Improving the Quality of Mathematics Learning in Elementary Schools through Lesson Study Using a Scientific Approach

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Abstract. The quality of learning in the classroom is inseparable from the ability of a teacher to implement his knowledge in the learning process. Various strategies, methods, and approaches have been carried out to improve the quality of learning. One of the efforts made by the government is to change the learning approach that was originally teacher-centered to student-centered, the approach in question is scientific. This study tries to explore the implementation of lesson study using a scientific approach to improve the quality of mathematics learning in elementary schools. This research was conducted in an elementary school in Purwakarta. Based on the results of the study it was found that lesson study is an effective way to improve the quality of mathematics learning in elementary schools. the use of a scientific approach also has an impact on learning activities with five stages of scientific thinking, namely observing, asking, trying, reasoning, and communicating to stimulate students to be active and think critically.

Keywords: Lesson Study, Scientific Approach, Mathematics In Elementary School.

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INTRODUCTION ~ The low learning outcomes of students are influenced by several factors, one of which is the teacher's teaching method that is not appropriate or optimal. This is supported by Mulyasa (Sutardi & Sugiharsono, 2016), who argues that teaching skills are quite complex professional competencies, as an integration of various teacher competencies as a whole and comprehensively.

Effective and efficient learning cannot be separated from the abilities and skills of a teacher, how he can implement his knowledge in the process of educative interaction, the steady use of teaching methods, class management, and class management, optimizing the situation and conditions of the ongoing teaching and learning process to the use of learning media. (Sartika, Dahlan, & Waspada, 2018). Ikhsanuddin in(Yurizki, Murniati, & Nur, 2018) mention if The teacher is the spearhead of determining the success of education.

According to BNSP in (Sedyawati, 2010), an appropriate educational model at this time will be realized if there is a shift in the mindset and pattern of action in various contexts of the implementation of the education and teaching process. Shifting the procedures for organizing educational and learning activities in the classroom or the environment around educational institutions where students gain knowledge. The shift includes the learning process from teacher-centered to student-centered. This is following learning according to the 2013 Curriculum which emphasizes student-centeredness. In this context, the teacher acts as a resource person/facilitator, organizes/directs learning activities, provides feedback, provides

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explanations, and so on(Mahmudi, 2015). The appropriate approach to achieve this goal is scientific. In the scientific approach there are several stages/activities, namely: Observing, Questioning, Associating/reasoning, Experimenting, and Presenting /Communicating (Fadhilaturrahmi, 2017). The scientific approach can make students active and enthusiastic, able to solve problems, not easily feel bored, and can create an optimal learning atmosphere. (PPSD Study Program PGSD FIP UNIMED & Karo-Karo, 2016)

Several problems occur when implementing learning with the 2013 curriculum according to (Oktaviani, Pd, Wulandari, & Pd, tt), one of which is related to teacher competence, namely teachers are less ready to follow changes in the classroom management process in the 2013 curriculum, lack of teacher skills in developing student skills, and teachers feel burdened with many assessment tools.

To determine the competence of teachers in teaching and the effectiveness of learning activities in the classroom, one of them can be through "lesson study" activities, namely learning about and from learning.

The concept and practice of Lesson Study were first developed by elementary education teachers in Japan, which in Japanese is called kenkyuu jugyo. Sumar Hendayana in(Rozak & Fauziah, 2013) *mention that* Lesson study is a model of coaching (training) the teaching profession through collaborative and sustainable learning assessments based on the principles of collegiality and mutual learning to build a learning community. other than that(Stigler & Hiebert, 2003)said that: Lesson study is a collaborative process in a group of teachers when identifying learning problems, designing a learning scenario (which includes activities to find books and articles on the topic to be taught); teaching students according to scenarios (one teacher carries out learning while the other observes), evaluates and revises learning scenarios, re-learns revised learning scenarios, re-evaluates learning and shares the results with other teachers (disseminates). Meanwhile,(Lewis, Friedkin, Emerson, Henn, & Goldsmith, 2019)states that: "lesson study is a simple idea. If you want to improve instruction, what could be more obvious than collaborating with fellow teachers to plan, observe, and reflect on lessons? While it may be a simple idea, lesson study is a complex process, supported by collaborative goal setting, careful data collection on student learning, and protocols that enable productive discussion of difficult issues".

Lewis & Hurd's (Copriady, 2013) revealed that the application of Lesson Study as an approach and initiative is effective in improving the capacity and professionalism of teachers.

Based on the opinions of several experts, this study aims to examine improving the quality of learning, especially mathematics in elementary schools, using a scientific approach through lesson study activities.

METHOD

The research method used is action research with stages 1). Plan 2). Do, 3). See, and 4). Act. The research was carried out in class IV A SD IT Cendekia Purwakarta with a total of 22 students

participating in the study. The selection of schools was based on the current COVID-19 pandemic situation which resulted in learning to be carried out online so that the research was carried out in schools where students were accustomed to using online learning using zoom meetings. Spires, Pau, & Kerkhoff in(Apsari, Wulandari, Lu'luilmaknun, & Salsabila, 2021)The ability to use digital communication media for teachers and students is needed so that teachers and students can apply the media correctly, responsibly, and efficiently. This statement is reinforced by(Munadhiroh & Mawarsari, 2020) which states "to increase the effectiveness of its implementation, online learning must be supported by adequate infrastructure, network strength, internet quota packages, and IT mastery.

The research data was taken from the recording of the learning implementation, observation and reflection sheets, as well as student learning outcomes tests. The learning process during the zoom meeting was recorded for further analysis purposes. After the implementation of the Teaching and Learning Activities, a discussion was held between the teacher and the observers. During reflection, the learning video recording is shown again to the teacher so that they can reflect on the lesson study activities that have been carried out. Reflection activities are directed at the teacher's perception of their ideas/views in carrying out learning and the benefits felt by the teacher on the lesson study activities that have been implemented.

The instruments used in this study were: 1. Observation sheets to observe the pedagogic and professional competencies shown by the teacher in the learning process. 2. Reflection sheet to analyze the teacher's views after participating in lesson study activities and their understanding of the implementation and benefits of lesson study that has been carried out. 3. Specific guidelines for analyzing learning videos. 4. The test device is in the form of worksheets to measure the improvement in the quality of learning outcomes.

RESULTS

1). Learning Planning (Plan)

The lesson study planning stage consists of several activities, namely: coordinating with the school where the lesson study is being carried out, selecting the class that is the object of research, determining the material to be delivered, determining the implementation time, compiling observation and reflection sheets, preparing learning implementation plans, making media learning, as well as making worksheets.

The preparation of learning tools is done collaboratively by the teacher. This lesson study activity is carried out by a team consisting of 1 teacher, 4 observers, and one supervisor. In the discussion, it was agreed that the lesson carried out in the lesson study activity was mathematics in grade IV with the main subject of statistics (reading and interpreting data). Group discussion activities begin with reviewing the syllabus according to the material to be delivered, determining basic competencies and compiling indicators of competency achievement, then preparing lesson plans, worksheets, and learning activity observation sheets. Through this group activity, learning components for mathematics were obtained. Assessment

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of the components of the lesson plan like this is rarely or never done by teachers in general.

In lesson study, the set of components of this lesson plan was then revised and completed by the team after being given suggestions and input from lecturers and colleagues. In the planning stage, there were several revisions made, namely in the core learning activities contained in the lesson plans and revisions to the questions in the worksheet. Observation sheets were also compiled collaboratively through discussion. Observation sheets are arranged not only to observe teacher activities in teaching but also student activities during learning activities. At the planning stage, a division of tasks was also carried out for the observers, where each observer had to observe 5-6 students.

2). Implementation of lesson study (Do)

Lesson study activities will be held on Wednesday, April 7, 2021, online using the Zoom Meeting application. The selected basic competencies are 3.1 Explaining student self-data and their environment presented in the form of bar charts 4.1 Collecting data on students and their environment and presenting it in the form of bar charts and indicators of competency achievement: 3.1.1 Explaining data presented in mathematical representations in the form of a table. 4.1.1 Interpreting the data presented in a mathematical representation in the form of a table. 4.1.2 Presenting data into a mathematical representation in the form of a table.

The following is a description of the lesson study activities that have been carried out. In general, the learning activities are carried out to attract the attention of students, encourage students to study seriously and think critically. Learning begins with a greeting from the teacher, followed by reading a prayer together led by one of the students. At the beginning of the lesson, the teacher makes an apperception by linking the material to be delivered with the current events, namely covid 19. This encourages the enthusiasm of students to start learning activities. the teacher succeeded in linking learning to the context of everyday life, namely by linking data regarding the covid 19 case with statistical material, which incidentally is material that learns about how to collect, process, and present data.

Entering the core activity, the teacher starts the activity by observing, the teacher presents the data on PowerPoint and asks students to observe the data presented (observing process). Then the teacher and students ask questions about the data that has been observed. After asking questions, the teacher asks students to observe the table. Here some students ask questions about how to present data in tables (the process of asking). To make learning activities more interactive, the teacher invites students to jointly present data into tables (trial process). At this stage, the teacher guides students to try to present data in tables. Students seem enthusiastic and able to answer questions asked by the teacher even though there are students who make mistakes when reading the tour. The teacher tries to explain again how to write and read turus. The activity of presenting data into tables takes quite a long time, but this is intended so that students

understand how to present data into tables.

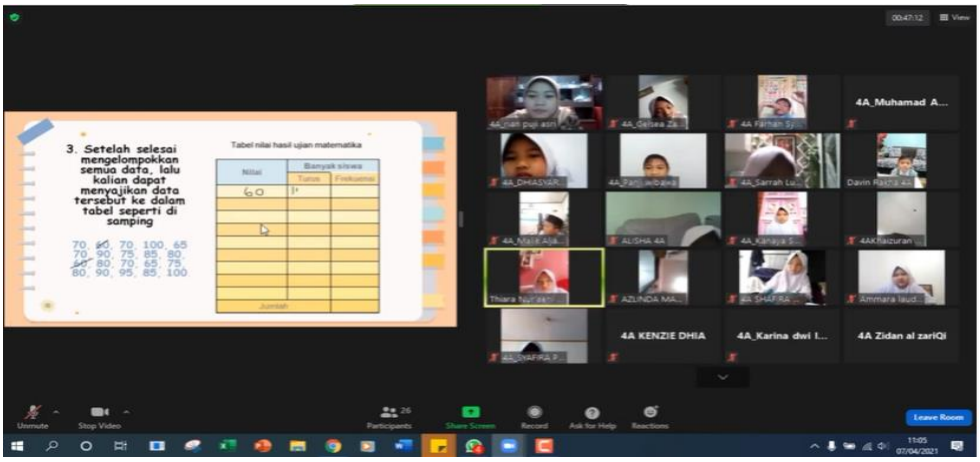

Figure 1: Implementing online lesson study

After the data has been entered into the table, the teacher guides the students to read and interpret the data (reasoning). The teacher asks several students questions about the data in the table. Here, the teacher tries to ask students who turn off the camera to check whether the students are still following the lesson or not. After being called, the student concerned is present and answers the teacher's questions.

At the end of the lesson, the teacher gives worksheets containing description questions related to the material that has been delivered. At this stage, students try themselves to solve problems related to statistics. Students work on the worksheets seriously and try to ask questions when there are questions that they do not understand. When working on worksheets students actively interact with other students even though learning takes place online. After all, have finished working on the worksheets, students send their answers to the class group WhatsApp to be corrected by the teacher (communicating process). The results of the evaluation are also an indicator of the success of teachers in teaching in lesson study activities that have been carried out.

When students are still working on the worksheet, the teacher seems to be in a hurry to ask students to finish their assignments immediately. This is because the time has exceeded the predetermined plan. This time limitation resulted in the teacher not having time to discuss the questions that had been given, not making conclusions, and reflecting at the end of the lesson.

3). Reflection (see)

The next stage that must be done in lesson study activities is reflection. In the reflection stage, the model teacher conveys a reflection of the results of the learning activities that have been carried out. The reflection is based on the strengths and weaknesses felt during the learning process and from the results of the corrected student evaluations. Based on the reflection of the model teacher, overall lesson study activities went

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smoothly and there were no significant obstacles. The model teacher appreciates students who are active and critical during the learning process so that the interaction between teachers and students is very intense. The model teacher also appreciates other team members as observers who observe the activities of teachers and students during the learning process.

There are several things that the model teacher notes from the reflection results, namely: time that exceeds the predetermined plan, not all students get attention during learning activities so that in the recorded video it can be seen that there are some students who are less focused on paying attention and there are also students which turn off the camera, besides that there are questions in the worksheet whose editorials are difficult for students to understand so that many students do not understand the meaning of the question. Based on the results of the evaluation, some students made mistakes in writing turus.

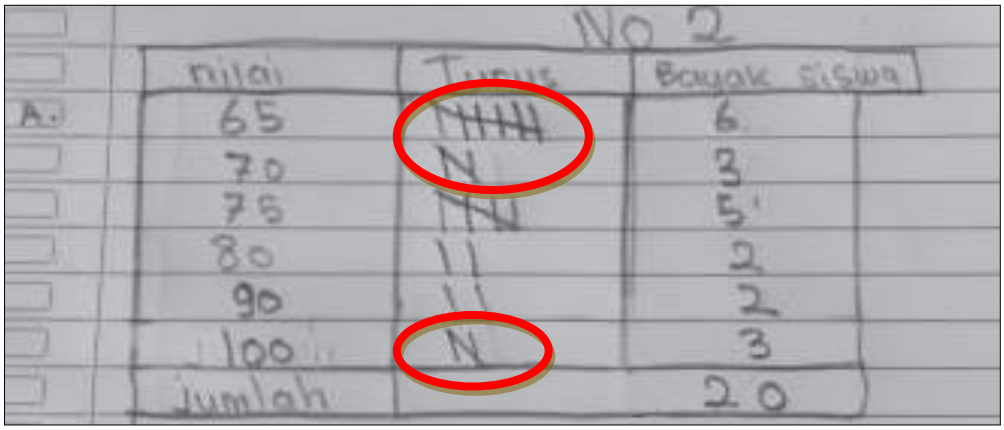

Figure 2. Example of student work

In addition to the model teacher, the observers also conveyed their observations on the lesson study activities that had been implemented. The results of these observations are both in terms of teacher teaching activities and terms of student activities during learning. Here, the observers conveyed the strengths and weaknesses they observed during the learning process.

Based on the observations of the observers, in general, the learning went well. Students are active and earnest in participating in learning. The students seemed enthusiastic because of the communicative role of the teacher. According to the observers, students seemed happy to follow the lesson because the teacher was able to create a pleasant learning atmosphere by inserting a little humor.

According to the observer, the model teacher has carried out learning following the stages in the scientific approach, namely observing, asking, trying, reasoning, and communicating. However, even though at the time of learning there were many question and answer activities, the teacher still did not train the students' reasoning skills because there

were still many parts of the material explained through the lecture method by the teacher. In addition, the lack of time management makes some activities undeliverable, such as conclusions and reflections. The limitations of the teacher are paying attention to all students during learning also causes not all students to get the attention of the teacher so that there are students who do not focus and turn off the camera. Observations are also focused on the difficulty of students to understand the meaning of the questions in the worksheet.

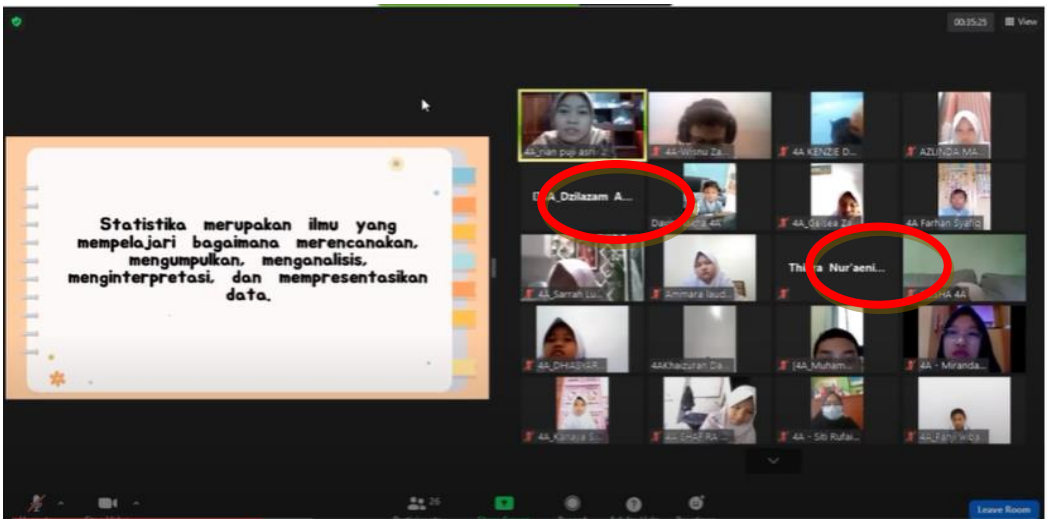

Figure 3. Some of the students turn off the camera

4). Follow-up stage (act)

From all lesson study activities that have been carried out, it can be concluded that lesson study activities using a scientific approach can improve the quality of mathematics learning in elementary schools. This is evidenced by active and critical students who follow the learning process. The results of the learning evaluation also showed that more than 75% of the students' scores reached the minimum criteria of mastery learning. This is certainly inseparable from the teamwork involved in this lesson study activity. All findings from observations from lesson study activities that have been carried out can be a source of valuable experience for both model teachers and observers involved in improving the quality of learning in the future.

Based on the results of reflection, several things are used as evaluations as improvements in the future, including time management so that at other times learning can be following the specified plan, minimizing the lecture method to train students to think critically and improve reasoning abilities, teachers must pay more attention to all students so that all students focus on learning activities, as well as making evaluation questions oriented to higher-order thinking skills (HOTS) but not with editorials that are difficult for students to understand. All evaluation results are used as material for future improvements to improve the quality of learning.

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DISCUSSION

Lesson study activities carried out at SD IT Cendekia Purwakarta consist of planning, implementation, reflection, and follow-up stages. This is following what was expressed by Slamet Mulyana in (Rochayati & Zakaria, 2010) with the concept of Plan-Do-Check-Act (PDCA) in the implementation of lesson study with details of activities as follows:

Planning Phase (Plan)

In the planning stage, all team members collaborate to develop a lesson plan. Planning begins with analyzing the needs and problems faced in learning, such as basic competencies and how to teach students so that real conditions can be known that will be used for learning purposes.

Implementation Stage (Do)

There are two main activities carried out at the implementation stage, namely: (1) learning implementation activities carried out by model teachers to practice the lesson plans that have been prepared together, and (2) observation activities carried out by other Lesson Study team members by paying attention to several things. , including a). The model teacher carries out learning following the lesson plans that have been prepared together. b). students are strived to undergo the learning process in a reasonable and natural setting,c). During learning activities, observers are not allowed to interfere with the course of learning activities and interfere with the concentration of teachers and students. d). Observers make careful observations of the interactions of students-students, students-teaching materials, students-teachers, students-other environments, using observational instruments that have been prepared together. e). observers can learn from the ongoing learning and not evaluate the model teacher. f). Observers recorded learning activities for documentation and further analysis materials and recording activities did not interfere with the learning process. g). Observers make notes about the learning behavior of students during the learning takes place.

Reflection Stage (See)

Reflection activities are carried out in the form of discussions which are attended by all Lesson Study participants where our team is guided by an expert lecturer in the field of education. The discussion started by conveying the impressions of the model teacher on the learning process he was doing. Furthermore, all observers submit comments or suggestions wisely and openly to the learning process that has been implemented. Responses or suggestions from observers are supported by evidence obtained from observations. Various discussions that developed in the discussion were used as feedback for all participants for the benefit of improving and improving the learning process in the future.

Follow Up Stages (Act)

From the reflection results obtained several new knowledge for improvement and improvement of the learning process. Various valuable findings and inputs presented during the discussion in the reflection stage (check) became evaluation material for the teachers/participants involved, both

acting as model teachers and observers to develop the learning process in a better direction.

In general, lesson study activities carried out at SD IT Cendekia Purwakarta run following the lesson study implementation guidelines. Starting from the planning stage, where all participants collaboratively design all the components of learning tools needed for lesson study activities ranging from lesson plans, worksheets, learning media, teaching materials, to observation sheets. At the implementation stage, all participants showed high dedication for the successful implementation of lesson study, this was evidenced by the model teachers who tried their best to show their best performance in teaching and the observers who observed the learning activities that took place with a focus on the observation points compiled, in line with what was expressed by Djamilah in(Nurhayati & Damayanti, 2018), things that need to be focused on when observing include the accuracy of time predictions, class management, implementation of the syllabus, student activities, and achievement of goals for each stage of learning activities.

In the reflection stage, all participants, starting from the model teacher and observer, openly conveyed messages and impressions, strengths and weaknesses encountered during the lesson study activities. Reflection also includes weaknesses in the components of the learning tools that have been prepared and the results of student evaluations at the end of the lesson. Said by Lewis & Hurd in (Widayati, 2018)that the expression of facts in the observation is not directed at judging or criticizing the model teacher, but focuses on learning activities. Here the model teacher graciously accepts all criticism and suggestions from other participants. Furthermore, the results of the reflection of all participants are accommodated as follow-up materials to improve the quality of learning in the future.

According to Cerbin & Bryan (Rahayu, Mulyani, & Miswadi, 2012)Lesson study activities aim to improve teacher professionalism through improving teaching methods and increasing knowledge so that Lesson study can be an effective way to improve the quality of mathematics learning. However, the success of lesson study cannot be achieved in a short time and is not the result of individual efforts, because the success of lesson study is the achievement of the results of a collaborative process of many parties, especially among teachers, principals, and other parties who have the same interests. in improving the quality of education, which is carried out on an ongoing basis. The sincerity of determination, openness, and togetherness of all collaborating parties will determine lesson study activities(Herman, 2012).

Another factor that determines the success of lesson study is the activeness of students in participating in learning. Here, the pedagogic competence of the model teacher in creating interactive learning is needed to liven up the atmosphere in the classroom. The teacher's ability to apply the right learning approach is also an important factor to stimulate students to be active and think critically. Optimization of all these factors can ultimately improve the quality of learning. (Herman,

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2012)revealed that several stages of activities carried out in lesson study in the form of planning and preparation of learning (plan), implementation of learning (do), and learning reflection (see) are a series of activities that are usually carried out by teachers in their daily lives. However, behind it all, there is something that teachers do not usually do, namely working collaboratively. According to Haithcock (Nursafitri, 2015), Lesson Study helps define strategies and best practices and builds capacity as it encourages peer-to-peer relationships and collaboration.

The advantages of lesson study activities are how the activities that are usually carried out by the teacher are studied, elaborated, and developed to produce a learning activity that is of higher quality than the previous activity. A learning activity that is carefully planned and prepared, its implementation is evaluated and reflected, will certainly result in a better quality of learning. Lesson study activities show that the teacher's ability to plan and implement learning becomes better following the demands of the curriculum.

The results of the lesson study activities that have been carried out at SD IT Cendekia Purwakarta use a process assessment by analyzing the results of learning video recordings. Based on the evaluation of this process, the results of the study indicate that lesson study is perceived as an activity that can improve the pedagogic and professional competence of teachers. In line with what Podhorsky & Moore stated in(Prihantoro, 2011) Lesson Study provides a way for teachers to be able to improve learning system so that this activity needs to be continued continuously to continue to develop teacher competencies as learning agents so that they can carry out the learning process as well as possible, within the framework of educational development. (Nurdianti, 2017)

CONCLUSION

The quality of learning in the classroom is inseparable from the pedagogic and professional competence of teachers. The combination of the scientific approach implemented through lesson study activities can be an effective way to improve the quality of mathematics learning in elementary schools because the scientific approach is a student-centered approach that encourages students to be active and think critically in participating in learning. Based on the results of the lesson study activities that have been carried out at SD IT Cendekia Purwakarta, it can be concluded that Lesson study can improve the pedagogic and professional competence of teachers and encourage the formation of a learning community for teachers who collaboratively strive to improve the quality of learning with the principle of collegiality so that Lesson study activities are deemed necessary. to be continued on an ongoing basis with the cooperation of all parties involved so that it can be carried out properly so that the learning carried out by teachers in the classroom can be optimized to improve the quality of learning

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