, and local communities to utilise existing potential. Thus, in addition to providing a positive impact on students, this approach can also contribute to the empowerment of local communities, both in economic, cultural, and social aspects, through more effective utilisation of local resources.

Implications of Implementing Local Wisdom-Based Science Learning Design

Table 4
Implications of Local Wisdom-Based Science Learning

Source	Data	Coding
P2, P11, P15, P10	Improving science literacy through contextual learning	Science Literacy
P9, P3	Noble values/characters, caring for the environment, mutual cooperation, responsibility, and unity will be maintained.	Character Values
P17, P13, P14, P5	Improving the preservation of nature and culture	Nature Conservation
P8, P11	Improving students' creativity and skills in utilising local potential	Creativity and Skills
P1, P6, P7, P12	Supporting the improvement of the welfare or economy of local communities through natural and cultural potential	Welfare

Source: Personal Document

Based on the data related to the impact of developing science learning designs based on local wisdom in Gunungkidul, it can improve students' understanding of science literacy. By linking science materials to the local context, students can more easily understand the lessons and feel more involved because the materials they learned are directly related to their daily lives. The source also assessed that this approach can enrich students' learning experiences, especially in terms of understanding the environment and local wisdom around them.

In addition, local wisdom-based learning design is considered capable of supporting the preservation of culture and the natural environment. Many sources emphasise that linking science learning with local traditions and culture will encourage students to better appreciate and preserve the cultural and environmental richness of Gunungkidul. With a deeper understanding of local values, students are expected to be able to play an active role in maintaining and preserving the traditions and natural resources in their area.

Another positive impact is the increase in students' creativity and skills in utilising local potential. Through this learning, students are invited to think creatively and

innovatively in solving problems related to the natural and cultural potential around them. In addition, several respondents also saw the great potential of local wisdom-based learning to support the development of the economy and the knowledge of local communities. By involving the community in the education process, this learning can create a strong synergy between schools and communities, which will ultimately provide long-term benefits for the development of community welfare.

Discussion

Teachers often face difficulties in designing and implementing contextual learning due to limited training and available resources. However, effective learning design is essential to develop students' knowledge, skills, and attitudes to prepare them for contemporary challenges (Kostøl & Remmen, 2022)(Liza et al., 2024). The improvement of teacher competencies is crucial to address learning issues (Munastiwi et al., 2022). With adequate support, teachers can utilise nature as a laboratory for science learning, thereby increasing student engagement, fostering creativity, and enabling direct interaction with real-world phenomena. Learning based on real experiences not only makes lessons more meaningful but also positively impacts students' understanding (Nurhalizah & Dahlan, 2022).

Understanding local wisdom is very important in designing learning that fosters cultural identity and personal development of students. Local wisdom helps preserve cultural traditions and empowers students to face the challenges of the global world. (Munawir et al., 2024). In its design, teachers need to analyse student development, set diverse learning objectives, and choose appropriate contexts and cognitive strategies to create effective instructional designs (Li & Dong, 2023). In addition, institutional support in the form of training and resource provision is crucial for enhancing teachers' ability to design effective and meaningful learning experiences (Mustikasari & Heggart, 2022).

Students who grow up with pride in their cultural heritage will have a deep understanding of their ancestors' noble values and a strong awareness of their national identity. This is a tangible result of integrating cultural values into education, where students not only understand their own culture but also cultivate a sense of belonging and respect for that heritage (Istiqomah et al., 2023;Sakman et al., 2024). With this approach, education not only shapes academic knowledge but also supports the formation of

students' identities as part of a larger community, providing them with a foundation to appreciate and preserve the cultural wealth around them.

More than just an understanding of culture, the integration of local wisdom in education also influences cultural identity and enhances students' performance in facing various challenges (Polii & Ahmadi, 2024). For example, the Bajo Mola community in Wakatobi National Park demonstrates how local wisdom embedded in environmental care values can serve as the foundation for character education. Through a curriculum that integrates these values, education can introduce students to care for nature and their environment from an early age (Marlina et al., 2023). By promoting culture, literature, and history in education, we ensure that traditional values remain alive and relevant, ready to be passed on to future generations who will uphold the nation's identity (Riyanto et al., 2024). Learning will be more meaningful if it can be applied in everyday life, and contextual phenomenon-based learning is one of the approaches that offers a solution. By connecting the subject matter to real-life situations, students become more motivated to learn and find it easier to understand the material being taught. Research shows that this approach can significantly improve students' scientific literacy, as they learn to connect scientific concepts with everyday life (Santoso et al., 2023). Moreover, by integrating local wisdom, we not only enrich the learning experience but also contribute to preserving local culture and the environment (Lathifah et al., 2024). The integration of locally based knowledge into the curriculum is seen as a beneficial strategy to enhance the economic value of the region. Education that prioritises local knowledge can introduce students to the economic potential of their regions, encouraging them to empower their surrounding communities (Madhakomala et al., 2024). Other studies also show that education focused on local empowerment can enhance economic independence in rural areas, creating synergy between education and better public health aspects (Arjaya et al., 2024). Thus, contextual education not only shapes intelligent and critical students but also plays a role in creating independent and prosperous communities.

Conclusion

One of the most important results obtained from this study is a deeper understanding of the specific needs of teachers in developing science learning designs based on local wisdom in Gunungkidul. This study successfully identified various

elements of local wisdom that are relevant to be used as educational content, such as cultural values and environmental practices commonly carried out by the local community. Without this study, the gap in the use of local wisdom as a learning resource may not be clearly visible, so that the local potential to enrich science learning is underutilised. Through interviews with 17 elementary and Islamic elementary school teachers, it was revealed that many teachers need guidance and resources to incorporate local wisdom into science lessons. This emphasises the importance of developing culturally relevant teaching materials to increase student engagement and connect learning to everyday life.

This study uses a qualitative approach that is very suitable for exploring an in-depth understanding of teacher needs. By involving 17 elementary and MI teachers as informants, this study was able to collect descriptive data on teacher perceptions and expectations of the development of teaching materials that combine science with local wisdom. The theory of learning design, science learning, and local wisdom are solid foundations in this study, because all prioritise the relevance of learning to the cultural background of students. This approach effectively answers the main problem of the study, namely, how to design science learning that is appropriate to the local context. The interview method and literature study used provide data that is rich in insight, allowing researchers to capture data into strong information in compiling science learning designs based on local wisdom.

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Declaration of Conflicting Interests

The researchers declare that there is no conflict of interest in this research.

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