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Madrasah Ibtidaiyah Teachers' Strategies for Fostering Scientific Attitudes in Science Learning: A Case Study of State Madrasah Ibtidaiyah in Aceh Besar Regency

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Abstrak. Pembelajaran IPA dalam Kurikulum Merdeka menekankan pengembangan sikap saintifik sebagai bagian penting dalam proses pembelajaran. Sikap saintifik diperlukan untuk membiasakan peserta didik bersikap teliti, jujur, kritis, dan memiliki rasa ingin tahu terhadap fenomena yang dipelajari. Penelitian ini bertujuan untuk mendeskripsikan peran guru dalam menanamkan sikap saintifik pada pembelajaran IPA kelas V di Madrasah Ibtidaiyah Negeri (MIN) Kabupaten Aceh Besar, baik pada tahap perencanaan maupun pelaksanaan pembelajaran. Penelitian ini menggunakan metode deskriptif kualitatif dengan desain studi kasus. Subjek penelitian adalah 3 orang guru kelas V pada 3 MIN di Aceh Besar. Teknik pengumpulan data meliputi observasi, wawancara, dan dokumentasi. Data dianalisis melalui tahapan reduksi data, penyajian data, dan penarikan kesimpulan. Hasil penelitian menunjukkan bahwa guru telah berupaya menanamkan sikap saintifik dalam pembelajaran IPA, namun pelaksanaannya masih bervariasi antar sekolah dan belum konsisten dalam setiap kegiatan pembelajaran. Sikap saintifik tampak melalui kegiatan mengamati, menanya, dan berdiskusi, dengan tingkat intensitas dan kedalaman yang berbeda sesuai kondisi kelas dan kebiasaan mengajar guru. Oleh karena itu, diperlukan penguatan dan pembiasaan berkelanjutan agar penanaman sikap saintifik dapat berjalan secara lebih optimal dalam pembelajaran IPA.

Kata kunci: sikap saintifik, peran guru, pembelajaran IPA, Kurikulum Merdeka

Abstract. Science learning in the Merdeka Curriculum emphasizes the development of scientific attitudes as an essential component of the learning process. Scientific attitudes are needed to cultivate students' carefulness, honesty, critical thinking, and curiosity toward the phenomena they study. This study aims to describe the role of teachers in fostering scientific attitudes in fifth-grade science learning at State Madrasah Ibtidaiyah (MIN) in Aceh Besar Regency, both at the planning and implementation stages of instruction. This study employed a qualitative descriptive method with a case study design. The research subjects consisted of three fifth-grade teachers from three State Madrasah Ibtidaiyah in Aceh Besar. Data were collected through observations, interviews, and documentation. The data were analyzed through the stages of data reduction, data display, and conclusion drawing. The findings indicate that teachers have made efforts to foster scientific attitudes in science learning; However, their

implementation varies across schools and has not been consistently integrated into every learning activity. Scientific attitudes were reflected in observing, questioning, and discussion activities, with varying levels of intensity and depth depending on classroom conditions and teachers' instructional practices. Therefore, continuous reinforcement and habituation are needed to optimize the cultivation of scientific attitudes in science learning.

Keywords: scientific attitude, teacher's role, science learning, independent curriculum.

INTRODUCTION

Natural Science (IPA) learning at the Madrasah Ibtidaiyah level plays a strategic role in equipping students with the ability to understand natural phenomena scientifically while simultaneously shaping the character and thinking skills needed in the 21st century. The essence of science learning emphasizes not only the mastery of scientific concepts and facts, but also the process of discovery and the development of students' scientific attitudes. Through science learning, students are expected to be able to develop critical thinking skills, solve problems, and make decisions based on empirical evidence. Therefore, science learning in elementary schools needs to be designed contextually and meaningfully so that students gain learning experiences that enable them to understand concepts and internalize scientific values in everyday life (Hosnan, 2014).

Epistemologically, science encompasses three main dimensions: product, process, and scientific attitude. The product dimension relates to scientific facts, concepts, principles, and theories, while the process dimension encompasses observation, experimentation, and scientific investigation. The scientific attitude dimension reflects scientific thinking and behavior, demonstrated through curiosity, honesty with data, openness to opinions, critical thinking, responsibility, and thoroughness in problem-solving (Sani, 2019). These three dimensions should be fully integrated into learning so that students not only understand the material cognitively but also develop the character and thinking habits of a scientist.

The importance of developing scientific attitudes is further emphasized in the implementation of the Independent Curriculum. This curriculum prioritizes student-centered learning through a variety of active, contextual, and meaningful learning experiences (Ministry of Education, Culture, Research, and Technology, 2017). In science learning, students are encouraged to engage in

activities such as observing, questioning, exploring, reasoning, and communicating their findings. Through these experiences, students not only gain knowledge but also develop scientific attitudes that serve as the foundation for developing higher-order thinking skills and the Pancasila Student Profile (Ministry of Education and Culture, 2013; Sani, 2019). Thus, the development of scientific attitudes is an integral and inseparable part of the science learning process in elementary schools.

The success of instilling scientific attitudes is greatly influenced by the teacher's role as a designer, facilitator, and role model in the learning process. Teachers are not only tasked with delivering material but also creating a learning environment that allows students to directly engage in scientific processes. The flexibility provided by the Independent Curriculum provides teachers with the space to develop learning strategies tailored to the needs and characteristics of students (Salsabilla & Nurhalim, 2024). However, implementing science learning oriented toward developing scientific attitudes requires teachers to be prepared to design learning activities that encourage students to actively ask questions, conduct investigations, and communicate the results of their observations (Shalsabila & Juhri, 2024; Okrianti & Aufa, 2024). Several studies have shown that the implementation of the Independent Curriculum and science learning has the potential to improve the quality of the learning process if supported by optimal teacher involvement. Salsabilla & Nurhalim (2024) emphasized that the flexibility of the Independent Curriculum Independent give room for Teacher For adapt learning with need real student. However, (Riswan , 2023) revealed that planting attitude scientific in school base Still often nature partial And not yet integrated in a way consistent in activity learning. Study other Also shows that science learning tends to stop at the concept mastery stage, without provide experience empirical Which adequately through experimental or inquiry activities (Sutopo, 2020).

Various studies have shown that science learning involving inquiry and experimental activities can improve students' scientific thinking skills and attitudes. A meta-analysis conducted by Putri et al. (2023) showed that inquiry-based learning has a positive effect on student learning outcomes. Research by Sutopo (2020) also found that experiment-based science learning can improve the scientific attitudes of elementary school students. Furthermore, Riswan

(2023) revealed that instilling scientific attitudes in science learning in elementary schools has not been optimally implemented and often only appears in certain activities. Research by Oviana (2025) shows that elementary and Islamic elementary school teachers have attempted to develop learning tools based on a scientific approach, but their implementation in the classroom still faces various obstacles.

Based on initial observations conducted at several State Elementary Schools (MIN) in Aceh Besar Regency, teachers have demonstrated awareness of the importance of developing scientific attitudes in science learning. Teachers strive to foster students' curiosity through question-and-answer activities and group discussions. However, learning implementation still shows a gap between planning and classroom practice. Learning activities are generally dominated by literature-based observations and have not been consistently followed up with experiments or empirical evidence. This situation limits students' opportunities to develop careful, objective, and critical attitudes through the scientific process. Student involvement in inquiry and experimentation is a crucial prerequisite for developing scientific attitudes (UNNES SNIPA Team, 2021).

Previous studies have generally focused on the implementation of the scientific approach, the effectiveness of specific learning models, or the measurement of student learning outcomes. Research specifically examining teacher strategies for instilling scientific attitudes in science learning in Islamic elementary schools (Madrasah Ibtidaiyah), particularly in the context of the implementation of the Independent Curriculum in Aceh Besar Regency, is still very limited. Furthermore, there are few studies that describe in depth how teachers plan, implement, and overcome various obstacles to instilling scientific attitudes in the classroom.

Based on these conditions, this study has a novel focus on the study, which examines in depth the strategies of Madrasah Ibtidaiyah teachers in instilling scientific attitudes in science learning through case studies at several MIN in Aceh Besar Regency. This study not only describes the learning practices carried out by teachers, but also analyzes the form of implementation of each indicator of scientific attitudes, the obstacles faced, and efforts made to optimize the instillation of scientific attitudes in science learning. This is in line with the demands of 21st-century learning that emphasizes the development of critical

thinking skills, collaborative, and And based experience direct (Permendikbudriset Indonesia, 2022; Vlastou-Dimopoulou, 2019) . Thus, this research has a greater contribution clear And significant, that is No only give description general, te tap i also produces analysis deep And solution practical Which can used as internal reference increase quality learning Science in Madrasah Elementary school.

RESEARCH METHODOLOGY

This research uses a qualitative approach with a case study design. This approach was chosen because it aligns with the research objective, which is to in-depth describe the strategies of Madrasah Ibtidaiyah teachers in instilling scientific attitudes in fifth-grade science learning, both during the planning and implementation stages. The case study design allows researchers to understand phenomena holistically and contextually based on the natural conditions that occur in the field (Creswell & Poth, 2018).

The research was conducted in the even semester of the 2025/2026 academic year at three State Islamic Elementary Schools (MIN) in Aceh Besar Regency. The study population included all fifth-grade science teachers and fifth-grade students at the three madrasas. The research subjects were selected using a purposive sampling technique, selecting informants based on specific considerations relevant to the research objectives (Sugiyono, 2020). The primary informant criteria were fifth-grade science teachers who had implemented the Independent Curriculum in their teaching.

Based on these criteria, the research sample consisted of three fifth-grade teachers, namely G1, G2, and G3, from three MIN (Islamic elementary schools) in Aceh Besar Regency. In addition, ten students were selected to represent the characteristics of students at each school and provide information about their experiences during science learning. Supporting informants in this study included the madrasah principal and fifth-grade students who played a role in enriching and confirming the data obtained from the main informants.

In qualitative research, the researcher acts as the primary instrument (human instrument) responsible for collecting, analyzing, and interpreting data systematically and reflectively (Creswell & Creswell, 2023). Several research instruments were used to support the data collection process, including

observation guidelines, semi-structured interview guidelines, and documentation sheets. The observation guidelines were used to observe science learning activities and the various forms of scientific attitude instillation that emerged during the learning process. The semi-structured interview guidelines were used to gather information regarding planning, implementation, obstacles, and teachers' efforts in instilling scientific attitudes. Meanwhile, the documentation sheets were used to collect supporting data in the form of teaching modules, learning tools, activity photos, and other relevant documents.

Data collection techniques included observation, interviews, and documentation. Observations were conducted in a participatory, non-interventional manner, meaning the researcher was directly present during learning activities without influencing the learning process. In-depth interviews were conducted with teachers, the madrasah principal, and several students to obtain comprehensive information related to the research focus. Documentation was used to supplement and strengthen the data from the observations and interviews.

Data analysis was conducted qualitatively using the interactive model proposed by Miles, Huberman, and Saldaña (2024), which includes three stages: data reduction, data presentation, and conclusion drawing or verification. The analysis process was carried out iteratively and continuously from the beginning of data collection until a deep understanding of the phenomenon being studied was obtained. To ensure data validity, this study applied source and technical triangulation techniques by comparing data obtained through observation, interviews, and documentation to maintain the credibility and reliability of the research findings.

RESULTS AND DISCUSSION

Results

1. The Emergence of a Scientific Attitude at the Science Learning Planning Stage

The research results were obtained through analysis of teaching modules, observations, and interviews with fifth-grade teachers at three Islamic elementary schools (MIN) in Aceh Besar Regency. The findings indicate that scientific attitude indicators have been incorporated into lesson plans, but their distribution is not evenly distributed across each teaching module developed by

teachers.

Based on document analysis, indicators of critical thinking and openness to opinions were the most frequently encountered indicators in lesson plans. Meanwhile, honesty was the least frequently encountered indicator in learning objectives, activity steps, and assessments. Indicators of curiosity, thoroughness, and logical thinking were included in most teaching modules, but their intensity varied across teachers and schools. The distribution of scientific attitude indicators at the lesson planning stage is presented in Table 1 and Diagram 1.

Table 1.

Scientific attitude indicators in science teaching module planning

No	ntific Attitude Indicators	Frequency	Percentage (%)
1	Curiosity	2	66.67
2	Be critical	3	100
3	Careful	2	66.67
4	Honest	1	33.33
5	Open	3	100%
6	Be logical	2	66.67

* Based on the results of observations of science learning planning carried out by G1, G2, and G3 MIN in Aceh Besar District

2. The Emergence of a Scientific Attitude at the Implementation Stage of Science Learning.

The results of learning observations show that the instillation of scientific attitudes has been carried out through various learning activities, such as asking questions, group discussions, observations, and presentations of learning outcomes.

Based on observations, curiosity and openness to opinions were the most dominant indicators that emerged during the learning process. Students were seen actively asking questions, discussing, and responding to their peers' opinions. Critical thinking indicators appeared in the moderate category, while conscientiousness, honesty, and logical thinking indicators showed a relatively lower percentage of occurrence. The distribution of scientific attitudes during the learning implementation stage is presented in Table 2 and Diagram 2.

Table 2.

Scientific attitude indicators on implementation of learning science

No	Scientific Attitude Indicators	Frequency	Percentage (%)
1	Curiosity	3	100
2	Be critical	2	66.67
3	Careful	1	33.33
4	Honest	1	33.33
5	Open	3	100
6	Be logical	2	33.33

* Based on the results of observations of the implementation of science learning carried out by G1, G2, and G3 MIN in Aceh Besar District

3. Teachers' Obstacles and Barriers in Instilling a Scientific Attitude

Based on interviews with teachers at three MIN schools, four main themes emerged regarding the obstacles teachers face in instilling a scientific attitude. The data obtained are presented in Table 3 below.

Table 3.

Teachers' Obstacles and Barriers in Instilling Scientific Attitudes

Findings Theme	**Direct Informant Quotes**	**Informant Code**	**Interpretation**
Limited conceptual understanding of scientific attitudes	*"The scientific attitude in the teaching module is more focused on making students active and not just memorizing the material."*	G1	Teachers view scientific attitudes more as a learning activity than a process of forming scientific ways of thinking.
Limited conceptual understanding	*"The important thing is that students actively ask*	G2	Teachers' understanding is still oriented towards

of scientific attitudes	*questions and discuss. That's what we understand as a scientific attitude."*		student participation and does not fully cover all indicators of scientific attitudes.
Difficulty integrating scientific attitudes into planning	*"We usually map out the material, learning objectives, then prepare discussions, experiments, and attitude evaluations, but it's still difficult to fit everything into one coherent plan."*	G3	Teachers have difficulty compiling learning tools that systematically integrate all scientific attitude indicators.
Limited learning time	*"During the learning process, not all steps can be carried out in depth due to limited time and the varying abilities of students."*	G2	Limited time allocation means that several scientific stages cannot be implemented optimally.
Student readiness	*"There are still students who are less active and less careful, so they need guidance and direction slowly."*	G1	Differences in student characteristics and readiness become obstacles in developing scientific attitudes.
Limitations of learning media	*"Using images or videos does help make lessons more interesting and easier to understand, but appropriate media isn't always*	G2	Supporting facilities for scientific learning are still limited so that the variety of learning activities is not optimal.

	available."		
Limitations of learning media	*"We would like to use more media or experimental tools, but the available facilities are still limited."*	G3	Limited facilities limit the implementation of experimental activities and direct observations.

Based on Table 3, the obstacles faced by teachers in instilling scientific attitudes include limited conceptual understanding of scientific attitudes, difficulty integrating them into lesson plans, time constraints, low student readiness, and limited media and learning support facilities. These findings indicate that optimizing the instillation of scientific attitudes requires support not only in terms of teacher competency but also in terms of facilities and learning conditions in madrasas.

Discussion

1. The Emergence of a Scientific Attitude at the Science Learning Planning Stage

The results of the study showed that during the learning planning stage, the most dominant scientific attitude indicators appearing in the teaching modules were critical and open, while honesty achieved the lowest percentage. Meanwhile, indicators of curiosity, thoroughness, and logical thinking emerged at relatively high percentages, although they were not yet optimally integrated across all the teaching modules analyzed.

The predominance of critical and open-mindedness indicators indicates that teachers have attempted to design learning activities that encourage students to express opinions, ask questions, discuss, and appreciate diverse perspectives. This is in line with Sani's (2019) opinion, which states that science learning should provide opportunities for students to think critically and be open to various information obtained through the scientific process. Furthermore, science learning in the Independent Curriculum also emphasizes the development of students' higher-order thinking skills (HOTS) and scientific skills (Permendikbudristek, 2022).

The indicators of curiosity, thoroughness, and logical thinking that

emerged in fairly high categories indicate that most teachers have incorporated scientific activities into their lesson plans, such as observing, identifying problems, and drawing conclusions. According to Hosnan (2014), these three indicators are important foundations in the scientific approach because they help students build knowledge through systematic, evidence-based reasoning.

Conversely, the low percentage of honesty indicators indicates that this aspect has not been explicitly formulated in the learning objectives, activity steps, or assessments contained in the teaching modules. This finding does not mean that teachers neglect instilling honesty, but rather that this indicator has not been systematically documented in the learning materials. However, honesty is a crucial characteristic in science learning because it is related to objectivity in observations, data reporting, and the presentation of experimental results (Sutopo, 2020).

Overall, these findings indicate that science learning planning in Islamic Elementary Schools has been directed towards the implementation of a scientific approach, but the integration of each scientific attitude indicator still requires refinement to ensure balanced and sustainable development. These findings align with those of Oviana (2025) and Putri et al. (2023), which stated that the success of science-based learning is greatly influenced by the quality of the teacher's lesson plans.

2. The emergence of a scientific attitude at the implementation stage of science learning

The research results show that the implementation of scientific attitudes during the science learning process has been quite successful, although the development of each indicator has not shown a balanced level of emergence. Curiosity and openness were the most dominant indicators emerging during the learning process.

These findings indicate that teachers have successfully created a learning environment that encourages students to actively ask questions, engage in discussions, and accept the opinions of others. These activities reflect the implementation of student-centered learning, as emphasized in the Independent Curriculum, which provides space for students to explore knowledge independently (Permendikbudristek, 2022).

On the other hand, critical thinking indicators were in the moderate category, while conscientiousness, honesty, and logical thinking indicators still showed relatively low percentages. This indicates that learning is still more focused on increasing student participation than on developing in-depth scientific thinking skills.

According to Rustaman (2011), developing scientific attitudes cannot be done instantly but requires continuous learning experiences through observing, asking questions, analyzing data, drawing conclusions, and communicating learning outcomes. Therefore, the low occurrence of several indicators indicates that teachers still need more structured learning strategies to optimally develop all dimensions of scientific attitudes.

The findings of this study are also in line with Riswan (2023) who stated that the implementation of scientific attitudes in science learning in elementary schools often does not develop evenly across all indicators because it is influenced by teacher readiness, student characteristics, and limited learning facilities.

3. Teachers' Obstacles and Barriers in Planning and Implementing Science Learning in Applying Scientific Attitudes

Interviews with fifth-grade teachers at three state Islamic elementary schools in Aceh Besar Regency indicate that efforts have been made to implement scientific attitudes in science learning from the planning stage through implementation. However, teachers still face various obstacles that prevent the implementation of scientific attitudes from being optimal.

One of the main obstacles is teachers' limited understanding of the concept of scientific attitudes comprehensively. Some teachers still interpret scientific attitudes as limited to practical activities or discussions aimed at making students more active during learning. However, scientific attitudes are not only related to student activity but also include the process of developing scientific thinking through observing, reasoning, drawing conclusions, and reflecting on learning outcomes. This condition indicates that teachers' understanding is still more oriented towards learning activities than towards developing students' scientific thinking skills in depth. This finding aligns with research by Amelia and Sitorus (2024), which states that teachers still experience difficulties in

understanding the essence of the scientific approach, particularly in systematically integrating scientific attitudes into learning objectives and steps.

This limited understanding impacts teachers' difficulties in integrating scientific attitude indicators into lesson plans. Teachers admitted to having attempted to map out the material, learning objectives, and scientific activities to be implemented, such as discussions and experiments. However, they still experience difficulties in developing a learning flow that connects objectives, activities, and attitude assessments in a structured and continuous manner. As a result, scientific attitude indicators are often only included administratively in teaching modules and have not been fully implemented consistently at each stage of learning. This finding aligns with research by Surul and Septiliana (2023), which revealed that teachers still face obstacles in implementing the scientific approach due to limited experience and a lack of guidance in developing learning materials.

Furthermore, limited learning time and student readiness also hinder the implementation of scientific attitudes. Teachers reported that the available time allocation often does not allow for in-depth implementation of all stages of scientific learning, particularly reflection, analysis, and conclusion-drawing activities. Furthermore, diverse student abilities mean that not all students can actively participate in learning activities. Some students still show a lack of thoroughness in conducting observations and are not yet accustomed to expressing opinions or drawing conclusions independently. This condition indicates that the formation of scientific attitudes requires a continuous process of habituation and cannot be achieved through just one or two learning activities. This finding is supported by research by Shalsabila and Juhri (2024), which states that the implementation of the scientific approach in elementary schools still faces obstacles in the aspects of observation, analysis, and consistent student involvement. This opinion is also reinforced by Hosnan (2014), who emphasized that the success of the scientific approach is greatly influenced by student readiness and the teacher's ability to manage learning.

Another obstacle relates to limited media and learning support strategies. Teachers recognize that using a variety of learning media can help students understand concepts and develop scientific attitudes. However, in practice, the media used is still limited to simple images and videos, so learning activities

involving observation and experimentation cannot be implemented optimally. These limited resources result in less diverse student learning experiences and impact the suboptimal development of several indicators of scientific attitudes. This finding aligns with research by Okrianti and Aufa (2024), which states that limited resources and a variety of learning strategies are among the factors hindering teacher readiness to implement the Independent Curriculum and optimally develop students' scientific attitudes.

Overall, the various obstacles faced by teachers indicate that the implementation of scientific attitudes in science learning is not only influenced by teacher competence in designing and implementing learning, but also by student readiness, time availability, and support for learning facilities and infrastructure. Therefore, efforts are needed to strengthen teacher competence through ongoing training and mentoring, accompanied by school support in providing adequate media and learning resources so that the implementation of scientific attitudes in science learning can take place more optimally.

CONCLUSION

This study shows that fifth-grade teachers at the State Islamic Elementary School in Aceh Besar Regency have attempted to instill scientific attitudes in science learning from the planning stage to the implementation stage. During the planning stage, teachers have integrated various indicators of scientific attitudes, including curiosity, critical thinking, accuracy, honesty, openness, and logical thinking skills, into teaching modules and learning activities. However, the level of occurrence of each indicator varies across schools and has not been systematically formulated.

During the implementation phase, the instillation of scientific attitudes is realized through activities such as observing, asking questions, discussing, and communicating learning outcomes. However, the implementation of each scientific attitude indicator has not developed in a balanced manner and is still influenced by the characteristics of the material, time constraints, student readiness, and the availability of learning media. These findings confirm that the role of teachers plays a crucial role in shaping students' scientific attitudes through focused and sustainable learning planning and implementation.

Based on these findings, efforts are needed to strengthen teacher

competency in integrating scientific attitude indicators more consistently at every stage of science learning. Furthermore, school support through professional development programs, assistance in developing learning materials, and the provision of adequate media and learning resources needs to be continuously improved. Further research is recommended to develop innovative learning models or strategies that are more effective in instilling scientific attitudes in elementary school students.

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