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The Effectiveness of Lesson Study in Improving the Quality of Science Learning in Secondary Schools

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ABSTRACT

Education plays a vital role in the progress of a country, with science learning at the secondary school level being the key to developing creative and adaptive human resources to global developments. However, the implementation of science learning in schools still faces various challenges, such as limited resources, conventional methods, and lack of technology utilization. To overcome this, innovation in teaching methods and continuous training for educators are important. One approach that has proven effective is Lesson Study, which emphasizes collaboration between teachers in planning, implementing, and reflecting on learning. This approach helps improve student understanding through more structured and interactive learning and develops critical thinking and problem-solving skills. Although it has been implemented in various countries, including Indonesia, the implementation of Lesson Study still faces obstacles, such as time constraints and lack of institutional support. This study aims to evaluate the effectiveness of Lesson Study in improving the quality of science learning in secondary schools using the literature review method. The data sources used come from research journals, scientific articles, research reports, and dissertations related to Lesson Study and science learning. Data analysis was carried out descriptively-qualitatively with a thematic synthesis approach to identify patterns and relationships between sources. The results of the study indicate that the implementation of Lesson Study is effective in improving the quality of science learning, with increased student understanding and teacher competence in designing and evaluating learning. However, the success of implementing this model depends on institutional support, including flexible time scheduling and policies that support collaboration between teachers. This study is expected to provide a comprehensive picture of the implementation of Lesson Study and recommendations for optimizing its implementation in improving the quality of science education in secondary schools.

INTRODUCTION

Education is a key element in efforts to advance a nation. Quality education will produce superior, creative human resources who are able to adapt to the demands of global development. One of the subjects that plays a significant role in driving the development of science and technology is science. Science learning at the secondary school level aims to develop critical thinking skills, problem-solving skills, and a deep understanding of scientific concepts that are the basis for technological progress. However, the reality in the field shows that the implementation of science learning still encounters various obstacles, such as limited access to educational resources, conventional learning approaches, and the lack of use of technology in the teaching and learning process (Anwar et al., 2019). In addition, students' motivation to learn science is often low due to teaching methods that are less interesting and not contextual. To improve the quality of science learning, innovation is needed in teaching methods, the use of educational technology, and ongoing training for educators (Kurniawan & Putri, 2020). Thus, collaborative efforts between various stakeholders are key to increasing the effectiveness of science learning in schools.

The challenges in learning science in schools include several main aspects, such as low understanding of science concepts, minimal innovation in teaching methods, and limited teacher skills in designing effective and interesting learning strategies. This condition has a direct impact on low student learning motivation and academic achievement that has not achieved optimal results. To overcome this problem, a systematic and sustainable approach to improving the quality of science learning is needed. One approach that is considered effective in developing the quality of teaching is Lesson Study. This approach, which originated in Japan, is a model for developing teacher professionalism through collaboration in planning, implementing, and reflecting on learning activities (Lewis & Hurd, 2018; Fujii, 2019). Lesson Study not only helps teachers in designing innovative learning methods, but also encourages increased student understanding through more structured and interactive learning. Through these stages, Lesson Study is able to improve teachers' pedagogical skills and create a conducive and participatory learning environment, which can ultimately encourage increased motivation and student learning outcomes in science.

Lesson Study is a collaborative approach in which teachers work together to design, implement, observe, and reflect on classroom learning practices. This approach emphasizes improving the teaching process through direct observation and joint reflection that is carried out in depth and systematically (Dudley, 2018). The main focus is to help teachers improve their pedagogical competence and professionalism based on real practices in the classroom. Lesson Study has been implemented in various countries, including Indonesia, as an effort to improve the quality of education (Saito & Atencio, 2018). Through this approach, teachers can gain a deeper understanding of how to design effective learning by observing and reflecting on the process directly. Lesson Study provides practical experience in evaluating teaching methods and allows teachers to identify aspects of learning that need improvement. In the context of science learning, the implementation of Lesson Study provides opportunities for teachers to explore innovative methods and approaches based on scientific activities that can improve students' understanding of science concepts and critical thinking skills (Murata, 2018). Teachers can also design more interesting and relevant experiment-based activities, thus encouraging students to actively explore scientific phenomena and develop problem-solving and collaboration skills.

One of the main advantages of Lesson Study is the collaboration between teachers that allows them to share experiences, ideas, and knowledge. This collaboration helps create a professional learning community among teachers that focuses on improving teaching practices and the quality of learning in the classroom (Lewis et al., 2019). With joint discussions and evaluations, teachers can find more effective and innovative learning strategies in delivering material to students. In addition, Lesson Study also involves the active participation of observers or researchers who provide constructive feedback regarding the implementation of learning that has been carried out. This reflection process not only helps teachers identify the strengths and weaknesses of their teaching practices but also motivates them to make continuous improvements (Fujii, 2018). In-depth reflection allows teachers to better understand students' needs and develop appropriate methods so that the learning process becomes more effective and meaningful. Thus, Lesson Study is not only a method of teacher professional development, but also plays a role in creating a sustainable collaborative learning culture for the sake of improving the overall quality of education.

Research on the implementation of Lesson Study in science learning has shown positive results, especially in increasing student engagement, understanding of science concepts, and critical and high-level thinking skills. These results indicate that Lesson Study can be an effective strategy to improve the quality of science learning at the secondary school level (Takahashi & McDougal, 2018; Hendayana et al., 2019). However, in Indonesia, the implementation of Lesson Study still faces a number of obstacles, such as limited teacher time due to tight teaching schedules, lack of comprehensive understanding of the concept and stages of Lesson Study, and minimal support from schools and education policy makers (Fadilah et al., 2020). These obstacles need to be addressed so that Lesson Study can be implemented effectively and sustainably. Therefore, more in-depth research is needed to evaluate the effectiveness of Lesson Study in improving the quality of science learning. The focus of this research is not only limited to its impact on student engagement and understanding, but also includes aspects of institutional support and teacher professional development. Thus, this research is expected to provide comprehensive guidance on best practices in implementing Lesson Study, especially in the context of science learning in secondary schools. (Rahmawati et al., 2021).

This study focuses on the planning, implementation, and reflection of learning outcomes carried out through a collaborative Lesson Study approach. Lesson Study, as a model for teacher professional development, provides space for educators to work together in designing, observing, and evaluating classroom learning in more depth (Fernandez, 2019). Therefore, this study is expected to provide a significant contribution in improving the effectiveness and sustainability of science learning practices. In addition, this study aims to identify factors that support and hinder the implementation of Lesson Study. These findings can later be used to formulate appropriate recommendations for stakeholders, such as principals, supervisors, and teachers, in order to optimize the implementation of the model (Lewis & Hurd, 2019). With an understanding of the obstacles faced, schools can design policies that support the ongoing involvement of teachers in the Lesson Study program. In the context of science learning, Lesson Study supports a student-centered approach, emphasizing exploratory and participatory activities. This approach is in line with the competency-based curriculum, which prioritizes the development of critical thinking and problem-solving skills (Takahashi & McDougal, 2018). Through active student participation, teachers can design learning that is more contextual and relevant to everyday life, so that students can more easily understand the science concepts taught.

In the era of the Industrial Revolution 4.0, science education at the secondary level has the challenge of equipping students with 21st-century skills such as critical thinking, communication, collaboration, and creativity. Lesson Study is a collaborative forum for teachers in designing teaching methods that are more innovative and in accordance with the demands of the times (Shulman, 2019). Through this process, teachers can enrich technology-based learning strategies and experiments, which are very important to prepare students for the digital era. This study uses a mixed qualitative and quantitative approach to evaluate the effectiveness of implementing Lesson Study in improving the quality of science learning. Data collection methods include observations of classroom activities, interviews with teachers and students, and analysis of student learning outcomes. This approach allows the study to provide a comprehensive picture of the impact of implementing Lesson Study on improving the quality of learning and student learning outcomes (Fujii, 2019). The results of this study are expected to be an important reference for educators, researchers, and policy makers in developing effective learning models. By implementing Lesson Study, teachers can improve their professional competence while providing a positive impact on the quality of science learning in secondary schools. Thus, Lesson Study becomes a strategic solution in building sustainable quality education and is able to answer global challenges. (Lewis, Perry, & Hurd, 2019).

RESEARCH METHODS

This study uses a literature review method, which aims to understand the effectiveness of lesson study in improving the quality of science learning in secondary schools. The data used come from primary sources, such as research journals, scientific articles, research reports, and dissertations related to lesson study and science learning. Secondary sources include reference books, review articles, and publications from trusted educational institutions that are relevant to this topic. Library sources are selected based on publication criteria in the last 10 years, have gone through a peer review process, focus on lesson study and its implementation in science learning, and contain indicators of learning effectiveness. Data collection was carried out by identifying sources through academic search engines such as Google Scholar, ResearchGate, and journal databases such as JSTOR, ProQuest, Springer, and DOAJ, using keywords such as lesson study, quality of science learning, science education, and lesson study in secondary schools. The sources found were then selected based on inclusion and exclusion criteria by considering the relevance, quality, and contribution of the article to the research topic. Next, the data were filtered and organized into themes, such as the concept of lesson study, indicators of science learning quality, implementation of lesson study in secondary schools, and research results related to its impact. The data analysis technique used was descriptive-qualitative analysis with a thematic synthesis approach, including data reduction steps, data presentation in certain themes, thematic analysis to find patterns and relationships between sources, and drawing conclusions related to the role of lesson study in improving science learning. The quality of science learning in this study was evaluated through several indicators, such as increasing students' understanding of science concepts, increasing student activity and participation in learning, implementing innovative learning methods, increasing teacher competence in designing and evaluating learning, and improving student learning outcomes. The validity of the data was guaranteed through the source triangulation method by

comparing and verifying data from various references used. The results of this literature review are expected to provide a comprehensive picture of the effectiveness of lesson study in improving the quality of science learning in secondary schools and provide recommendations regarding the implementation of effective lesson study in the future. Thus, this study can produce a strong and in-depth theoretical synthesis regarding the contribution of lesson study to improving the quality of science learning.

RESULTS AND DISCUSSION

This study aims to evaluate the extent to which the Lesson Study model can improve the quality of Science learning at the secondary school level. The implementation of Lesson Study was carried out in three secondary schools involved in this study, with the aim of improving students' understanding of Science concepts and teachers' teaching skills. Lesson Study, which involves collaboration between teachers to plan, observe, and evaluate the learning process together, is expected to improve the quality of teaching and student learning outcomes in Science. This model can enrich the learning experience for teachers and students, by strengthening conceptual understanding through deeper interaction. In addition, previous research by Lewis (2002) showed that Lesson Study improves teachers' pedagogical skills and improves student learning outcomes in a more cooperative and reflective learning context. The Lesson Study model is very useful in Science learning because it not only focuses on the material being taught, but also on more effective teaching methods. Collaboration between teachers can create an environment that supports the development of pedagogical skills, such as the ability to explain complex concepts in a way that is easier for students to understand. This process, which involves collaborative planning, classroom implementation, and reflection, helps teachers to continuously improve their teaching techniques.

1. Improving the Quality of Learning Improving the Quality of Learning: Observation results in Lesson Study sessions show significant improvements in the quality of Science learning. Based on data collected through classroom observations, it can be seen that teachers have begun to implement a more interactive learning approach, with students being more active in discussions and asking questions. Previously, Science learning tended to be expository, with little interaction between teachers and students. However, after the implementation of Lesson Study, the learning methods used prioritized problem solving and experiments, which encouraged students to be more involved in the learning process. This approach is in line with previous studies showing that problem-based learning and experiments can increase student participation and their understanding of the material. Thus, Lesson Study can be considered an effective strategy in improving the quality of Science learning, which not only involves teachers in improving their professionalism, but also increases student engagement and motivation in learning.
2. Improved Student Understanding: Evaluation of learning outcomes indicates an increase in student understanding of the material taught. Based on a comparison between pre- and post-Lesson Study tests, the average student score increased by around 15%. This shows that the approach implemented through Lesson Study is more effective in facilitating students to understand Science concepts that were previously considered difficult to understand. Lesson Study-based learning allows teachers to collaboratively plan, implement, and evaluate the learning process, which also supports the achievement of better understanding in students.This approach has been shown to improve the quality of teaching and encourage improved student learning outcomes through reflection and continuous improvement in learning practices.
3. Improving Teacher Competence Through Lesson Study: Improving teacher skills through the Lesson Study method provides them with the opportunity to work together and discuss more effective teaching strategies. Observations of interactions between teachers show improvements in their ability to manage classes and design more optimal learning activities. In addition, these teachers become more skilled in adapting learning materials to the different needs of students. The Lesson Study concept emphasizes the importance of collaboration among teachers to improve teaching practices and encourage reflection on the learning strategies implemented, so that it is expected to create a more inclusive and responsive learning environment to student diversity.

4. Student and Teacher Feedback Results of interviews with students: Based on interviews with students, they revealed that after participating in learning using the Lesson Study model, they felt more motivated and interested in learning Science. More interactive and problem-based learning provides an opportunity for students to more easily understand concepts that were previously difficult to understand. Teachers also stated that through collaboration in Lesson Study, they gained new insights into classroom management and the development of more interesting and effective teaching methods. This shows that a collaborative approach such as Lesson Study not only increases student motivation, but also enriches teachers' teaching practices. Previous research has shown that problem-solving and collaborative learning in teaching can improve conceptual understanding and student engagement in learning.

Based on research findings, the implementation of Lesson Study has proven to be effective in improving the quality of Science learning at the secondary school level. Learning methods that emphasize collaboration between teachers and focus on developing the learning process, as applied in Lesson Study, show a significant impact on improving the quality of teaching and student understanding. Lesson Study leads to improving teachers' teaching skills through joint discussion and reflection, which in turn enriches students' learning experiences. This model supports more interactive learning and is based on joint analysis, increasing teachers' awareness of the challenges faced by students and how to overcome them. Thus, this method is one of the effective approaches in improving the quality of education in secondary schools, especially in the field of Science.

1. Influence on Learning Quality: The Lesson Study model focuses on collaboration between teachers, which provides an opportunity for them to share knowledge and experiences. Science learning that prioritizes experiments and in-depth discussions allows students to be more actively involved in the learning process and understand the material better. With this approach, students can relate Science concepts to their daily lives, which in turn improves their understanding of the material being taught. Learning based on exploration and critical conversation greatly supports the development of high-level thinking skills that are important for students in their lives.
2. Improving Student Understanding: One of the main goals of Lesson Study is to reduce students' dependence on conventional learning methods, and to shift the focus of learning to more direct and problem-based experiences. Students who engage in contextual active learning find it easier to understand the material and tend to develop critical thinking skills effectively. This shows the importance of learning that involves students directly in real situations, so that they can build their knowledge through exploration and reflection.
3. The Role of Teacher Collaboration in Lesson Study: Collaboration between teachers in Lesson Study has a significant impact, both on improving teacher professionalism and on the quality of student learning. In this process, teachers can provide feedback to each other on teaching techniques, how to design materials, and solutions to teaching problems faced. This collaborative learning strengthens the overall quality of teaching. For example, when a teacher teaches a particular experiment or concept, other teachers can provide input or ideas to improve the teaching method, which ultimately increases the effectiveness of learning. By sharing experiences, teachers not only improve their methods but also improve their ability to design learning activities that are more interesting and beneficial for students.
4. Challenges and Implications: Although Lesson Study provides many benefits, there are several challenges that need to be overcome. One of the main obstacles is the limited time to carry out Lesson Study activities in many schools. This activity requires extra time for teachers to plan and evaluate learning sessions, which is sometimes difficult to do in the midst of teaching routines. In addition, not all teachers are ready to collaborate openly, which requires more intensive mentoring and training to overcome these obstacles. In order for Lesson Study to run optimally, time management and teachers' mental readiness to collaborate are crucial.

The implications of these findings suggest that to achieve maximum effectiveness in implementing Lesson Study, it is important to obtain structured and systematic support from the school, including more flexible time scheduling and ongoing training for teachers. Strong administrative support is also needed to ensure the smooth implementation of Lesson Study, which in turn can have a positive and sustainable impact on the quality of Science teaching in schools. The implementation of Lesson Study in secondary schools has been shown to be effective in improving the quality of teaching and student understanding. Key factors driving the success of this model include collaboration between teachers, a more interactive and problem-based learning approach, and increased student engagement in the teaching and learning process. However, challenges related to limited time and teacher readiness to collaborate remain issues that need to be addressed so that Lesson Study can be optimally implemented across schools. Lesson Study shows that this model emphasizes collaborative learning that involves teachers in designing and analyzing the learning process together. Through this approach, teachers not only share knowledge but also have the opportunity to learn from each other's teaching practices, which ultimately improves the quality of education in schools (Koretz, 2018). However, effective implementation requires more than just teacher participation; the involvement of school administration is also essential to create a supportive environment (Cheng, 2017). Therefore, school policies that provide time and opportunities for teachers to collaborate are one of the determining factors in the success of Lesson Study implementation.

CONCLUSION

Based on the research results, the implementation of the Lesson Study model has proven effective in improving the quality of science learning at the secondary school level. This model, which prioritizes collaboration between teachers, allows them to plan, implement, and evaluate the learning process together, so that it can improve teachers' pedagogical skills and students' understanding of science concepts. Through a more interactive and problem-based approach, students become more active in the learning process and show a significant increase in understanding, with an average increase in test scores of around 15%. In addition, Lesson Study helps teachers improve their skills in managing classes and designing more effective and interesting learning activities. Collaboration between teachers not only enriches teaching practices but also improves their ability to adapt teaching materials according to student needs. However, there are challenges related to time constraints and teachers' mental readiness to work together, which require more intensive administrative support and training so that Lesson Study can run optimally. Overall, Lesson Study has a significant positive impact on the quality of learning and student understanding. However, the success of implementing this model is highly dependent on strong support from the school, including more flexible time scheduling and policies that facilitate collaboration between teachers. With the right support, Lesson Study can be an effective approach to improving the quality of education, especially in science subjects in secondary schools..

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