



Implementation of a Lesson Study on Pascal's Law Using Liveworksheet-Based E-Student Worksheets Media to Analyze the Learning Process in Junior High School

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Abstract

Lesson studies have long been used to increase a teacher's professionalism in designing a lesson. Lesson study consists of the plan, do, and see (reflection) stages. The lesson study research was carried out in class VIII-H on January 11, 2023, to analyze the learning process conducted by the model teacher. The results of the observer's assessment showed that learning had gone well and was interactive. The implementation of learning by the teacher is also following the lesson plan. The cognitive assessment results in grade VIII junior high school using the live worksheet-based E-LKPD media revealed that 41% of students scored higher than the standard passing score, and 59% scored lower than the passing grade standard score. Teachers must continue to provide reinforcement, particularly regarding mathematical calculations on science topics.

Keywords: E-student Worksheets; Lesson Study; Liveworksheet

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INTRODUCTION

Education is a critical component that must be prioritized in the development of a nation. There are still problems that frequently occur during the implementation of the learning process and are not resolved optimally. To achieve an optimal educational process, efforts must be made to improve educational quality. Improving education quality can be accomplished by focusing on three factors: (1) learning materials; (2) teacher competence; and (3) education management, which could support efforts to improve education (Almujab et al., 2018; Komalasari et al.,

2020; Mulang, 2021; Murkatik et al., 2020).

Government Regulation number 13 of 2015 concerning national education standards explains that learning is an interaction between students and educators and students, and learning resources in a learning environment. One of the subjects in the process is science. Science learning is the knowledge that teaches students about the basic concepts of science and their natural surroundings (Brown, 2017; Pertiwi et al., 2018). Science learning intends for students to have the ability to understand a concept. Students learn science by identifying



existing problems and then solving them by applying the appropriate concepts to predetermined problems (Karyatin, 2017). In practice, science learning activities in schools can benefit from technology. According to Suharyat et al. (2022), using technology in science learning activities helps educators optimize learning.

According to the observations, school science learning has not been fully optimized. The observation results show that the designed learning is not following student profiling data, resulting in less effective implementation of teaching and learning activities. The Traditional model, namely lectures, is still used in the design of learning activities by the teacher. As a result, learning remains focused on or oriented toward the teacher. Because students only act as listeners and recipients of lessons when the teacher explains, they cannot comprehend and remember learning material. Students are also denied the opportunity to express their opinions or enthusiasm for learning, leading to a passive attitude toward teaching and learning activities (Suardana et al, 2020). Teachers have also failed to use and create engaging learning media to implement learning. On the other hand, students in junior high schools are allowed to bring cell phones to school. This resulted in students still being found using cell phones to play games or carry out other activities during learning hours. Teachers must be creative in designing appropriate learning activities to achieve learning objectives and engage students actively in learning activities to carry out teaching and learning activities more effectively to increase the quality of learning in the class.

Lesson-study activities are one way to improve the quality of learning. Japanese teachers have used lesson study for over a century since the 1890s (Sato., 2014; Shimizu, 2013). Since the early 2000s,

lesson study is well known in Indonesia (Suratno, 2012; Towaf, 2016). Sato's research incorporates lesson study into learning activities to improve the quality of learning in the twenty-first century. To allow students to develop their knowledge, lesson study learning in observation begins with perception, group work exposure, reflection, class assignment presentation, and individual assignment presentation (Sato., 2014).

Lesson study activities increase a teacher's professionalism when designing a lesson. Lesson study is an activity related to the teacher's efforts in the process of planning lessons, implementing learning activities, observing, and reflecting on the implementation of learning that has been designed and carried out (Junaid & Baharuddin, 2020). Using lesson study is an excellent way to improve the efficiency with which learning activities are implemented. Lesson study is also an effort to improve the quality and professionalism of prospective teachers (Almujab et al., 2018). Optimal teacher professionalism improves the effectiveness of learning activities, which improves the quality of education (Iqbal, 2016).

The teacher's learning in lesson study must account for the media and teaching materials used. According to (Danial et al., 2022), one factor that influences the success of the learning process is the use of teaching materials and learning media that can increase learning effectiveness. One of the media that teachers can use is student worksheets. In the industrial era 4.0, technological developments are accelerating so that learning can be carried out using learning media by utilizing technology, one of which is electronic student worksheets, or E-student worksheets. The benefits of E-student worksheets are available to all students, wherever and whenever they want to study. Furthermore, the implementation of e-student worksheets

may be an effort by teachers to use cell phones brought to school by students for learning activities.

The live worksheet website can be used to create an e- student worksheets. Using a live worksheet, the E- student worksheets can include pictures, videos, and questions that students can answer in real time. According to (Hurrahma & Sylvia, 2022), creating e- student worksheets using the live worksheet website has several advantages, which include: (1) it is more interactive and effective because students can answer questions directly; (2) students are more active in learning activities; (3) teachers can optimize their creativity by utilizing the live worksheet features; and (4) e- student worksheets can be accessed anywhere and at any time.

Implementing lesson study with E- student worksheets media based on live worksheets is to improve teacher skills in understanding problems that arise during learning so that, through these activities, the teacher can apply various learning methods/strategies that are appropriate to the situation, conditions, and problems encountered. Furthermore, it makes learning more innovative. It can increase teachers' creativity in lesson planning by utilizing existing technology to make the E- student worksheets interactive and fun, attracting students' learning interest. Based on the explanation above, a study on the application of Lesson Study to improve the quality of science learning was conducted, which was integrated with the live worksheet-based E- student worksheets.

METHOD

On January 11, 2023, the Lesson Study was carried out. This research used a sampling technique, namely purposive sampling. Model teachers carried out the lesson study in VIII-H with 23 students on the topic of Pascal's law using liveworksheet-based learning tools and E- student worksheets. Lesson study

implementation takes three hours of lessons (3x40 minutes). Lesson study carried out to make student learning more meaningful. The application of lesson study in classroom learning is carried out in three stages: the "plan" stage, the "do" stage, and the "see" stage (reflection). Before class learning begins, the "plan" stage is completed to discuss all learning tools provided during learning with lecturers and lesson study team members. The "do" stage occurs when the teacher provides learning in class and is accompanied by observer activities. Finally, after the lesson, the "see" stage is carried out, which consists of reflection activities from observers who follow the course of learning and from students. Students will receive a separate reflection sheet as data for researchers at the end of the lesson.

RESULT AND DISCUSSION

The teacher uses the guided inquiry model as a learning model for implementing Lesson Study. Guided inquiry is a learning model that can make students active and make learning student-centered. The guided inquiry model is a learning model that, in the teaching and learning process, asks more questions that lead to learning material and the process of discovery by the students. The teacher's activities before, during, and after learning to correspond to the stages of the lesson study, namely: (1) plan, (2) do, and (3) see (observation and reflection). The following is a description of the activities performed by the teacher.

Plan

The "plan" stage is planning the learning activities with the supervisor and the Lesson Study team through a consultation session. The consultation activities gave input, improvements, and suggestions for the lesson plan designed by the model teacher. According to (Widiyantoro & Wahyuni, 2020), the

learning process is a planned activity organized by the teacher so that students can learn and achieve the expected competencies. As a result, before beginning to teach, the teacher must develop a learning plan. According to (Rayuni, 2010), planning learning activities is the teacher's effort in preparing learning designs that include

objectives, materials, tools, media, approaches, strategies, and evaluations that will be used as learning guidelines. Learning to plan is critical because it serves as a guideline and standard in pursuing goals.

Planning with lecturers and teachers on lesson plans is documented in Figure 1.



Figure 1 Planning with lecture and teacher about lesson plan

This study's "plan" stage includes preparing learning instruments from lesson plans, teaching materials, learning media, assessment instruments, student worksheets, and other non-technical matters. From the "plan" stage, learning implementation plans and other valid instruments are obtained that can be applied in the classroom.

Do

The "Do" stage carried out in the classroom is documented in Figure 2.



Figure 2 The "Do" stage executed in the classroom

The Do stage is divided into four sections: (1) introduction, (2) core activities, (3) closure, and (4) reflection

and observation. Each stage of the learning implementation is described below.

Introduction

The teacher gave students an apperception during the introduction stage. Then students were directed to make hypotheses about the topic of learning that was being carried out at the time, namely the hypothesis about Pascal's law. The teacher's perception guides students' hypothesis-development process. This lesson's perception is of car washes that use the working principle of a hydraulic pump. Apperception is critical in the implementation of learning. According to (Saidufin, 2015), learning will be successful if it begins with an understanding of what will be taught. Understanding perception is important when a teacher needs to relate students' real-world experiences to the learning process. Pascal's law is used in various contexts, including car washes and automotive repair shops that use hydraulic jacks. Using these two examples, students can get a clear picture

of Pascal's Law principles from real-life examples.

Core activities

The core activity in this Lesson study is the implementation of the liveworksheet-

based E-student worksheets experiments on Pascal's law. The implementation of learning using the guided inquiry model with syntax can be seen in Figure 3.

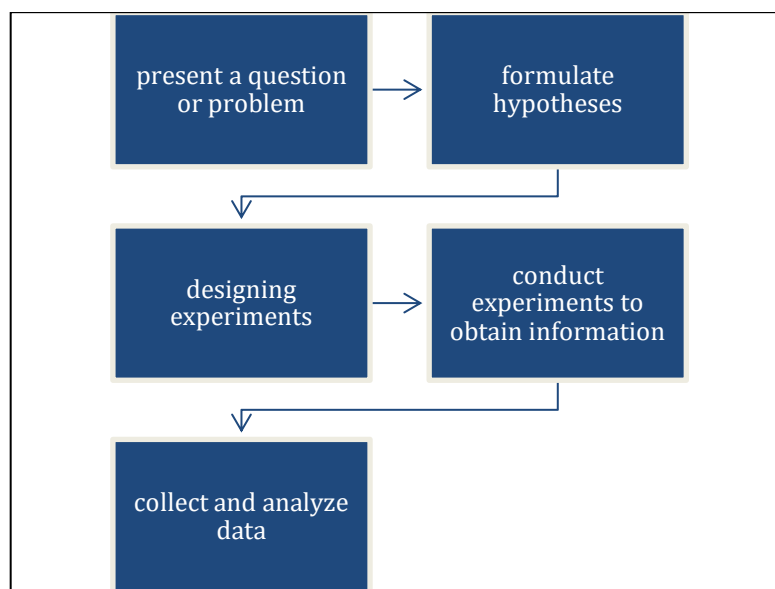


Figure 3 The syntax of the guided inquiry model
Modified from (Astuti & Setiawan, 2013)

The experiment simply demonstrates Pascal's law principles using a hose filled with water and a syringe at each end. After students complete the E-student worksheets, one student from each group will come forward to present the results of their research. Students carry out experiments with Pascal's law documented in Figure 4.

Closure

In this activity, the teacher reinforces material related to their experiments and material related to Pascal's law to students. Cognitive reinforcement is used in the final stage of reinforcement. Cognitive is a domain that focuses on developing intellectual abilities and skills (Degeng 1989 in Abidin & Praherdhiono (2019). Bloom divides the cognitive domain into six levels in his taxonomy: remembering, understanding, applying, analyzing, evaluating, and synthesizing. The teacher's reinforcement in the closure stage is at the level of comprehension and application. The student's understanding of reinforcement is based on experimental results and what factors cause these results to vary, as well as reinforcing the understanding that students have not mastered, namely the application of Pascal's law calculations.



Figure 4 Students experimenting with Pascal's law

See (reflection and observation)

Discussion and evaluation with lectures about the learning process is documented in Figure 5.



Figure 5 Discussion and evaluation with a lecture about the learning process

The observer and the model teacher observe the learning activities at the "See" stage (observation and reflection). The model teacher then describes the findings and learning outcomes that are achieved based on the lesson plans that have been prepared. Reflection is not only done by teachers but also by students. A Google Form collects student reflections at the end of their learning. Reflection activities are conducted to improve future learning. Table 1 displays the findings of the observer's notes on the model teacher's implementation of learning.

Table 1 Learning observation results

Learning Activities	Observation results	
	Yes/No	Comments:
1. Are there students who do not pay attention to the learning process?	Yes	Observer 1: <i>Some students focus on their activities.</i>
	Yes	Observer 2: <i>Some students chatted with other group members instead during the experiment</i>
2. Do students ask questions to the teacher or fellow students?	Yes	Observer 1: <i>When students have difficulty understanding the E-LKPD, students ask questions</i>
	Yes	Observer 2: <i>When students experience experiment difficulties, they ask the teacher.</i>
3. Do students answer questions from the teacher or other students?	Yes	Observer 1: <i>When the teacher asks a question, the students answer it</i>
	Yes	Observer 2: <i>Students answer questions, especially on apperception and discussion</i>
4. Do students work together with other students to solve problems?	Yes	Observer 1: <i>All students work together with one another to complete work on E-LKPD</i>
	Yes	Observer 2: <i>Especially when conducting experiments and discussing completing experiments.</i>
5. Are students pressured to participate in learning?	No	Observer 1: <i>Students appear relaxed but serious in participating in learning activities</i>
	No	Observer 2: <i>Students look happy during learning</i>

Learning Activities	Observation results	
	Yes/No	Comments:
6. Do students seem happy in following the lesson?	Yes	Observer 1: <i>Because students are actively involved in the learning process with interesting activities</i>
	Yes	Observer 2: <i>Students are enthusiastic about following and conducting experiments</i>
7. Is there material that is difficult for students to understand?	Yes	Observer 1: <i>Material related to the calculation of Pascal's law</i>
	yes	Observer 2: <i>Especially related to the calculation of Pascal's law</i>
8. Has the teacher carried out his role according to the plan?	Yes	Observer 1: <i>The teacher has carried out learning according to the planning and syntax of learning</i>
	Yes	Observer 2: <i>Implementation of learning is done following the plan</i>
9. Is the method used by the teacher appropriate?	Yes	Observer 1: <i>The method used is appropriate using a variety of learning methods</i>
	Yes	Observer 2: <i>Teachers use a variety of methods so that learning is fun</i>
10. Were the overall learning objectives achieved following the plan?	Yes	Observer 1: <i>Learning objectives have been achieved</i>
	Yes	Observer 2: <i>The learning objectives have been achieved according to planning.</i>

Based on the observer's notes in Table 1. It can be said that learning in the Lesson study has been going well and is interactive. Students seemed enthusiastic about following the lesson and experimenting with the principle of a hydraulic pump using a syringe and a plastic hose. This is consistent with the (Subiantoro, 2010) notion that the science learning process should emphasize providing direct experience to develop competence in scientifically exploring and understanding nature. Science education focuses on the process of inquiry and practice to help students gain a deeper understanding of the natural world around them. Students can gain meaningful experiences from experimental activities based on Pascal's law that simulate the operation of a hydraulic pump, as shown in Figure 6.



Figure 6 Experiment process carried out by students

The teacher has carried out learning according to the planned and used the right and fun method for students. This is shown by the observer's statement that, during the implementation of learning, the students did not feel pressured and were relaxed but serious about participating in the experiment. Students actively ask the teacher questions when working on the E-student worksheets or conducting experiments. Students can answer questions from the teacher during

apperception activities and discussions with other groups. Overall, the learning objectives in the class taught by the model teacher in Lesson Study activities have been achieved. However, some sub-chapters are still difficult for students to understand, namely regarding the calculation of Pascal's law.

The distribution of cognitive assessment results obtained by students is shown in Figure 7.

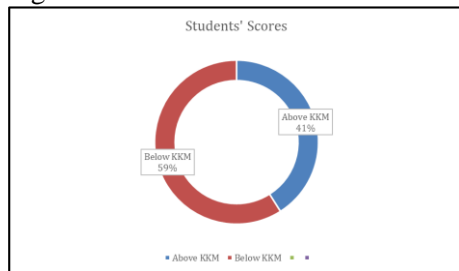


Figure 7 Graph of students' cognitive scores

Based on the graph above, it is known that as many as 41% of students get scores above the standard passing score, while as many as 59% of students get scores below. According to the findings of the observations, many students still did not pay attention and did not properly follow the learning process. Some students concentrated on their activities, while others conversed with other groups during the experiment. Based on the results of research conducted by Bariroh (2013), students' attitudes during learning affect the completeness of their learning outcomes. Students who demonstrate an active attitude toward learning and perform activities well outperform those who are inactive in class. This explains the possibility that many students who have not achieved a completeness score are not paying serious attention when the teacher gives understanding reinforcement. However, this is only one possibility. Observation results show that students follow the learning well in the early stages and implementation of the experiment. Students may lose focus

after the presentation stage because they feel their work is done.

Another finding is that most students have difficulty solving problems involving calculations and Pascal's law equations, as observed by the observer. According to Sarahudin and Wahab (2019) in (Gusal et al., 2021), some science topics frequently show learning outcomes under the passing grade standard score are related to physics.

In this study case, some students in classes VIII-H can correctly write cases, equations, and calculations involving Pascal's law as shown in Figure 8.

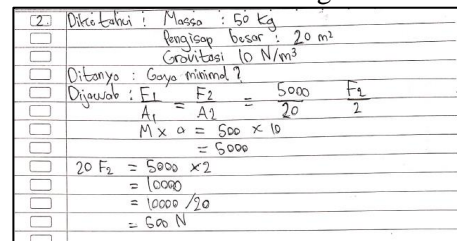


Figure 8 Results of students' problem solving

Student work in Figure 4 shows that students already understand using Pascal's equation in Figure 9.

$$\frac{F_1}{A_1} = \frac{F_2}{A_2}$$

Figure 9 Pascal's equation

Students understand the concept of force as the product of the mass of an object (m) and the acceleration of gravity (g). However, students made a mistake in determining the correct unit of gravitational acceleration, students wrote the unit of gravitational acceleration as N/m³, where the acceleration of gravity should have units of m/s². This shows the need for more reinforcement by the model teacher on material still difficult for students to understand after the core learning is finished; in this case, the calculation material using Pascal's equations.

Students' low mathematical communication skills while carrying out science learning could be one of the factors causing them to continue to struggle. According to Ariawan & Nufus (2017), students with poor mathematical communication skills struggle to communicate the mathematical ideas in their mind. Students will have difficulty communicating their ideas about the use of equations in science learning. As a result, reinforcement of material involving mathematical calculations and equations must prioritize the development of the students' own mathematical abilities.

CONCLUSION

The lesson study in class VIII is divided into three stages: plan, do, and see. According to the observation sheet, learning in the lesson study is going well and is interactive. Students appeared to be enthusiastic about learning and conducting experiments. The teacher followed the lesson plan and used the most appropriate and enjoyable method for the students. Students are also actively asking the teacher questions if they are having difficulty working on the e-student worksheets and carrying out the experiment.

The cognitive assessment results in Class VIII-H using the liveworksheet-based e-student worksheets revealed that 41% of students scored above the passing grade score, while 59% scored below. Several factors contributed to many students scoring below the passing grade. These factors include students' still-negative attitudes toward learning and students' continued difficulty working on calculations-related questions. The number of student errors in working on questions in the form of calculations demonstrates this. The teacher still needs to provide clearer reinforcement for the calculation in Pascal's law so that students understand the topic.

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