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Implementation of Local Potential-Based Science Learning at Krakal 1 Public Elementary School, Alian, Kebumen

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Abstract: This study aims to analyze the implementation of local potential-based science learning at Krakal 1 Public Elementary School using a phenomenological qualitative approach. Data collection techniques include interviews, observation, and documentation, which are then analyzed using the Miles, Huberman, and Saldana model, including data condensation, data presentation, and data verification. Science education based on local potential utilizes both natural resources (SDA) and human resources (SDM) available around the school. The results of the study show that the integration of local potential, such as agriculture and the tofu industry, makes learning more contextual and meaningful. Despite challenges in the form of time and cost constraints, the utilization of local potential has an impact on increasing student enthusiasm, collaboration, communication, activity, and critical thinking skills. Therefore, science learning based on local potential needs to be developed to provide a learning experience that is relevant and applicable in the community.

Keywords: Science Education, Local Potential, Elementary School.

Introduction

The Merdeka Curriculum is a curriculum developed in Indonesia in 2020 by the Ministry of Education and Culture (Kemendikbud). The aim of this curriculum is to give schools the freedom to design curricula according to local needs and characteristics, thereby contributing to improving the quality of education and producing higher-quality graduates (Fatimah, 2024). Schools can also incorporate elements of local culture, regional languages, and local wisdom into their curriculum.

Learning is a process of interaction between teachers and students in a learning environment. Science learning in elementary school is the foundation for building knowledge, skills, and scientific attitudes in students, which not only covers facts, concepts, and principles, but also emphasizes the process of systematic exploration of nature and developing scientific attitudes through experience (Mardiana, 2018).

The learning objectives of science according to the independent curriculum are for students to develop themselves in accordance with the Pancasila student profile, as well as:

1) To be able to develop curiosity to study natural phenomena around them
2) To be able to play an active role in maintaining, preserving, and conserving the natural environment, and managing natural resources and the environment wisely
3) Develop inquiry process skills to identify, formulate, and solve problems through concrete actions.
4) Understand the necessary requirements so that students can contribute to solving problems related to themselves and their environment.
5) Develop knowledge and understanding of science concepts and apply them in everyday life

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Science learning requires a more contextual learning environment that is appropriate to their surroundings. The use of contextual learning with an approach based on the students' surroundings is considered effective in improving student learning outcomes in science (Johannes, 2023). Learning through the environment can make it easier for students to understand the material (Fitri April Yanti et al., 2022). Contextual learning emphasizes higher-order thinking (Bustami et al., 2018), cross-disciplinary knowledge transfer, and information processing from various sources. Contextual learning assumes that the human mind will naturally seek meaning in accordance with the real circumstances around it through logical and useful connections (Khaerani, 2020).

Contextual learning helps relate the material to the students' situation (Kusmiyati, 2009; Primayana et al., 2019), thereby creating real and meaningful learning. This learning encourages students to apply their knowledge in their lives. Independently, students explore knowledge to discover social values. One form of contextual learning in science is learning based on local potential.

Science education has a strong connection with local culture or potential (Fatimah, 2023). Science is a subject that studies the universe and is related to everyday life (Hasanah et al., 2016). Government Regulation No. 19 of 2005 concerning National Education Standards in Article 17 (1) explains that the education unit level curriculum is developed in accordance with local potential in the region/characteristics of the region, the socio culture of the local community, and students. This allows teachers to utilize the local potential that exists in the students' environment.

Ministry of Education and Culture Regulation No. 79 of 2014 concerning local content in the 2013 curriculum, Article 1 paragraph (1) states that local potential/local content is study material or subjects in educational units that contain content and learning processes about local potential and uniqueness. Local potential is the wealth of a region that can be used as teaching material in learning (Destiara, 2020). Local potential includes the wealth possessed by a region, including natural resources, human resources, geographical conditions, culture, and historical aspects. This potential can take the form of community activities or industrial sectors that thrive in the region, and can be utilized to support and enrich the learning process (Anisa, 2017).

Krakal is a village in the Alian subdistrict, Kebumen regency, Central Java, Indonesia. The village covers an area of 663 hectares and is inhabited by 8,099 residents as of 2023, spread across 8 hamlets. Geographically, Krakal Village is located at 109°42'12.38 LS 7°36'47.26 BT. The village is located northeast of the Kebumen Regency administrative center and is the northernmost village in the Alian subdistrict. The village is famous for its local specialty, Krakal tofu. Krakal tofu is produced by the local villagers using a very natural process. Krakal Tofu is a type of Sumedang tofu but is more porous/hollow and has a slightly saltier, savory taste and is not as hollow as usual. This local potential can be used as material for science lessons in elementary schools.

In addition, Krakal village also has local potential in agriculture, with most of the population working as rice and secondary crop farmers. This activity can be a source of science learning about ecosystems, food chains, and the life cycle of living things. By observing the interactions between plants, soil, and water, students can learn about the reciprocal relationships in ecosystems.

Studies on science learning based on local potential have been widely reviewed. Research Reka Nurjannah et al states that learning that integrates local potential as a medium and source of learning enables students to understand the material more easily, increases their motivation, and provides support in achieving contextual learning objectives (Reka Nurjanah et al., 2024). Research Suryanda, states that science learning does not only focus on mastering facts and concepts, but also emphasizes the process of discovery and understanding of oneself and the surrounding environment (Suryanda et al., 2021). However, not much research has been done on science learning based on local potential, especially in elementary schools. Elementary school children are closer to their environment, so it would be more relevant to integrate learning with the local potential around students.

Based on the results of interviews conducted by researchers on Saturday, September 27, 2025, with fourth-grade teacher Mrs. Rigiarti S.Pd., she stated that *"Learning by linking local potential around students can increase student enthusiasm, make material easier to understand, help students become more familiar with their environment, and foster their critical thinking skills."* (Rigiarti, September 27, 2025).

Based on the background description above, this study aims to analyze the implementation of local potential-based science learning in elementary schools, the challenges faced and how to overcome them, as well as the impact of implementing local potential-based science learning. Local potential-based science learning needs to be developed in order to provide learning experiences that are relevant and applicable in the community. This study is expected to serve as a reference in efforts to create more contextual and meaningful learning.

Materials And Methods

This study uses a phenomenological qualitative approach. According to (Nasir et al., 2023), phenomenology is a scientific study that examines and investigates an event experienced by an individual or a group of individuals. This type of research aims to describe the awareness and experiences of individuals regarding a particular phenomenon (Ngonde, 2024), making it highly relevant for exploring the perceptions and actual practices of educators in the field. This approach was chosen because the researcher wanted to know how teachers at SDN 1 Krakal implemented science education based on local potential. This research was conducted at State Elementary School 1 Krakal, Alian, Kebumen on Saturday, September 27, 2025. This location was chosen because the school has implemented science learning based on local potential, namely the Krakal tofu industry and agricultural land.

The informant in this study was a fourth-grade teacher, Mrs. Rigiarti, S.Pd (36 years old), who had been teaching at the school for 13 years. The informant was selected using purposive sampling, which is the selection of individuals who are considered to have the best understanding of the phenomenon being studied (Miles et al., 2020). Data collection techniques included in-depth interviews, observation, and documentation. Structured interviews were conducted with the informant to determine the strategies, obstacles, and impacts of implementing science learning based on local potential. Data analysis used the Miles, Huberman, and Saldana model, which included data condensation, data presentation, and data verification (Figure 1).

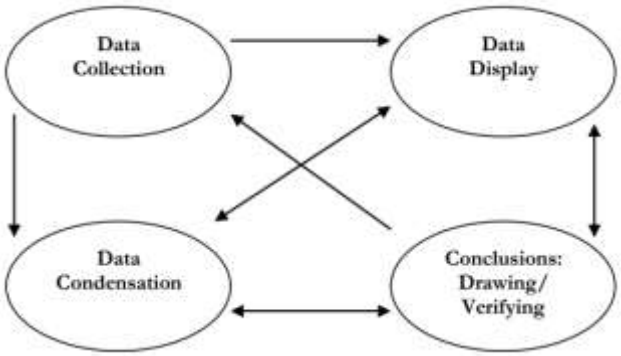

Figure 1. *Qualitative data analysis procedure chart based on the Miles, Huberman, and Saldana model.*

Data condensation is carried out by selecting, focusing, simplifying, abstracting, and transforming field notes, interview transcripts, documents, and other empirical materials (findings) to strengthen the data. The term data condensation means compressing data while still maintaining the possibility of data correlations that appear insignificant but can complement more detailed information (Fajri et al., 2023). The next stage is to present the data in the form of images, direct quotes, and descriptions so that the meaning of the research data can be understood. The final step is data verification or drawing conclusions. The existing data is then summarized based on the research objectives, and overall conclusions are drawn. To ensure data credibility, researchers employ various methods, such as conducting intensive field observations, triangulating data, and providing adequate references (Khusniati et al., 2023).

Results And Discussion

Implementation of Science Education Based on Local Potential

Based on the interview results, SDN 1 Krakal has implemented local potential-based science learning by utilizing natural and human resources in the school's surrounding environment. Fourth-grade teacher, Mrs. Rigiarti, explained that *"Science learning by linking local potential around the school can make learning more meaningful and contextual to the students' environment"* (Rigiarti, September 27, 2025). (Figure 2)

Figure 2. *Interview process with teachers at Krakal Elementary School 1*

In practice, students visit the Krakal Tofu factory to observe the tofu-making process (Figure 3).

Figure 3. *Students observe the process of making tofu.*

Based on the observations, students also assisted in the process of making Krakal tofu at the visit location. This activity provided students with concrete experience and made it easier for them to apply their knowledge in the community (Figure 4).

Figure 4. *Students assist in the process of making tofu.*

In addition to visiting the tofu factory, another example of utilizing local potential that has been implemented at SDN 1 Krakal is utilizing the agricultural environment. Mrs. Rigiarti said:

"I utilize the agricultural environment around my school to study ecosystems and food chains. I invite my students to observe living things such as rice plants, insects, frogs, and snakes, as well as non-living factors such as water, soil, and sunlight. Through these activities, they can see firsthand the interactions between the components of the ecosystem" (Rigiarti, September 27, 2025).

During the learning process, teachers provide stimuli in the form of questions to students to stimulate their critical thinking skills regarding ecosystem balance. Teachers ask students to imagine what would happen if one component of the rice field ecosystem were reduced or lost. Students can understand the importance of each component of the ecosystem.

The development of local potential in science learning is carried out by identifying potential that is relevant to science material, linking it to the concepts being studied, and designing innovative learning activities so that students are more active and understand the meaning of learning. Through collaboration with various parties, contextual learning can still be implemented, for example by inviting community leaders or local business

people to schools to share their knowledge and experiences, so that students continue to receive meaningful learning without having to make direct visits to locations.

Challenges in Science Education Based on Local Potential

Science education based on local potential faces several major challenges, namely limited time for field trips. As stated by Mrs. Rigiarti, S.Pd., *"Local potential-based learning requires careful time planning because it involves observation and hands-on activities in the community"* (Rigiarti, September 27, 2025). The busy lesson schedule often makes it difficult for teachers to synchronize time with location.

In addition, cost is also a significant obstacle. Ms. Rigiarti explained that

"Activities such as visits to tofu production sites or observations of agricultural land are indeed very interesting for students, but they require additional costs for transportation and learning equipment, which are not insignificant. Coordination with the principal and parents is also necessary to ensure that activities can run without burdening students" (Rigiarti, September 27, 2025).

This shows that even though this learning method has great benefits, support and collaboration from various parties is very much needed.

Another factor that needs to be considered is the safety of students during activities outside the classroom. Ms. Rigiarti emphasized that teachers must ensure that learning activities are safe and focused. She said:

"Before learning activities are carried out, I always give instructions to students about what to do, what they can and cannot do at the location, so that they remain safe and focused on learning" (Rigiarti, September 27, 2025).

This statement emphasizes that teachers are not only facilitators in learning, but also supervisors and mentors who ensure that learning activities run optimally.

To overcome these obstacles, Ms. Rigiarti sometimes changes the field trip method to project-based learning.

"Field trips are indeed very beneficial in learning, but if there is insufficient time, I usually allocate farm visits to the school garden, or I can change the learning model to project-based learning in the classroom, such as ecosystem dioramas." (Rigiarti, September 27, 2025).

By allocating these activities, the learning process remains effective and efficient (Figure 5).

Figure 5. *Learning activity: creating an ecosystem diorama project.*

The Impact of Science Education Based on Local Potential

The implementation of local potential-based learning at SDN 1 Krakal, Alian, Kebumen has proven to have a positive impact on students' enthusiasm and critical thinking skills. As stated by Mrs. Rigiarti, S.Pd., *"Local potential-based learning provides students with a more realistic and enjoyable learning experience"* (Rigiarti, September 27, 2025). By highlighting the potential of the surrounding environment, such as agricultural products, natural ecosystems, and the Krakal Tofu industry, learning becomes more contextual and meaningful. Students learn not only from textbooks, but also by seeing, touching, and directly experiencing processes related to their daily lives.

Furthermore, Mrs. Rigiarti, S.Pd. said that *"Through educational activities based on local potential, students become more active and critical"* (Rigiarti, September 27, 2025). When students observe the tofu production process at a factory or study plant growth on farmland, they learn to ask questions, explore cause-and-effect relationships, and draw conclusions from the phenomena they observe.

Ms. Rigiarti, S.Pd., added, *"Learning that utilizes local potential can develop students' problem-solving skills"* (Rigiarti, September 27, 2025). Through real-world learning activities, students learn to find

solutions to environmental issues in their surroundings, such as managing tofu waste to prevent environmental pollution or maintaining ecosystem balance on farmland. Students not only understand science concepts theoretically but also apply them meaningfully and sustainably in their daily lives.

Discussion

Implementation of Science Education Based on Local Potential

The results of interviews with fourth grade teachers, Mrs. Rigiarti, show that SDN 1 Krakal has implemented science learning based on local potential by utilizing natural resources and human resources in the school environment. These efforts are considered capable of increasing the relevance of teaching materials to the real lives of students. Local potential, such as culture, natural resources, and other local wisdom, offers a concrete context for students to understand scientific concepts (Wilujeng et al., 2024).

The implementation took the form of a visit to the Krakal Tofu factory and the utilization of the agricultural environment around the school. During the visit, students observed the process of making Krakal Tofu and helped with the production process. This activity provided students with direct experience to understand scientific concepts such as changes in the form of objects, heat energy, and their relationship with everyday life. This activity supports students in the problem-solving process that is built through real and reflective experiences (Davidsson & Enochson, 2021).

In addition, utilizing the agricultural environment is also effective for understanding scientific concepts in everyday life. Students can learn about ecosystems and food chains firsthand. They are asked to observe living things such as rice plants, insects, frogs, and snakes, as well as abiotic factors such as water, soil, and sunlight. Through these observations, they can understand the interactions between ecosystem components and the importance of maintaining environmental balance. Local potential-based learning not only strengthens the understanding of scientific concepts but also raises awareness of the importance of preserving local potential in the surrounding environment (Azizi, 2022).

This is in line with research Lestari and Rahmita, which states that utilizing local potential can teach science concepts such as ecosystems and other materials (Lestari & Rahmita, 2025). Research Widiarini et al, also states that the implementation of local potential in science learning can strengthen students' understanding of science concepts through relevant contexts, instill values of environmental awareness, shape critical and creative thinking skills through observation and exploration, and help make science learning more meaningful (Widiarini et al., 2025).

The development of local potential is not only through field activities, but can also be done through collaboration with community leaders and local business actors who become resource persons in classroom activities. This strategy allows contextual learning to continue without conducting field visits. (Nurvitasari et al., 2025) states that learning media and interactive, contextual, and local potential-based activities can increase students' understanding and motivation to learn. In addition, the use of teaching materials based on local potential is also important. The use of teaching materials related to local potential can increase learning interest, strengthen understanding, and foster a love for the surrounding environment (Kholifahrini et al., 2019).

According to the results of an interview with Mrs. Rigiarti, local potential can be developed in the following ways:

1. Identify local potential.
   Identify local potential around the school, such as the Krakal tofu factory and agricultural environment, which can be used as learning resources.
2. Link local potential to science material.
   Once local potential has been identified, the next step is to link it to the science material that must be taught in class.
3. Designing innovative activities.
   Teachers must design innovative learning activities so that local potential can be utilized to the fullest.

The utilization of local school resources as media requires consideration of the following: learning objectives, support for lesson content, ease of obtaining media, teachers' skills in using media, and suitability for students' level of thinking (Widowati, 2012). The integration of local potential must be tailored to needs, beginning with an analysis of basic science competencies to determine the form of local potential that is appropriate to the concepts being studied (Parmin, 2015).

Challenges in Science Education Based on Local Potential

Science education based on local potential provides students with the opportunity to become more familiar with their environment, so that scientific concepts that were initially abstract become more contextual to their environment. Although effective, the implementation of local potential has a number of challenges. Time constraints are one of the obstacles in exploring and linking local potential to learning (Lestari, 2025). Observation and field trip activities require careful planning. This is in line with (Holmes et al., 2021) who state that field-based learning has significant constraints related to time limitations. Learning that involves field trips requires a long time to ensure that students have the relevant basic knowledge before leaving the classroom.

Research Khasanah et al, also mentions that time constraints are a major obstacle (Khasanah et al., 2025). Meanwhile Firda et al, adds that the availability of time is a determining factor in the implementation of contextual learning based on local potential (Firda et al., 2024). The packed school schedule and programs also limit teachers' opportunities to implement contextual learning outside the classroom. This situation is consistent with the experience of Mrs. Rigiarti, who mentioned that field activities are difficult to carry out because they must be adjusted to the school schedule and limited time. Therefore, teachers need to consider the effectiveness of time in every learning plan.

In addition to time constraints, cost factors also pose a major challenge in implementing science education based on local potential. The success of field learning activities also depends on financial support from schools and parents. This is in line with research Asfiana et al, that one of the main challenges is the limited facilities and resources available in schools, such as time constraints and access to suitable locations for learning outside the classroom (Asfiana et al., 2025). Collaboration between schools, government, and the community is essential to ensure the availability of adequate infrastructure and resources to support learning (Sukiastini et al., 2024).

Limited school budgets can cause field activities, which should enrich students' learning experiences, to be less than optimal. Pratiwi et al, underline the impact of limited funds as a major obstacle for teachers in carrying out regular activities outside the classroom (Pratiwi et al., 2025). This situation requires teachers to find more cost-effective learning alternatives that are still relevant to the students. An interview with Mrs. Rigiarti reinforced the need for coordination with the principal and guardians so that activities can continue without burdening the students.

The next obstacle that needs to be considered is student safety during field activities. It is necessary to socialize what will be done and what should be avoided so that activities run safely and smoothly. A teacher needs to plan learning activities carefully and consider field conditions (Purwasih & Wilujeng, 2023). In this case, teachers act as supervisors who ensure that all activities run safely and in a focused manner. The success of contextual learning depends on the maturity of activity planning, risk management, and school environment support.

To overcome these obstacles, teachers at SDN 1 Krakal implemented a project-based learning approach. This learning model has proven effective in increasing student activity and critical thinking skills, as it continues to develop students' scientific abilities without requiring significant resources. Research Apriansyah et al, supports this, stating that project-based learning has been proven effective in improving students' scientific process skills and creative thinking skills (Apriansyah et al., 2024). This learning method is considered capable of creating meaningful and enjoyable learning experiences. This project-based approach, which utilizes local potential, contributes

significantly to building students' scientific attitudes holistically (Sudirman et al., 2025).

The Impact of Science Education Based on Local Potential

Science education based on local potential has a positive impact on students' enthusiasm, critical thinking skills, and environmental awareness. The learning process, which incorporates local potential such as the agricultural ecosystem and the Krakal tofu industry, makes learning more contextual and meaningful. Students can learn directly by utilizing available local potential. This is relevant to research Rahma, which states that integrating local potential can increase sensitivity to the environment (Rahma, 2022). Zahro and Maulida also mention that implementing science learning by utilizing local potential can help students understand scientific concepts contextually, creativity, and increase environmental awareness (Zahro & Maulida, 2023).

Science learning that integrates local potential can create more relevant and character-building learning, thereby encouraging students' environmental awareness (Septina et al., 2025). This learning helps students increase their sense of pride, so that they can develop and explore their local strengths (Sriyati et al., 2023). Local potential-based learning also enables students to understand the concepts they have learned and become aware of the enormous local potential around their homes (Busyairi et al., 2022). In addition, it is also a way to increase sensitivity towards the environment (Rozi et al., 2024).

In addition to increasing enthusiasm for learning, local potential-based learning can also strengthen student activity and collaboration among students. As stated by Mrs. Rigiarti, observation activities at tofu factories or visits to agricultural land encourage students to work together, discuss, and exchange information while observing the environment. This finding is reinforced by Cahyanti et al, who state that the use of e-modules as teaching materials based on local potential in project-based learning can improve collaboration and critical thinking skills among students (Cahyanti et al., 2023).

This learning process also makes students more communicative and participatory in activities. As stated by (Saptaningrum & Ade Cyntia Pritasari, 2023), science learning integrated with local potential can improve students' communication skills. In this activity, students will communicate with other students, teachers, and the surrounding community to learn about the local potential they are studying.

The implementation of science learning based on local potential can also develop students' critical thinking and problem-solving skills. Activities oriented towards real-life situations encourage students to analyze environmental issues, such as industrial waste management or agricultural ecosystem conservation. Students will then seek logical and easily applicable solutions. This is in line with the results of research Afkarina Izzata Dini and Febri Setiya Rini, which found that learning based on local potential, such as cultural traditions and natural resources, plays an important role in improving 21st-century skills, especially critical thinking and problem solving (Afkarina Izzata Dini & Febri Setiya Rini, 2024). Critical thinking is not just about finding answers, but about building the ability to reason through answers, question facts or information, and then draw conclusions based on real evidence. Critical thinking skills are very important for building students' independent knowledge and developing life skills, as well as preparing them to solve problems they will face in the future (Rahmi et al., 2023).

In implementing local potential-based science learning, the use of valid and practical teaching materials is also necessary. The use of these teaching materials is effective in improving students' critical thinking skills (Hafizhah et al., 2025). In addition, local potential-based teaching materials can enrich students' scientific understanding and improve their critical thinking skills (Ramadani, 2025).

The implementation of local potential-based science learning at SDN 1 Krakal has been proven to provide contextual, relevant, and meaningful learning experiences. This learning is able to significantly increase student activity (Isnaeni & Agus, 2024), improve collaboration and

communication skills. Learning that relates to local potential can encourage critical thinking skills in dealing with problems in the students' environment (Izza et al., 2025; Rini, 2023). Thus, the implementation of local potential is relevant and effective for realizing contextual and meaningful learning.

Conclusions

The implementation of local potential in science education at SDN 1 Krakal, Alian, Kebumen has proven to have a positive impact on students. The utilization of environmental potential, such as the Krakal Tofu factory and agricultural land, makes learning more contextual and meaningful. Students not only learn science concepts theoretically, but through observation and field trips, they can relate them to their daily lives.

The findings of this study show an increase in learning enthusiasm, activity, critical thinking skills, collaboration, communication, and environmental awareness among students. The integration of local potential in science learning can be an effective strategy for developing 21st-century skills, which include critical thinking, collaboration, communication, and creativity. Teachers must optimize natural and human resources to shape students' scientific character. In addition, support from various parties is also needed to provide facilities, time, and partnerships with the community to support the smooth running of local potential-based learning.

Thus, science learning based on local potential not only enriches students' learning experiences, but also has implications for the formation of Pancasila students who are critical thinkers and care about the environment. This approach is one of the strategies for realizing learning that is creative, contextual, relevant, meaningful, and oriented towards the real lives of students.

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