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The Effect of Experiential Learning on Students' Conceptual Understanding and Science Learning Outcomes on Energy Resources in Elementary School

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ABSTRACT

Learning science in elementary school should not only emphasize memorization but also involve direct experiences that enable students to actively construct knowledge. Experiential learning is considered an effective instructional approach that integrates students' experiences into the learning process, allowing them to develop conceptual understanding and improve learning outcomes. This study aims to examine the effect of experiential learning on students' conceptual understanding and learning outcomes in science, particularly on the topic of energy resources. This research employed a quantitative approach with a descriptive research design. The study was conducted at MIN 9 Magetan with 30 fourth-grade students as research participants. Data were collected using questionnaires, tests, interviews, and documentation. The questionnaire was used to measure students' perceptions of experiential learning and their level of conceptual understanding, while written tests were used to measure science learning outcomes. The collected data were analyzed using multiple linear regression analysis. The findings indicate that experiential learning has a significant effect on both students' conceptual understanding and learning outcomes. The regression analysis shows that experiential learning contributes 15.5% to students' conceptual understanding and 66.4% to students' science learning outcomes. These findings suggest that learning activities based on direct experiences can enhance students' engagement and help them understand scientific concepts more effectively. Therefore, experiential learning can be considered an effective instructional strategy for improving elementary students' conceptual understanding and learning outcomes in science learning.

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1. INTRODUCTION

Science education in elementary schools plays a crucial role in shaping students' scientific literacy, critical thinking skills, and problem-solving abilities. At this level of education, science learning should not merely emphasize memorization of concepts but should also facilitate students in developing an understanding of natural phenomena through observation, experimentation, and reflection. Science learning is expected to introduce students to ways of thinking scientifically and encourage them to explore relationships between concepts and real-life experiences. According to educational theorists, meaningful learning occurs when students actively construct knowledge based on their interactions with their environment rather than simply receiving information from teachers (Bruner, 1961; Vygotsky, 1978). In the context of elementary education, science learning must therefore be designed to provide opportunities for students to directly engage with phenomena occurring in their surroundings. However, many science learning practices still rely heavily on traditional instructional approaches where teachers dominate the learning process while students play a passive role as recipients of knowledge. Such practices limit students' opportunities to explore scientific concepts independently and may result in superficial understanding of the material. Consequently, students often experience difficulties in understanding abstract concepts in science, including those related to energy sources and their applications in everyday life (Zubaidah et al., 2018; Hisbullah & Selvi, 2018).

The limitations of conventional teaching methods in science classrooms have encouraged educators to explore more student-centered instructional approaches that can promote deeper conceptual understanding. Student-centered learning approaches emphasize the active participation of learners in constructing knowledge through inquiry, exploration, and collaborative interaction. Constructivist learning theory suggests that knowledge is not passively received but actively built by learners through their experiences and interactions with the environment (Piaget, 1972; Fosnot, 2013). In science education, this perspective implies that students should be encouraged to investigate scientific phenomena, formulate hypotheses, conduct experiments, and reflect on their findings. Such learning activities can help students develop meaningful conceptual understanding rather than simply memorizing scientific facts. In addition, active learning environments can improve students' motivation, engagement, and retention of knowledge. When students are involved in hands-on activities and real-world problem-solving situations, they are more likely to understand the relevance of scientific concepts in everyday life. Therefore, innovative instructional models that emphasize experience-based learning are increasingly considered important in improving the quality of science education in elementary schools.

One instructional approach that aligns with the principles of constructivist learning is experiential learning. Experiential learning emphasizes the role of direct experience as the primary source of knowledge construction. Kolb (1984) defines experiential learning as a process through which knowledge is created through the transformation of experience. According to Kolb's experiential learning cycle, learning occurs through four interconnected stages: concrete experience, reflective observation, abstract conceptualization, and active experimentation. Through this cycle, learners are encouraged to engage directly with learning situations, reflect on their experiences, develop conceptual understanding, and apply their knowledge in new contexts. Experiential learning therefore provides opportunities for students to learn through meaningful activities that involve observation, experimentation, and reflection. In science education, experiential learning is particularly relevant because scientific knowledge is closely related to empirical investigation and experimentation. When students participate in experiential learning activities, they are able to observe scientific phenomena firsthand, conduct simple experiments, and reflect on the results of their investigations. Such experiences not only enhance students' conceptual understanding but also foster positive attitudes toward science learning (Kolb & Kolb, 2009; Silberman, 2015).

Several previous studies have demonstrated the effectiveness of experiential learning in improving students' understanding of scientific concepts and learning outcomes. For example, research conducted by Sholihah and Mahmudi (2015) found that experiential learning can significantly improve students' conceptual understanding in mathematics learning by encouraging active participation and reflective

thinking. Similarly, a study by Suryani et al. (2018) revealed that the implementation of experiential learning in biology laboratory activities improved students' learning outcomes and scientific skills. Other research also indicates that experiential learning can enhance students' engagement, motivation, and critical thinking skills in science classrooms (Kolb & Kolb, 2009; Beard & Wilson, 2018). These findings suggest that learning activities that integrate direct experiences can create more meaningful learning environments and facilitate deeper understanding of scientific concepts. Despite these positive findings, the application of experiential learning in elementary science classrooms remains limited in many educational settings. Many teachers still rely on traditional lecture-based instruction due to time constraints, limited teaching resources, or lack of familiarity with innovative teaching strategies. As a result, students may have fewer opportunities to engage in experiential learning activities that allow them to explore scientific concepts more actively.

Considering these challenges, it is important to investigate the implementation of experiential learning in elementary science education and its impact on students' conceptual understanding and learning outcomes. The topic of energy resources was selected in this study because it represents an important concept in science education that relates closely to students' daily experiences. Understanding energy sources and their transformations requires students to observe phenomena, conduct simple experiments, and relate scientific concepts to real-life situations. Therefore, experiential learning is considered a suitable instructional approach for teaching this topic. This study was conducted at MIN 9 Magetan with fourth-grade students as research participants. The main objective of this research is to examine the effect of experiential learning on students' conceptual understanding and science learning outcomes in the topic of energy resources. The findings of this study are expected to contribute to the development of more effective science teaching strategies in elementary schools and provide empirical evidence regarding the benefits of experiential learning in improving students' understanding of scientific concepts.

2. METHODS

This study employed a quantitative approach with a descriptive research design to examine the effect of experiential learning on students' conceptual understanding and science learning outcomes. Quantitative research was selected because it allows researchers to analyze relationships between variables using statistical procedures and to produce objective measurements of learning outcomes (Creswell, 2014). The research was conducted at MIN 9 Magetan during the 2021/2022 academic year. The participants of the study were 30 fourth-grade students who were selected as research respondents. The study involved three variables: experiential learning as the independent variable (X), students' conceptual understanding as the first dependent variable (Y1), and science learning outcomes as the second dependent variable (Y2). Experiential learning was implemented during science instruction on the topic of energy resources through activities that involved observation, simple experimentation, and reflective discussion. These learning activities were designed to provide students with direct experiences that could support the development of conceptual understanding and improve their learning outcomes.

Data were collected using several techniques, including questionnaires, written tests, interviews, and documentation. The questionnaire consisted of 30 statements divided into two sections: 15 statements measuring the implementation of experiential learning and 15 statements measuring students' conceptual understanding of the science topic. The written test was used to measure students' science learning outcomes after the learning process. In addition, interviews and documentation were used to obtain supporting information regarding the implementation of the learning process in the classroom. The collected data were analyzed using quantitative statistical techniques. Prior to hypothesis testing, the data were examined using a normality test to ensure that the distribution met the assumptions required for regression analysis. Multiple linear regression analysis was then applied to determine the effect of experiential learning on students' conceptual understanding and science learning outcomes. The results of the statistical analysis were interpreted to identify the magnitude of the influence of experiential

learning on the dependent variables and to determine whether the relationships between variables were statistically significant.

3. FINDINGS AND DISCUSSION

Implementation of Experiential Learning in Science Learning

The implementation of experiential learning in science learning on the topic of energy resources was carried out through a series of learning activities that emphasized students' direct experiences. The learning process began with an introductory activity in which the teacher guided students to recall their prior knowledge related to energy sources in daily life. Students were then encouraged to observe several phenomena related to energy transformation, such as the use of electrical devices in the classroom and simple demonstrations involving movement and heat. These activities were designed to stimulate students' curiosity and to encourage them to actively participate in the learning process.

During the core learning activities, students were involved in several experiential learning tasks, including observing simple experiments, discussing their observations, and reflecting on the results of these activities. For example, students were asked to observe how electrical energy can produce light and motion through the use of classroom equipment such as lamps and fans. In addition, students conducted simple demonstrations such as clapping their hands and heating spiral paper to observe energy transformations. These activities allowed students to experience scientific phenomena directly rather than merely learning them through theoretical explanations. The teacher also facilitated class discussions to guide students in connecting their observations with scientific concepts related to energy sources and energy transformation.

The learning process was supported by the use of instructional videos and guided discussions to strengthen students' understanding of the concepts being studied. Through these activities, students were encouraged to reflect on their experiences and to relate them to scientific explanations. The implementation of experiential learning in the classroom created a more interactive learning environment in which students actively participated in observation, discussion, and reflection activities. As a result, students showed greater enthusiasm and engagement during the learning process.

Students' Conceptual Understanding of Energy Resources

Students' conceptual understanding of the topic of energy resources was measured using a questionnaire consisting of 15 statements related to their understanding of the science concepts taught during the learning process. The questionnaire responses were obtained from 30 students who participated in the study. The results indicate that students' conceptual understanding varied across different score ranges.

The analysis of the questionnaire results showed that 23.3% of students obtained scores in the range of 45–48, indicating a relatively low level of conceptual understanding. Meanwhile, 46.7% of students obtained scores in the range of 49–52, representing a moderate level of understanding. The remaining 30% of students achieved scores in the range of 53–56, which indicates a relatively higher level of conceptual understanding. These findings suggest that most students were able to demonstrate a moderate to good understanding of the science concepts related to energy resources after participating in experiential learning activities.

Based on classroom observations, several factors influenced students' conceptual understanding. One factor was the limited instructional time available for exploring scientific concepts in greater depth. In addition, some students still experienced difficulties in focusing on the learning activities, which affected their ability to fully understand the material presented during the lesson. Nevertheless, the experiential learning approach provided students with opportunities to observe scientific phenomena directly and to relate these experiences to conceptual explanations, which contributed to improving their understanding of the topic.

Students' Science Learning Outcomes

Students' science learning outcomes were measured through a written test consisting of five open-ended questions related to the topic of energy resources. The test was administered after the completion of the learning activities to evaluate students' mastery of the material that had been taught during the experiential learning process. The results of the test indicate that students achieved varying levels of performance.

The analysis of the test scores showed that 36.7% of students obtained scores in the range of 60–80, while 63.3% of students achieved scores in the range of 81–100. These results indicate that the majority of students were able to achieve relatively high learning outcomes after participating in experiential learning activities. The relatively high percentage of students who achieved scores above 80 suggests that experiential learning contributed positively to students' mastery of the science material.

Classroom observations also revealed that students who actively participated in the experiential learning activities tended to perform better on the written test. Students who were actively involved in observing experiments, discussing their observations, and reflecting on the results demonstrated a better understanding of the concepts being tested. This finding indicates that learning activities that involve direct experiences can enhance students' engagement and support their learning achievement.

The Effect of Experiential Learning on Students' Conceptual Understanding and Learning Outcomes

To examine the effect of experiential learning on students' conceptual understanding and science learning outcomes, the collected data were analyzed using multiple linear regression analysis. Before conducting the regression analysis, a normality test was performed to ensure that the data met the assumptions required for statistical analysis. The results of the normality test indicated that the data for all variables were normally distributed. The regression analysis results showed that experiential learning had a statistically significant effect on students' conceptual understanding. The regression coefficient for the relationship between experiential learning (X) and conceptual understanding (Y1) was 30.296, with a t-value of 2.268 and a significance value of 0.031. Since the significance value was lower than the probability threshold of 0.05, the relationship between experiential learning and students' conceptual understanding was considered statistically significant. The coefficient of determination (R^2) for this relationship was 0.155, indicating that experiential learning contributed 15.5% to students' conceptual understanding.

Furthermore, the regression analysis also revealed that experiential learning had a stronger effect on students' science learning outcomes. The regression coefficient for the relationship between experiential learning (X) and learning outcomes (Y2) was 86.015, with a t-value of 7.438 and a significance value of 0.000. The coefficient of determination (R^2) for this relationship was 0.664, which indicates that experiential learning contributed 66.4% to students' science learning outcomes. These findings demonstrate that experiential learning plays an important role in improving students' academic achievement in science learning. Overall, the results of the statistical analysis indicate that experiential learning has a significant positive effect on both students' conceptual understanding and their science learning outcomes. The learning activities that involved direct experiences, observation, and reflection enabled students to develop a deeper understanding of scientific concepts and to achieve better learning performance in science education.

Discussion

The findings of this study indicate that the implementation of experiential learning has a significant positive effect on students' conceptual understanding and science learning outcomes on the topic of energy resources. These results support the theoretical framework of experiential learning proposed by Kolb (1984), which emphasizes that learning occurs through a cycle of concrete experience, reflective observation, abstract conceptualization, and active experimentation. According to Kolb's experiential learning theory, knowledge is constructed when learners actively transform their

experiences into conceptual understanding through reflection and experimentation. In the context of science learning, this process allows students to explore scientific phenomena directly, enabling them to develop deeper understanding compared to traditional lecture-based learning approaches (Kolb & Kolb, 2009). The results of this study demonstrate that when students are involved in hands-on activities and direct observation of energy transformation phenomena, they are better able to understand the scientific concepts underlying these experiences.

From a constructivist perspective, the positive influence of experiential learning on students' conceptual understanding can be explained by the idea that learners actively construct knowledge through interaction with their environment. Constructivist learning theory suggests that meaningful learning occurs when students connect new information with their prior knowledge and experiences (Piaget, 1972; Fosnot, 2013). In this study, students were encouraged to observe everyday examples of energy use, conduct simple demonstrations, and discuss their observations during the learning process. These activities provided opportunities for students to construct their own understanding of scientific concepts related to energy sources and energy transformation. Through experiential learning activities, students were not only exposed to theoretical explanations but were also able to directly observe and reflect on real-life phenomena. This finding supports the argument that experience-based learning can enhance conceptual understanding because students engage cognitively and emotionally in the learning process (Beard & Wilson, 2018).

The results of this study also show that experiential learning contributes significantly to students' science learning outcomes. The relatively high percentage of students who achieved scores in the upper score range indicates that experiential learning can enhance students' academic achievement. This finding aligns with the view that active learning strategies improve student engagement and motivation, which in turn influence learning outcomes (Prince, 2004; Freeman et al., 2014). When students participate actively in learning activities, they are more likely to retain information and apply their knowledge effectively. Experiential learning creates opportunities for students to explore concepts through practical activities, which helps them develop a deeper understanding of the subject matter. In science education, this is particularly important because many scientific concepts involve abstract ideas that can be difficult for students to understand through verbal explanation alone.

Several previous studies have also demonstrated the effectiveness of experiential learning in improving students' understanding and academic performance. For instance, a study conducted by Sholihah and Mahmudi (2015) found that experiential learning significantly improved students' conceptual understanding in mathematics learning by encouraging active participation and reflection. Similarly, research by Suryani et al. (2018) reported that the application of experiential learning in biology laboratory activities improved students' learning outcomes and scientific skills. Another study by Kolb and Kolb (2009) emphasized that experiential learning environments enhance students' ability to connect theoretical knowledge with practical experience. These findings suggest that learning activities that incorporate direct experiences provide meaningful learning opportunities that support students' cognitive development.

Other studies in science education also support the positive effects of experiential learning. For example, Beard and Wilson (2018) argue that experiential learning promotes deeper learning because students are actively engaged in reflecting on their experiences and applying their knowledge in new contexts. Likewise, research by Cantor (1997) highlights that experiential learning enhances students' ability to understand complex concepts by linking theoretical knowledge with real-world experiences. In the context of elementary science education, experiential learning allows students to observe natural phenomena and conduct simple experiments that help them understand scientific principles. Such experiences are particularly valuable for young learners because they enable students to connect abstract concepts with observable phenomena in their environment.

The findings of this study also confirm that experiential learning can improve classroom interaction and student engagement during the learning process. During the implementation of experiential learning activities, students demonstrated greater enthusiasm and participation compared

to traditional classroom instruction. This result supports previous research indicating that experiential learning promotes collaborative learning and encourages students to actively participate in classroom discussions (Kolb, 1984; Silberman, 2015). When students are given opportunities to explore, observe, and discuss their experiences, they become more involved in the learning process and develop a sense of ownership over their learning.

Overall, the results of this study reinforce the importance of experiential learning as an effective instructional approach in science education. By integrating direct experiences, observation, reflection, and experimentation into the learning process, experiential learning enables students to develop deeper conceptual understanding and achieve better learning outcomes. These findings suggest that teachers should consider incorporating experiential learning strategies into science instruction, particularly in topics that involve observable phenomena such as energy resources. Through experience-based learning activities, students can develop scientific understanding more effectively while also enhancing their motivation and engagement in the learning process.

4. CONCLUSION

This study aimed to examine the effect of experiential learning on students' conceptual understanding and science learning outcomes on the topic of energy resources among fourth-grade students at MIN 9 Magetan. The findings indicate that the implementation of experiential learning contributes positively to students' understanding of scientific concepts as well as their academic performance in science learning. Through learning activities that involve direct observation, simple experimentation, and reflective discussion, students are able to connect theoretical knowledge with real-life experiences. As a result, students develop a more meaningful understanding of scientific concepts related to energy sources and energy transformation.

The statistical analysis also demonstrates that experiential learning has a significant influence on both students' conceptual understanding and learning outcomes. The regression analysis shows that experiential learning contributes to improvements in students' conceptual understanding, while its influence on science learning outcomes is even more substantial. These results suggest that learning approaches that emphasize students' active participation and direct experience can enhance both cognitive understanding and academic achievement in science education.

From a pedagogical perspective, the findings of this study highlight the importance of implementing experiential learning strategies in elementary science classrooms. Teachers are encouraged to design learning activities that provide students with opportunities to observe, explore, and reflect on scientific phenomena through hands-on experiences. Such approaches can create a more engaging learning environment and help students develop deeper understanding of scientific concepts.

However, this study has several limitations, including the relatively small number of participants and the focus on a single learning topic. Future research is therefore recommended to investigate the implementation of experiential learning in different science topics and educational contexts, as well as to involve larger samples in order to obtain more comprehensive findings. Despite these limitations, the results of this study provide empirical evidence that experiential learning can serve as an effective instructional approach to improve students' conceptual understanding and learning outcomes in elementary science education.

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