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Developing KALOAS: a local wisdom-based learning model for science and social skills

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ABSTRACT

Purpose: to develop the KALOAS (*kearifan lokal untuk optimalisasi aktivitas sains dan sosial* "local wisdom-based science and social learning") model for IPAS learning in Madrasah Ibtidaiyah, designed to integrate science process skills and social skills through local wisdom-based learning activities.
Method: this study used a qualitative descriptive method, adapted from the first three stages of Gall's et al. R&D model: information gathering, model design, and preliminary product development. The outcome was an initial prototype of the KALOAS learning model for IPAS learning.
Findings: the KALOAS model was developed as a local wisdom-based IPAS learning model consisting of eight instructional stages. The model was designed to integrate science process and social skills through contextual learning activities grounded in local wisdom.
Implications: the KALOAS model provides a contextual learning framework that helps teachers integrate science, social, and local cultural aspects in IPAS learning.
Originality: lies in the development of the KALOAS model, which integrates local wisdom-based learning with science process skills and social skills development in IPAS learning, providing a new framework for contextual and culturally relevant elementary education.

Introduction

The kurikulum merdeka brings various changes to learning in elementary schools and Islamic elementary schools (MI), one of which is through the integration of natural sciences (IPA) and social sciences (IPS) into natural and social sciences (IPAS) (Purba et al., 2023). This integration is designed to help students understand natural and social phenomena holistically through a contextual and meaningful approach. Essentially, IPA and IPS share similar characteristics, namely an emphasis on reasoning processes, scientific thinking, and the development of the ability to understand and solve problems in the surrounding environment (Zakarina et al., 2024). Therefore, IPA learning requires strategies that integrate scientific and social aspects in a balanced manner, enabling optimal achievement of learning objectives.

However, the implementation of science and science learning in elementary schools, including Islamic elementary schools, still faces various challenges. Research by Kharisma et al. (2024); K. Saidah & Damariswara (2024) shows that, although textbooks have been designed in accordance with the demands of the kurikulum merdeka, some teachers still teach science and social studies materials separately in different semesters. This situation indicates a gap between curriculum design and learning practices in the field. Furthermore, teachers still experience various obstacles in implementing the kurikulum merdeka, particularly in science and science learning (Alimuddin, 2023; Nikmah et al., 2023). These problems are influenced by various internal and external factors, such as teachers' limited understanding of the integrative concept of science and of science itself, the lack of appropriate learning models, and low active student participation in teacher-centered learning (Islamiyah et al., 2025; R. A. Saidah et al., 2025).

Conceptually, science learning not only aims to develop conceptual mastery but also to develop 21st-century skills relevant to students' lives. In science, science process skills are essential for students to systematically conduct scientific investigations, including identifying problems, formulating hypotheses, conducting experiments, analyzing data, and drawing conclusions (Aydogdu, 2015). These skills have been shown to improve students' critical thinking (Ginting et al., 2022; Irwanto et al., 2019). However, various studies indicate that students' science process skills remain low, necessitating more context-rich and hands-on learning strategies (Lestari & Diana, 2018; Maisyaroh et al., 2023). The use of experimental methods and practical activities is an effective alternative to improving these skills (Febriana & Hasirin, 2025; Sari et al., 2021).

On the other hand, as a result of integration with social studies, science learning also has the responsibility of developing students' social skills. Social skills are an individual's ability to interact effectively with others, be accepted in social environments, and make a positive contribution to society (Bali, 2017). These skills include the ability to ask questions, obtain information, analyze information, and present information appropriately (Simbolon, 2018). The development of social skills is becoming increasingly important because students need to be prepared to face the increasingly complex and collaborative challenges of life (Daulay, 2025). Therefore, science learning ideally should not only be oriented toward developing science process skills but also strengthen students' social skills simultaneously.

Previous research has examined the implementation of science learning in the kurikulum merdeka, the application of contextual approaches, the use of experimental methods to improve science process skills, and cooperative learning models to develop social skills (Kristin, 2016; Sari et al., 2021; Susanto et al., 2024). Other studies have also highlighted the importance of integrating science and social studies in improving students' scientific and social literacy (Hidayat & Febriana, 2025; Zakarina et al., 2024). However, these studies generally focus on one aspect of the skills, either science process skills or social skills, separately. Furthermore, there is still limited research on developing a science learning model based on local wisdom that simultaneously strengthens students' science process and social skills. In fact, local wisdom has great potential as a learning context that is close to students' lives, thereby increasing the meaningfulness and relevance of learning.

This research offers a novelty by developing the KALOAS learning model, a local wisdom-based science learning model designed to integrate the development of science process and social skills within a single learning series. This model leverages the potential of local culture and wisdom as contextual learning resources, enabling students to conduct scientific activities while interacting and collaborating within their social environment. This research aims to develop a valid, practical, and relevant syntax of the KALOAS learning model for use in science learning in Islamic Elementary Schools. Specifically, this research seeks to develop learning stages that facilitate the integrated development of students' science process and social skills through the utilization of local wisdom.

This research is crucial because the need for a science and natural sciences learning model that aligns with the characteristics of the kurikulum merdeka remains significant. The presence of a learning model capable of integrating scientific, social, and local cultural dimensions is expected to help teachers implement science and natural sciences learning more effectively, contextually, and meaningfully. Furthermore, a learning model grounded in local wisdom has the potential to strengthen students' cultural identity while enhancing their ability to face 21st-century challenges. The expected contributions of this research include theoretical and practical contributions. Theoretically, this research enriches the body of knowledge on developing a science and natural sciences learning model based on local wisdom that integrates science process skills and social skills. In practice, the research results can serve as an operational guide for teachers in implementing more contextual and participatory science and natural sciences learning, as well as a reference for curriculum developers and other researchers in developing culture-based learning innovations in elementary education settings.

Method

This study uses a qualitative descriptive approach to develop an initial design for a local wisdom-based science and science learning model, oriented toward developing science process and social skills for phase B students at an Islamic elementary school (MI). The qualitative approach was chosen because this study focuses on the process of developing the learning model through theoretical studies, needs analysis, and the formulation of learning syntax relevant to student characteristics and the demands of the kurikulum merdeka.

This research is the initial phase of research and development (R&D) and adapts the development model of Gall et al. (2010). Of the ten stages proposed by Gall et al. (2010), this research only carried out three initial stages, namely: (1) information collection (research and information collecting), (2) planning and designing the model (planning), and (3) developing the initial product (developing a preliminary form of product). These three stages were chosen because the research objective was to develop the initial syntax of the learning model, which would serve as the basis for validation and trial stages in subsequent research.

The first stage, information gathering, was conducted through a comprehensive literature review of relevant scientific sources, including journal articles, books, kurikulum merdeka policy documents, and previous research on science and science learning, science process skills, social skills, and local wisdom-based learning. The literature analysis was conducted to identify the characteristics of science and science learning, the needs of phase B students, indicators of science process skills and social skills, and the potential for integrating local wisdom into learning. The results of this stage served as a conceptual basis for designing the developed learning model.

The second stage is designing the learning model. At this stage, the model's conceptual framework is developed based on the results of the needs analysis and theoretical studies. The design process includes determining the model's philosophical and theoretical foundations, identifying learning objectives, defining model components, and developing a learning syntax flow that integrates scientific and social activities grounded in local wisdom. The model design also considers the characteristics of science and science learning in the kurikulum merdeka, which emphasizes contextual, participatory, and student-centered learning.

The third stage is the development of the initial product, namely the preparation of an initial prototype of the learning model named KALOAS. The initial product produced is a learning model syntax that includes learning stages, teacher and student activities, and the integration of science process skills and social skills indicators at each learning phase. The developed syntax is designed to facilitate students in conducting scientific investigations, constructing knowledge based on local phenomena, and interacting and collaborating within their social environment.

The research data consists of conceptual data obtained from the results of literature and document analysis. Data analysis was conducted descriptively and qualitatively through data reduction, data presentation, and conclusion drawing. The results of the analysis were used to define the characteristics of the learning model, determine the relationship between the model's syntax and indicators of science process skills and social skills, and compile an initial design for the KALOAS learning model as a development product. The main output of this research is the initial syntax of the KALOAS learning model, namely, a local wisdom-based science and science learning model designed to integrate the development of science process skills and social skills of phase B students. This initial product can then serve as the basis for expert validation, practicality testing, and effectiveness testing in subsequent development research.

Results and discussion

This research resulted in an initial design for a local wisdom-based science and education learning model called KALOAS. The model was developed through three stages of research and development adapted from Gall et al. (2010), namely: (1) information gathering, (2) model design, and (3) initial model development. The results of each stage are explained as follows.

Information gathering

The information-gathering stage was conducted through literature reviews and a review of previous research on science learning, the kurikulum merdeka, science process skills, social skills, and local wisdom-based learning. The study results indicate that implementing the kurikulum merdeka has encouraged the integration of science and social studies in science subjects. Research by Widiarini et al. (2024) shows that science learning in the kurikulum merdeka has strengthened the Pancasila Student Profile dimension through project-based learning. Furthermore, Sugih et al., (2023) found that science learning in elementary schools has been implemented in an integrated manner, including through an assessment system that combines science and social studies.

However, several studies have shown that implementing science and science learning still face various obstacles. Parisu & Sisi (2025) found that some teachers still teach science and social studies separately even though the curriculum has integrated the two. Research by Alimuddin (2023) also showed that teachers still experience difficulties in understanding and implementing the kurikulum merdeka effectively. In addition to empirical studies, this stage also includes a theoretical analysis of various concepts that form the basis for model development, including the characteristics of elementary school/Islamic elementary school students, science learning, science process skills, social skills, the contextual teaching and learning (CTL) approach, constructivism, and the concept of local wisdom. The results of these studies served as a conceptual basis for designing the KALOAS learning model.

Model design

Based on the results of the literature study and needs analysis, the initial design of the KALOAS learning model was prepared as a local wisdom-based science learning model oriented towards the development of science process skills and social skills (Figure 1). The KALOAS model was developed through four main components, namely: (1) model components, (2) model content, (3) model targets, and (4) learning outcomes. The model components include theoretical foundations, prior research results, and local wisdom used as the learning context. The theoretical foundations include constructivism theory, the CTL approach, the characteristics of elementary school students, and theories of science process skills and social skills.

The local wisdom used as the learning context is ecoprint crafts, which utilize the diversity of plants in the surrounding environment as a resource for learning. The selection of ecoprint was based on its relevance to plant science and related materials, and on its closeness to the lives of the local community. The designed model consists of a learning model chart and learning support tools, including teaching modules, student worksheets, and evaluation instruments. The target of model development is to produce a valid, practical, and effective learning model to support science and science learning. The model's focus is on improving students' science process and social skills.

Figure 1 illustrates the framework for developing a local wisdom-based science and natural sciences learning model for elementary school students. Model development begins with a study of local wisdom, learning theory, and initial research, which serve as the philosophical foundation of constructivism and the contextual teaching and learning (CTL) approach, adapted to the characteristics of elementary school students. These components are integrated into a local wisdom-based science and natural sciences learning model consisting of learning syntax, social systems, reaction principles, instructional and accompanying impacts (DI & DP), and a support system. Model implementation is supported by learning tools such as blueprints, worksheets, and assessments. The learning process is carried out through eight stages: environmental exploration, hypothesis formulation, investigation, data analysis, presentation, conclusion drawing, reflection, and follow-up. This model aims to produce valid, practical, and effective learning aligned with the curriculum, while simultaneously improving students' science process and social skills through the use of local wisdom as a learning resource.

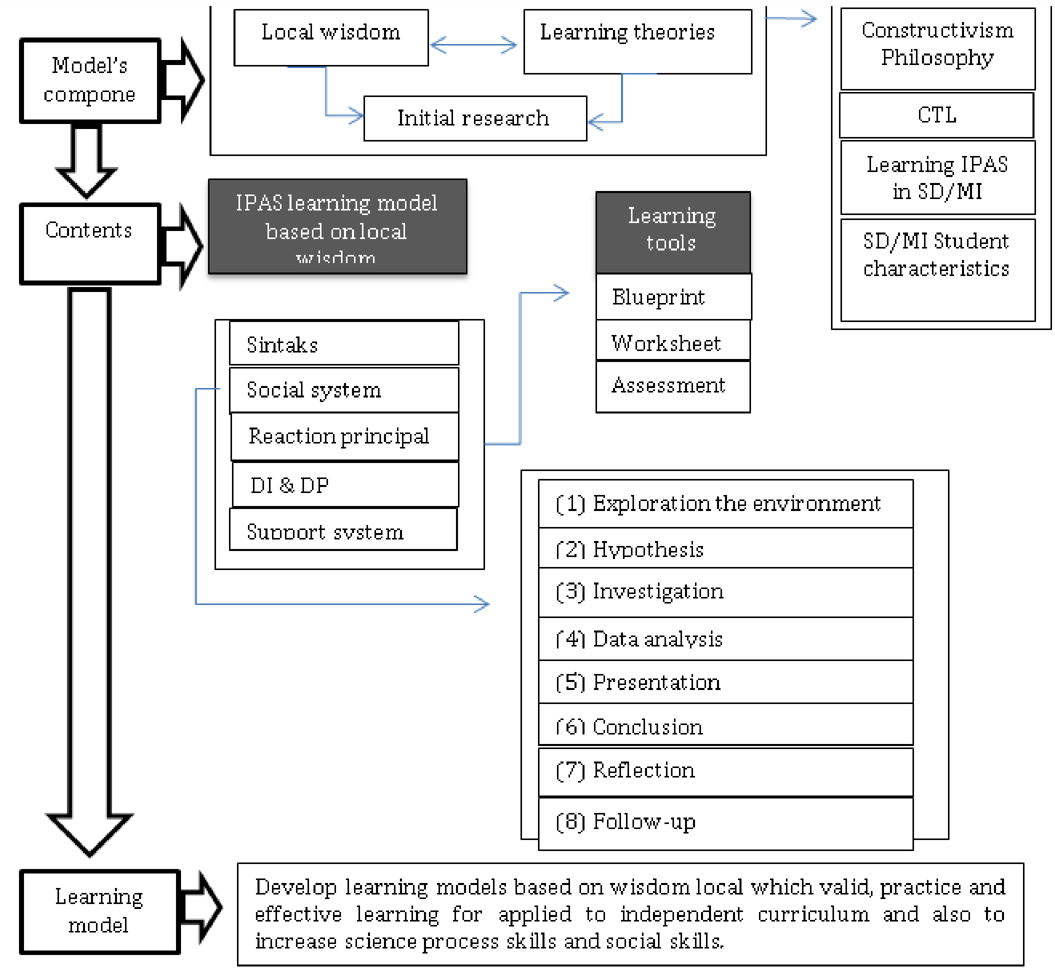

Figure 1 science-based learning model, local wisdom beginning
Source: secondary data, processed

Initial model development

This stage produced an initial prototype of the KALOAS learning model along with its supporting learning tools. The KALOAS model was designed as a science learning model that utilizes local wisdom as a learning context to connect scientific and social concepts with students' real lives. Model development focused on plant material: the source of life on earth, by utilizing ecoprint activities as contextual activities. In this context, students are expected to conduct scientific investigations while developing their abilities to interact, collaborate, and communicate. The KALOAS model was developed based on the learning model components proposed by Joyce et al., which include syntax, social systems, reaction principles, support systems, instructional impacts, and accompanying impacts. The development results show that the KALOAS model has the main characteristic of integrating environmental exploration activities, scientific investigations, and social interactions grounded in local wisdom.

Syntax of the KALOAS learning model

The main result of this study is the syntax of the KALOAS learning model, which consists of eight learning stages: environmental exploration; hypothesis determination; investigation; data analysis; presentation; conclusion drawing; reflection; and follow-up. This syntax is designed to facilitate active student involvement in the learning process, from observing phenomena and formulating tentative assumptions to collecting and analyzing data, and delivering learning results and reflection. For more details on the syntax, see Table 1.

Table 1 syntax of the KALOAS learning model and learning activities

Nu.	Syntax	Teacher activities	Student activities
1	The exploration environment around	Give a question to the student	Answer the teacher's questions
2	Determination hypothesis	Invite the child to determine the hypothesis	Determine the answer temporarily
3	Investigation	Accompanying and supervising student do investigation	Do investigation
4	Data analysis	Monitoring students to analyze data	Analyzing data
5	Presentation	Accompanying students	Presenting the results of the investigation
6	Conclusion	Accompanying students determine the conclusion	Determine conclusion
7	Reflection	Guiding discussion related to materials and investigations that have been done	Do discussion
8	Follow up	Invite the child to explore more in related materials and implementation in life	Do more exploration in related materials and implementation in life

Source: secondary data, processed

Based on Table 1, the KALOAS learning model is implemented through eight stages that position students as active subjects in the learning process, while the teacher acts as a facilitator and guide. Learning begins with exploring the surrounding environment, guided by the teacher's provocative questions to build students' prior knowledge. Next, students are guided to formulate hypotheses or temporary answers to observed problems. During the investigation stage, students conduct direct investigations under the teacher's guidance and supervision. Students then analyze the data to identify relevant patterns and relationships. The results of this analysis are presented to classmates, fostering knowledge sharing and learning. Afterward, students draw conclusions based on the investigation results under teacher guidance. The reflection stage is carried out through discussions about the material and the learning process implemented to strengthen students' understanding. Finally, in the follow-up stage, students are encouraged to conduct further exploration and apply the knowledge gained in everyday life. These results indicate that the KALOAS model is designed to develop scientific, problem-solving, and social skills and to foster the ability to relate learning to real-world contexts through student-centered activities.

The relationship between syntax and science process skills

The mapping results show that all stages of the KALOAS syntax accommodate indicators of science process skills. Indicators integrated into the model include the ability to observe, classify, predict, formulate hypotheses, communicate results, use spatial and temporal relationships, conduct measurements, and draw conclusions. Science process skills are developed gradually through exploration, investigation, data analysis, presentation, reflection, and follow-up activities, providing students with the opportunity to experience the scientific process as a whole. For more details on the syntax, see Table 2.

Table 2 relationship step activities and achievements aspect science process skills

Nu.	Syntax	Indicator science process skills
1	Exploration environment around	Observe, use connection space / time
2	Determination hypothesis	compile hypothesis, predict
3	Investigation	Observe, classify, do communication
4	Data analysis	Measuring, communicating, classifying
5	Presentation	Communicating
6	Determination conclusion	Conclude
7	Reflection	Communicating, using connection space / time
8	Action carry on	Communicating, using connection space / time

Source: secondary data, processed

Based on Table 2, each stage in the KALOAS learning model is related to the development of students' science process skills. In the environmental exploration stage, students are trained to observe phenomena and understand spatial and temporal relationships based on the objects observed. The hypothesis determination stage develops students' ability to formulate tentative assumptions and predict possible outcomes. Next, in the investigation stage, students make observations, classify data, and communicate their findings. In the data analysis stage, skills in measuring, grouping, and communicating information are further strengthened as data are processed. The presentation stage specifically focuses on scientific communication skills, namely, systematically conveying the results of the investigation to others. In the conclusion-drawing stage, students develop the ability to draw conclusions based on the evidence and data obtained. Meanwhile, the reflection and follow-up stage again emphasizes communication skills and the ability to understand spatial and temporal relationships by linking learning outcomes to real-life experiences and situations. Overall, the results in Table 2 show that the syntax of the KALOAS model is designed to integrate various indicators of science process skills, such as observing, predicting, classifying, measuring, communicating, and concluding, thereby supporting the gradual and continuous development of students' scientific abilities.

The relationship between syntax and social skills

In addition to focusing on science process skills, the KALOAS model is also designed to facilitate the development of students' social skills. Mapping results indicate that each stage of syntax includes social skill indicators, including asking questions, obtaining information, analyzing information, and presenting information. Social skill development primarily occurs through group discussions, joint investigations, presentations, reflections, and follow-up activities. Thus, the KALOAS model not only develops students' academic abilities but also their ability to interact and collaborate in social contexts.

Table 3 activity steps and indicators social skills

Nu.	Syntax	Indicators social skills
1	Exploration environment around	Skills ask
2	Determination hypothesis	Skills analyze
3	Investigation	Skills get information, skills analyze
4	Data analysis	Skills serve information
5	Presentation	Skills serve information
6	Determination conclusion	Skills analyze
7	Reflection	Skills analyze
8	Action carry on	Skills analyze

Source: secondary data, processed

Based on Table 3, each stage of the KALOAS learning model contributes to the development of students' social skills through activities that encourage interaction, communication, and critical thinking. In the environmental exploration stage, students are trained to develop questioning skills as a form of curiosity about observed phenomena. The hypothesis-building stage emphasizes analytical skills, where students process initial information to formulate tentative assumptions. Next, in the investigation stage, students develop skills in gathering information and analyzing the collected data. In the data analysis and presentation stage, students are trained to present information systematically and communicatively to peers and teachers. The conclusion-building, reflection, and follow-up stages further strengthen analytical skills by interpreting learning outcomes, evaluating learning experiences, and connecting acquired knowledge to everyday life situations. Overall, the results in Table 3 indicate that the KALOAS model is not only oriented toward mastery of concepts but also designed to develop students' social skills, particularly the ability to ask questions, seek information, analyze, and present information effectively during the learning process. Overall, this study produced an initial prototype of the KALOAS learning model, along with a learning syntax designed to integrate science process and social skills through the utilization of local wisdom in science learning.

Discussion

The development of the KALOAS learning model demonstrates that local wisdom can serve as a bridge connecting the scientific and social dimensions in science learning. This finding reinforces the view that science learning alone is insufficient to integrate science and social studies content administratively; it must provide learning experiences that enable students to understand the relationship between natural phenomena and social life as a whole. The use of local wisdom as a learning context offers students opportunities to learn scientific concepts through the realities of everyday life. Thus, the learning process becomes more meaningful because students not only learn concepts abstractly, but also understand their relevance in the social and cultural environment in which they live.

The ecoprint context used in the KALOAS model provides a concrete example of how science learning can be developed contextually. Activities such as identifying plant species, observing leaf characteristics, understanding plant functions, and using plants as craft materials encourage students to connect scientific knowledge with social practices. This finding aligns with the contextual teaching and learning (CTL) approach, which emphasizes that knowledge is more easily understood when linked to students' real-life experiences (Susanto et al., 2024). Learning that starts from a local context also allows students to build knowledge from direct experience, as constructivist theory explains: knowledge is actively constructed through interactions between individuals and their environment.

The KALOAS syntax, which begins with environmental exploration, demonstrates the importance of the observation process as a foundation for science learning. This stage not only serves as an apperception activity but also as a means to foster students' curiosity about the phenomena around them. From a science-learning perspective, curiosity is the starting point for developing scientific skills because it encourages students to ask questions, identify problems, and seek explanations grounded in empirical evidence. Therefore, the environmental exploration stage in the KALOAS model provides students with space to develop systematic observation skills before entering more complex investigation stages.

The findings of this study also indicate that the syntax of the KALOAS model is designed to accommodate all indicators of science process skills. This is important, as science process skills are among the key competencies students must possess in 21st-century learning. According to Aydogdu (2015), science process skills are not only related to the ability to conduct experiments, but also include the ability to formulate problems, formulate hypotheses, identify variables, analyze data, and draw conclusions. These skills are integral to the scientific thinking process. The integration of science process skill indicators in each stage of learning allows students to experience the complete investigation process, so that learning does not stop at mastering concepts alone. These findings support the research of Irwanto et al. (2019); Ginting et al. (2022), which showed that science process skills are closely related to students' critical thinking skills. When students are allowed to collect data, compare information, test hypotheses, and conclude investigations, they are indirectly trained to think logically and evidence-based. Therefore, the KALOAS model has the potential to be a learning alternative that not only improves understanding of science concepts but also supports the development of higher-order thinking skills.

In addition to focusing on science process skills, the KALOAS model is also designed to strengthen students' social skills. This aspect is important because the characteristics of science as an integrative subject emphasize not only understanding natural phenomena but also the ability to understand and interact in social life. Group investigation activities, discussions, presentations, reflections, and follow-up contained in the KALOAS model provide opportunities for students to interact actively with their peers. Through these activities, students learn to ask questions, obtain information, analyze information, and convey ideas effectively. This finding aligns with Bali's (2017) view, which states that social skills develop through social interactions that provide opportunities for individuals to participate actively in a group environment.

The development of social skills in the KALOAS model is also supported by the collaborative-learning characteristics that emerge at several stages of syntax. Learning through group work helps students learn to respect others' opinions, communicate effectively, and solve problems together. These results reinforce Kristin's (2016) findings, which showed that a cooperative approach can increase student engagement in social learning. In the context of science learning, the ability to work together becomes increasingly important because the various problems studied often require analysis from various perspectives, both scientific and social.

One of the important contributions of the KALOAS model is its ability to integrate science process skills and social skills into a single, cohesive learning design. Most previous research tends to develop these two skills separately. Research focused on science learning generally emphasizes improving science process skills through experiments and investigations (Febriana & Hasirin, 2025; Sari et al., 2021), while research in social studies focuses more on developing social skills through collaborative activities and discussions (Aulia & Pebriani, 2023). The KALOAS model offers a different approach by integrating these two skills into a series of mutually supportive learning activities. This integration aligns with the nature of science learning, which combines both scientific and social dimensions simultaneously.

Another novelty of the KALOAS model lies in its use of local wisdom as the primary basis for learning development. Previous research has highlighted the importance of contextual learning and the integration of local values in primary education. However, limited research has specifically developed a science and science learning model that simultaneously connects local wisdom with the strengthening of science process skills and social skills. In this context, the KALOAS model serves not only as a means of learning science concepts but also as a medium for preserving local culture and strengthening student identity. By utilizing local potential within the community, students gain a more authentic learning experience while simultaneously developing an appreciation for their regional culture.

Overall, the results of the KALOAS model development indicate that local wisdom-based science and education learning have the potential to address various challenges in implementing the kurikulum merder, particularly in creating integrative, contextual, and student-centered learning. This model not only provides an operational framework for teachers to implement science and education but also offers an approach that can develop science process and social skills in a balanced manner. Thus, the KALOAS model has the potential to become an alternative, relevant learning innovation to support the achievement of science and education learning objectives in Islamic elementary schools.

Conclusions

This research successfully developed an initial prototype of the KALOAS learning model, a local wisdom-based science learning model designed to integrate the development of science process and social skills for phase B students in Madrasah Ibtidaiyah. The KALOAS model was developed through three initial stages of research and development by Gall et al. namely information gathering, model design, and initial product development. The results showed that the KALOAS model has eight learning syntaxes, namely environmental exploration, hypothesis determination, investigation, data analysis, presentation, conclusion drawing, reflection, and follow-up. The syntax was designed based on the foundation of constructivism, the contextual teaching and learning (CTL) approach, the characteristics of science learning, and the use of local wisdom in the form of ecoprint as a learning context. Conceptually, this model has accommodated indicators of science process skills and social skills, which are the main objectives of science learning.

The implications of this research indicate that local wisdom has the potential to serve as a relevant learning context to support the implementation of more contextually relevant, integrative, and meaningful science and science learning. The KALOAS model can be an alternative learning framework that helps teachers connect science and social concepts to students' real lives while strengthening local cultural identity. However, this research still has limitations because it only reached the initial model development stage and did not include expert validation, practicality testing, or testing the model's effectiveness in real learning situations. Furthermore, the model development was still focused on a single science and a single form of local wisdom, so its scope of application remains limited.

Given these limitations, further research should continue through validation by experts, limited trials, and field tests to assess the validity, practicality, and effectiveness of the KALOAS model. Further research is also needed to develop the model's application to various scientific disciplines and materials, as well as to various forms of local wisdom across different regions, to obtain a more adaptive model with broader utility. In addition, experimental research can be conducted to test the effect of the KALOAS model on improving science process skills, social skills, and other competencies relevant to the demands of 21st-century learning.

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