Application of Lesson Study on Circle Material to Improve the Quality of Mathematics Instruction in Grade XI

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Abstract

Improving the quality of mathematics learning is an important step to ensure students can understand mathematical concepts deeply. This study aims to improve the quality of mathematics learning on circle material in class XI through the application of lesson study. This research is a qualitative research that aims to explore and understand the process of implementing lesson study in mathematics learning with the stages of plan, do and see. In the first cycle, the lesson study was applied with Problem Based Learning (PBL) model with LKPD and PowerPoint media. The second cycle used Think Pair Share (TPS) model with the support of wordwall interactive media. The results of this study showed that lesson study effectively increased student participation and learning quality through method innovation, interactive media utilization, and improved time management. Therefore, lesson study can be used as an effort to improve the quality of mathematics learning, especially on circle material.

Keywords: *Learning Quality; Lesson Study; Mathematics.*

Abstrak

Peningkatan kualitas pembelajaran matematika merupakan langkah penting untuk memastikan siswa dapat memahami konsep matematika secara mendalam. Penelitian ini bertujuan meningkatkan kualitas pembelajaran matematika pada materi lingkaran di kelas XI melalui penerapan lesson study. Penelitian ini merupakan penelitian kualitatif yang bertujuan untuk menggali dan memahami proses penerapan lesson study dalam pembelajaran matematika dengan tahapan plan, do dan see. Pada siklus pertama lesson study diterapkan dengan model pembelajaran Problem Based Learning (PBL) diterapkan dengan media LKPD dan PowerPoint. Siklus kedua menggunakan model Think Pair Share (TPS) dengan dukungan media interaktif wordwall. Hasil penelitian ini menunjukkan bahwa lesson study efektif meningkatkan partisipasi siswa dan kualitas pembelajaran melalui inovasi metode, pemanfaatan media interaktif, dan perbaikan pengelolaan waktu. Oleh karena itu, lesson study dapat digunakan sebagai upaya peningkatan kualitas pembelajaran matematika, khususnya pada materi lingkaran.

Kata Kunci: Kualitas Pembelajaran; Lesson Study; Matematika.

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INTRODUCTION

Education plays an important role in shaping competent human resources (HR). Through education, students are taught various skills and knowledge that help them to grow into individuals who are able to think critically, creatively, and independently (Zubaidah, 2016). In addition, quality education also plays a role in instilling moral, ethical, and national values, thus creating individuals who are not only intellectually intelligent, but also have a strong character to face the dynamics of life in the modern era (Noventue et al., 2024). By producing excellent human resources, education can be one of the keys to driving the nation's progress, responding to global challenges, and ensuring that the next generation has the skills needed to contribute to various sectors of life (Abdillah, 2024; Santika, 2021).

However, to create competent human resources, the quality of education must be continuously improved. Quality education involves not only knowledge transfer, but also character building, improved thinking skills, and optimal development of each student's potential (Fristadi & Bharata, 2015; Nurnaningsih et al., 2023). Without good quality education, it is difficult for a country to achieve sustainable progress (Safitri et al., 2022). Therefore, improving the quality of education is a priority that must be supported by innovative efforts in various aspects of learning (Sulistiani & Masrukan, 2016). To improve the quality of education, efforts are needed to improve the quality of learning, which includes strengthening teaching methods, using innovative media, and creating a conducive learning environment centered on student needs (Hamid & Muadin, 2024).

Many aspects affect the quality of education, one of which is by improving the quality of mathematics instruction. As a subject that underlies many fields of science and technology, mathematics has a strategic role in shaping students' logical, critical, and systematic thinking skills (Firdausi et al., 2018). Quality mathematics instruction not only helps students understand basic concepts, but also trains them in solving problems creatively and effectively (Salsabilah et al., 2024). In addition, mathematics also contributes to building analytical skills that are important for decision making in various aspects of life

(Sartika, 2019). Therefore, mathematics instruction should be designed in such a way that it does not only focus on theory, but also on practical applications that are relevant to students' needs so that the quality of mathematics instruction can improve.

One way to improve the quality of mathematics instruction is by implementing lesson study. Lesson study is a professional development model that involves teachers in a collaborative process to design, implement, and reflect on learning (Burhanuddin et al., 2023; Juano et al., 2019). With lesson study, teachers can work together to evaluate the effectiveness of teaching methods, identify student needs, and find the best way to deliver the material (Subroto, 2023). Lesson study aims to improve the quality of teaching in a sustainable manner, so that the teaching and learning process can run more effectively and meaningfully for students (Eriyanti, 2019).

Lesson study consists of three main stages: plan, do, and see (Juano et al., 2019). In the planning stage, teachers jointly develop a detailed lesson plan that meets the needs of the students. At the implementation stage, the plan is implemented in the classroom, where other teachers can be present as observers. Furthermore, at the reflection stage, teachers jointly review the learning process, analyze the results, and discuss to find ways to improve future learning. Through these stages, lesson study helps create a continuous cycle of improvement in teaching practice.

Before starting the lesson study implementation, observation is needed first. This observation aims to find out the classroom situation and problems that exist in mathematics learning before the lesson study is held. Based on the observation, it was found that learning math during the day tends to reduce students' enthusiasm in learning. In addition, the learning method used is still dominated by a teacher centered approach with a monotonous model, so that students become less active in the learning process. To overcome this problem, student centered learning is needed to make the classroom atmosphere more interesting and conducive. Learning that utilizes interactive media is also expected to increase student enthusiasm and involvement during the learning process.

Through this observation, there was also a gap between the actual conditions and the ideal conditions of mathematics learning. The actual conditions show that learning is still teacher-centered with minimal use of interesting media, so students tend to be passive. On the other hand, the ideal condition of mathematics learning is student centered learning, using approaches that involve students actively and innovatively, and utilizing learning media that are relevant to student needs. Previous research, such as that conducted by Tadanugi (2015), has proven the effectiveness of lesson study in improving the quality of mathematics learning, but the focus is more on learning models without digital media integration. Meanwhile, another study by Wardani et al. (2023) highlighted the application of lesson study with Problem Based Learning (PBL) in improving the quality of mathematics learning on the material of rows and series.

Based on the problems previously described, the importance of a student-centered learning approach. In this case, the researcher planned learning on circle material with problem-based learning in cycle 1 and learning with think pair share in cycle 2. Researchers also use learning media to support learning such as PPT, LKPD and wordwall. With the learning plan is expected to overcome the problems that occur, so that the quality of mathematics learning can be improved.

RESEARCH METHODS

This research is a type of qualitative research that aims to explore and understand the process of lesson study implementation in mathematics instruction. This qualitative research is used to obtain in-depth data about the plan, do and see stages in lesson study practice, as well as its impact on the quality of mathematics instruction in the classroom. This research was conducted at MAN 4 Bantul on October 26, 2024 and October 3, 2024. The subjects of this study were students of class XI F3 with a total of 34 students in the 2024/2025 school year. In addition, this study also involved two observers whose role was to provide comments and input related to the implementation of lesson study conducted by the model teacher. Data collection techniques are carried out through several stages, namely: 1) observation, observation is carried out in the classroom to see firsthand the

learning process and see what problems are experienced during learning; 2) documentation, documentation in the form of official documents such as teaching modules, observation sheets, and documentation during learning. The data analysis process includes stages: 1) data reduction by summarizing and simplifying data obtained from observations, and documentation; 2) data presentation by compiling data in the form of descriptive narratives to describe how the application of lesson study to improve the quality of mathematics instruction; 3) drawing conclusions about the application of lesson study to improve the quality of mathematics instruction.

Data collection in this research was conducted using the lesson study method which consists of three main stages: planning (plan), implementation (do), and reflection (see). In the planning stage (plan), the model teacher explores the problems that exist in the classroom, such as difficulties experienced by students in understanding the material or obstacles in the learning methods used. At the implementation stage (do), the model teacher implements the lesson plan that has been prepared. In the do activity, there are two observers to record and observe student interactions, the implementation of the lesson plan, and the level of student involvement in learning. After the implementation stage, there is a discussion and reflection (see) between the model teacher and the observers to evaluate the success of the learning process. This discussion involves analyzing the implementation of the lesson plan, the challenges faced during learning, and how the method applied can improve students' understanding. Based on the reflection results obtained, the model teacher and the observer plan a follow-up which includes improvements in the implementation of the next lesson.

RESULTS AND DISCUSSION

Implementation of Lesson Study Cycle 1

Plan

In the plan stage of cycle 1, preparations were made related to things that needed to be done when learning was carried out. Lesson planning prepared in the form of learning devices in the form of teaching modules, LKPD and powerpoints

that will be used in lesson study activities. The class used as lesson study practice is class XI F3. In cycle 1 lesson study, the lesson plan was prepared using problem-based learning model on the tangent of circle with the sub-material of inner tangent and outer tangent of circle. The learning media used in this cycle 1 are Learner Worksheets (LKPD), and powerpoints. The LKPD used in cycle 1 consists of activity 1, activity 2 and activity 3. Each activity contains steps that students must complete in finding the concept of the tangent line of the circle, the tangent line of the inner fellowship and the tangent line of the outer fellowship on two circles. This LKPD also contains problems that students must solve when they have found the concept of the tangent line of the circle, the tangent line of the inner fellowship and the tangent line of the outer fellowship on two circles.

The activity plan for this meeting is that the model teacher starts by saying greetings and inviting students to pray together before starting the lesson. Then, the model teacher asked for news and checked students' attendance and ensured students' readiness to learn by asking if they were ready and excited. Next, the model teacher conveyed the learning objectives which included three main things: defining and explaining the tangent line of a circle, explaining the inner and outer tangent lines, and solving problems related to the inner and outer tangent lines on a circle. In the core learning activities, the model teacher provides apperception in the form of sparking questions to attract students' attention, such as asking if they have learned about tangents before. The model teacher then provides contextual problems and asks students to observe and identify these problems individually first.

After that, the model teacher organized students into small groups of 4-5 people to discuss the problems on the Learner Worksheet (LKPD) that had been distributed. Students then discuss in groups to find solutions to the problems given, guided by the model teacher who goes around monitoring and providing direction. The model teacher will also provide assistance to groups or individuals who have difficulty in completing the LKPD. Furthermore, the model teacher asked representatives from several groups to come forward to present the results of their discussions related to solving the problems contained in the LKPD.

Students from other groups are asked to provide responses or arguments to the presentation. After all groups have finished presenting the results of their discussions, the model teacher will ask students to give appreciation to their friends who have actively participated in learning.

In the closing activity, the model teacher invites students to jointly summarize the material that has been learned. The model teacher then provides clarification and reinforcement if there is an incorrect understanding of the students, especially related to the concept of the tangent line of the circle. The model teacher also invites students to reflect on the learning outcomes and provides opportunities for students to ask questions if there are things that have not been understood. The lesson will end with a prayer together and closing greetings from the model teacher.

Do

At the do stage of cycle 1, if seen from the preliminary activities, the model teacher taught the material of the tangent line of the circle quite well. Learning tools used by model teachers such as teaching modules, PPT, LKPD, practice questions and observation sheets are also appropriate. The implementation of learning carried out by the model teacher is in accordance with the lesson plan prepared. In the introductory activities, the model teacher starts with appreciation and motivation so that students are eager to learn. Students' responses to the apperception and motivation given showed that they were quite enthusiastic in listening and paying attention to the direction of the model teacher. About 80% of students are actively involved in physical and mental (thinking) activities, although there are some students who are not effectively involved because they are not involved in groups.

In the core learning activities, when viewed from the aspect of teaching materials, the model teacher explains related material and the procedure of activities that must be carried out by students has been explained well. The connection of the material with contextual problems is conveyed appropriately, so that students can understand the relevance of learning to real life. The

mathematical concepts taught have also been conveyed appropriately and correctly. Then when viewed from the aspect of managing learning resources, model teachers use learning resources, such as Learner Worksheets (LKPD) and Powerpoint media (PPT), have been utilized well. Both of these resources are in accordance with the material taught, and help students in understanding the concepts learned. Students are actively involved with these learning resources, especially when working on tasks on the LKPD. Student activeness during the discussion can be seen in Figure 1 below:

Figure 1. Student Group Discussion in Cycle 1

When viewed from the aspect of learning strategies, the model teacher has implemented a good learning strategy, in this case the model teacher uses the Problem Based Learning (PBL) approach. During learning, most students can follow the flow of learning activities well and present the results of the discussion with enthusiasm.

The model teacher gives directions by going around and providing direct guidance to each student, encouraging them to ask questions, think critically and actively participate. About 80% of students are actively involved in physical and mental activities during the learning process. In the closing activity, the model teacher provides reinforcement through reviewing the material that has been learned, summarizing the key points, and concluding the learning. Students' responses were quite good, with most students seeming to understand the summaries presented. This reinforcement helps clarify concepts that may still be poorly understood by students. Evaluation is carried out through giving practice questions consisting of description questions. This method aims to measure the

extent to which students understand the material in depth, both in terms of concepts and applications. Overall, the achievement of learning objectives and the level of student completeness are considered good, with the majority of students successfully meeting the set competency standards.

See

In the see stage of cycle 1, based on the observers' observations during the learning process, all planned stages were in accordance with the teaching module that was prepared. But pay attention to time management when learning, especially when using the group discussion learning model. Class management is an important component in learning, so that learning in the classroom runs conducive. In learning, involving students in every learning process will make students more active and pay attention to what the model teacher says. Observers also said that students who initially looked passive, during group discussions they were active in discussions and asked the model teacher if there were things they did not understand. From this, it can be seen that learning with Problem-based learning can increase active participation, so that from the learning that takes place the quality of mathematics learning in the classroom increases. This is in line with Priyanti & Nurhayati (2023) which shows that PBL can improve student learning outcomes and active student participation. In addition, Fitrah (2017) also suggested that problem-based learning helps students understand the relationship between theory and practical application so that students are more active in learning and increase their understanding of the concepts taught. Wardani et al. (2023) also suggested that by implementing lesson study with PBL learning model, the quality of mathematics learning in the classroom can be improved.

Implementation of Lesson Study Cycle 2

Plan

At the plan stage of cycle 2, the learning plan prepared by the model teacher is by preparing learning tools in the form of teaching modules, powerpoints and questions on the wordwall platform. The learning model used in

this second lesson study is think pair share in the evaluation section on the material of the circular arc rope, with the sub-material of the arc rope quadrangle. learning media used in this second practice are powerpoint and wordwall. The use of wordwall in cycle 2 is expected to increase student enthusiasm and active participation of students during learning, resulting in an increase in the quality of mathematics instruction.

The activity plan for this meeting was that the model teacher opened the lesson with greetings and invited them to pray together before starting the lesson. After the prayer, the model teacher asked for news and checked the students' attendance. The model teacher then gave an overview of the material to be learned, which was about the circular arc rope. The model teacher also conveyed the learning objectives, which included understanding and explaining the concept of the bowstring and its relationship with rectangles.

After the introductory activities, the core learning activities began with the model teacher explaining the material about the circular bowstring presented through Powerpoint slides. When the model teacher explains, students will be asked to answer the questions asked by the model teacher and come forward to solve the problems given by the model teacher. Then students will be asked to write down the material and explanation in their notebooks. The model teacher also asked some triggering questions to attract students' attention and understanding. After the material explanation is complete, the next step is the implementation of the think, pair and share stage.

At the “think” stage, the model teacher divided the students into four groups based on their seating rows. Each group is asked to choose one problem from the wordwall box, and students work on the problem individually first. After that, in the “pair” stage, students are asked to discuss with their seatmates the answers they have worked on. This discussion was monitored by the model teacher to ensure that students shared their understanding and solutions. At the “share” stage, the model teacher asks representatives from each group to present the results of their discussion in front of the class. If no one volunteered, the model teacher drew lots to select the students who would present. The selected

students present their results, while other students provide responses or arguments related to the results of the presentation delivered. The model teacher listens to each presentation and provides confirmation and clarification of the correct answers and additional explanations to clarify students' understanding.

At the end of the lesson, the model teacher reflects with the students, emphasizing the important things that have been learned. The model teacher also provides opportunities for students to ask questions if there are still things that are not understood. After giving appreciation to students who have been active in learning, the model teacher invites students to pray together as a closing and ends learning activities with greetings, which are answered by students enthusiastically.

Do

At the do stage of cycle 1, if seen from the introductory activities, the model teacher does apperception well and is associated with everyday life, so that students can see the relevance of the material to be learned. Students' prior knowledge was also explored through questions that were appropriate to the topic, students responded to the problems given by the model teacher with enthusiasm and enthusiasm as seen in Figure 2.

Figure 2. Learning Activities in Cycle 2

In the core learning activities when viewed from the aspect of teaching material, the model teacher explains the material well, there are no mistakes in explaining the material. The teaching material and activity procedures that must be carried out by students have also been conveyed by the model teacher well.

The material provided is also related to everyday life through contextualized questions. The suitability and depth of teaching materials are in accordance with the standards, and no conceptual errors were found from both students and model teachers.

Seen from the aspect of managing learning resources, the learning media used, such as LKPD, has been utilized well and in accordance with the material taught. Most students (around 90%) actively interact with the learning media provided, especially when working on tasks on the wordwall platform. When viewed from the aspect of learning strategies, the learning process is implemented with the right strategy and runs smoothly. Most students were able to follow the flow of learning activities. The model teacher gave directions by going around, guiding, and giving instructions to each group, thus encouraging students to ask questions, think, and do activities.

In the closing activity, the model teacher summarized the material that had been learned, reviewed the important points, and gave homework to students. Students' responses at this closing stage were quite good, with most students accepting the conclusions conveyed by the model teacher. Learning assessment was carried out with descriptive questions. This evaluation aims to measure students' understanding of the material as a whole. Overall, the achievement of learning objectives and student learning completeness is considered good, with most students successfully achieving the expected competencies.

See

At the see stage of cycle 2, based on observers' observations during the learning process, Teaching and Learning Activities went well, most students could follow the learning well. The use of IT (PPT and wordwall) helped learning to be maximized. The use of the “open the box” feature in the wordwall succeeded in attracting students' attention. They were very enthusiastic when given the opportunity to choose questions interactively, making the learning atmosphere more fun and students more active in learning. Students were also active in answering the questions given and discussing with their classmates. Material

mastery, class management and time management need to be improved. Because the success of learning is greatly influenced by the mastery of material by educators, efficient time management, and good classroom management. These three aspects are very important to create an optimal learning atmosphere for students. From this, it can be seen that learning with think pair share can increase students' active participation. The active participation of students shows an increase in the quality of mathematics learning in the classroom. This finding is in line with research by Harahap et al. (2023) which states that the success of learning is influenced by classroom management, mastery of material, and appropriate learning strategies. Research by Sari (2016) also shows that learning with TPS is effective in increasing interaction between students and encouraging student involvement in learning. In addition, these results are also supported by Azizah (2013), which found that the application of TPS in learning mathematics can improve student learning outcomes and active participation of students so that the quality of mathematics learning can be improved.

Follow Up

In general, the implementation of this lesson study can improve the quality of mathematics instruction. This can be observed in each cycle, in cycle 1 about 80% of students were actively involved during learning while in cycle 2 about 90% of students actively interacted with the learning media provided, especially when working on tasks on the wordwall platform. Therefore, it can be said that the application of this lesson study can improve the quality of mathematics instruction. This is supported by research conducted by Siregar et al. (2021) which says that a quality mathematics instruction process is a mathematics instruction process that takes place interactively, inspiring, fun, challenging, motivating students to actively participate, and providing sufficient space for initiative, creativity and independence. After conducting lesson study in cycle 1 and cycle 2, model teachers can conclude that variations in learning methods need to be done with the intention of getting a new atmosphere in the classroom. In addition, variations in learning models are a form of creativity from a teacher or

educator in improving the quality of mathematics instruction. This is in line with Andhika & Wahyuni (2020) which states that quality learning is determined by teacher creativity to find new ideas for solving a problem and using the right learning model. Learning methods must also be adapted to classroom conditions. Based on the experience in this lesson study, the follow-up plan that I will do is to choose a learning model that does not require too much time. In my opinion, if I really want to use a group work system, then I will immediately apply Problem Based Learning so that the discussion time is not cut off when I explain the material. In addition, I will further implement the use of digital quizzes such as wordwall, quizizz, kahoot, etc., because I want to take advantage of the problems of students who on average use cellphones during learning.

CONCLUSION

The implementation of lesson study in cycle 1 and cycle 2 succeeded in improving the quality of mathematics learning in class XI F3, especially in terms of active student participation. In cycle 1, the application of the Problem Based Learning (PBL) learning model succeeded in involving about 80% of students in learning, while in cycle 2, the use of the Think Pair Share (TPS) model with interactive digital media such as wordwall could involve about 90% of students actively participating during learning. This shows that variations in learning methods, utilization of interactive media, and good classroom management can significantly improve the quality of mathematics learning. Thus, lesson study proved to be an effective strategy in improving students' active participation and the quality of mathematics learning in a sustainable manner.

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