RESEARCH ARTICLE

Developing prospective teachers' science-task knowledge and practice through lesson study

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Abstract: Science learned requires constructivist experiences so that students could learnt to discover and conclude. However, today's learned challenges were increasing along with the diversity of students and interests. The aimed of this researched was to increase the knowledge and practiced of prospective science teachers in didactic practiced through lesson studied activities. Didactic knowledge and practiced includes aspects of knowledge in preparing student assignments and analyzing student learned difficulties. Apart from that, updating student competency achievements as a curriculum requirement was also a challenged for prospective teachers. This researched was a qualitative studied that conducted researched on the lesson studied group of prospective teachers consisting of two groups totaling eleven prospective teachers. Data collection was carried out through direct group observation, semi-structured interviews, and participant observation. The results of the implementation of the lesson studied project revealed the stages of science learned through the preparation of various learned ideas, the preparation of structured learned paths by thinking about the future, thinking about the process of student collaboration and the learned process. Constructed science concepts to determine objective learned outcomes. The results of this researched revealed how teams of prospective teachers collaborate in lesson studied learned and did things that built and support the team in achieving common goals.

Keywords: observation; prospective teacher; student task; science learning

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Article history:
Received: 21 September 2023
Revised: 5 January 2024
Accepted: 14 January 2024
Published: 18 January 2024

10.22219/jpbi.v10i1.29332

p-ISSN: 2442-3750
e-ISSN: 2537-6204

How to cite:
Istikomayanti, Y., Mitasari, Z., Lathifah, A. S., Mashuri, M., & Desy, P. (2024). Developing prospective teachers' science-task knowledge and practice through lesson study. *JPBI (Jurnal Pendidikan Biologi Indonesia), 10*(1), 1-11. https://doi.org/10.22219/jpbi.v10i1.29332

Introduction

Teaching is something complex and requires preparation. The first lesson experiences delivered by prospective teacher students provide more explanations of material rather than connecting the material with the students' prior knowledge. This is important for teacher training institutions, to develop prospective teachers who have low self-efficacy. Therefore, it is necessary for research the curricula education of prospective teachers (Flores, 2020; Gkioka, 2019) and involve collaboration with schools (Saito et al., 2020) as an effort to develop the competency of prospective teachers. The results of previous research (Lathifah et al., 2021) show that prospective teacher students' efficacy in implementing student-centered learning at a sufficient level. So, it is important to improve self-efficacy of prospective teachers especially in providing student-centered learning.

Student-centered learning is a constructivist philosophy that supports students to be more active during study. The learning process of students with diverse learning styles requires a variety of stimuli from the surrounding environment. The Indonesian government in the Ministry of Research, Technology and Higher Education conveys the existence of differentiated learning. Differentiated learning gives freedom to students to learn according to their learning style or character tendencies and talents. Several

government programs through *Sekolah Merdeka*, *Guru Penggerak* and special independent learning programs provide freedom of learning to students according to the student development phase.

The learning plan contained in lesson plans documents until mostly included teacher plans and learning strategies (Nguyen et al., 2023; Smith et al., 2023). Meanwhile, the student learning process is less considering in general lesson plan and not specific exploring of students thinking in the class. Thus, teachers and prospective teacher's skills are needed to develop more in didactical planning.

Didactic planning places more emphasis on teacher-student interaction activity plans as well as student interaction with media and learning tasks. Through learning assignments students will be given the opportunity to solve problems according to their representation, and build concepts from the findings they do (Nilsson, 2008; Nilsson & Karlsson, 2019; Handoko et al., 2019; Kumar Shah, 2019; Rasmuin & Ilmi, 2021). Students do exploration in their assignments so students can be involved in more meaningful learning (Schussler et al., 2015). However, the selection of student exploratory learning activities is still rarely arranged and is a challenge for teachers and prospective teachers in preparing challenging learning (Nilsson, 2008; Nilsson 2022).

Some of the trainings that are often held by the education office and other educational institutions have not had enough impact on changing student-centered learning strategies. Previous research stated teacher's belief (Lathifah et al., 2021), changing the teacher's mindset towards student freedom in learning is something that is difficult to change. Most of the teachers still entrust themselves as teachers who provide primary knowledge and students as listeners and writers (Smith et al., 2023; Yakar & Turgut, 2017; Istikomayanti, et al., 2019; Lathifah et al., 2021). This is appropriate with several generations before. However, by analyzing current students millennial characters there is a change in the way students think nowadays to be faster and tend to build knowledge. Students are more willing to do experiments, make their own experiments, and also concretize more abstract matters.

Several activities that were felt to have sufficient impact on prospective teachers in this study chose lesson study activities (Durdu & Dag, 2017; Gomes et al., 2022; Nurmatin & Rustaman, 2016; Saito, 2023). Lesson study is an activity for the professional development of teachers and also prospective teachers through a collaborative process (Budiyanto et al., 2021; Miharja et al., 2020). Collaboration that is carried out is a joint practice of planning learning. The planning that is prepared includes predicting the expected achievements after students learn and with a backward step planning previous activities to reach the next stage. This method is known as future mapping (Phillips, 1996) which is adapted in learning design.

Professional development is not a static thing according to presented teachers' professional development demonstrates the timeless, dialectic, dynamic and socio-historical nature of and depends on the initial and continuous teacher education. The perspective of reserachers (Nilsson, 2008; Rauduvaitė et al., 2015; Toto et al., 2021) therefore circumscribes elements that are present in school cultures, such as which professionals relate to each other, how they perceive each other and interact in the professional context, how they make curriculum and didactic decisions. The lesson study team provides an opportunity for each member to learn and take reflection from the observations and discussion processes carried out. Prospective teachers will be more prepared in providing learning because in detail in the lesson plan various predictions of student responses are prepared. Predictions of student responses to teacher questions, assignments in investigations or student discussions are predicted in detail. This stage provides benefits for prospective teachers in the knowledge aspect to prepare lesson plans.

The skills of prospective teachers in lesson study activities are built through the practice of opening classes. The practice of open class is to give model teachers the opportunity to carry out lesson plans and see how students respond to the interactions given. Observers as observers of the learning process also from the element of prospective teachers can be skilled at observing the interactions of students with teachers, students with students, and also the interactions of students with teaching media. Indirectly the skills of prospective teachers as observers are also honed from the didactic aspect.

The purpose of this research is to increase the knowledge and practice of prospective science teachers in didactic practice through lesson study activities. Didactic knowledge and practice (Gomes et al., 2022; Mor et al., 2015; Widjaja et al., 2015) includes aspects of knowledge in preparing student assignments and analyzing student learning difficulties. Several research studies provide analysis on the importance of providing didactic skills. However, there are still few formulations that succeed in providing didactic skills well (Haverly & Davis, 2023). This study can imply how didactic knowledge can be built together with the prospective teacher community which is the learning community. As several studies convey the need for growth of thinking in teachers and prospective teachers, one of them is by practicing self-reflection activities.

The didactic parameters in this research include aspects of preparing student assignments consist of estimates of material or science concepts, wording and questions for students. Aspects of analyzing student learning difficulties consist of previous material concepts students have, common difficulties encountered, triggering questions that support and predictions of student responses. Didactic practice is the practice skills of prospective teacher open classes, observation skills and how to professionally

reflect and appreciate and learn for themselves and their learning community.
Lesson study activities have had several positive impacts on prospective teachers from research (Hidayat, 2019; Lathifah et al., 2021; Saito & Pham, 2019). Seeing this, it can be concluded that the need for a teacher's learning community can be developed from the learning stages as a prospective teacher. The learning community on the didactic aspect is expected to be able to develop various didactic aspects of each of its members. Differences in a variety of teaching techniques is an art, so what is needed is a community that can reward each member's learning activities and challenge its members to develop. All the objectives of these activities are obtained in the lesson study learning community.

Method

This research is a qualitative research that conducts studies on lesson study groups of prospective teachers consisting of two groups with a total of eleven prospective teachers. Lesson study groups conducted in December 2022 and April-May 2023 at MTs Muhammadiyah 1 Malang schools and Sunan Giri Middle School Malang, Malang City, East Java. The first group consisted of six female teacher candidates, and the second group consisted of four female and 1 male teacher candidates. This group also involved class teachers, especially science teachers in each school with 2 years and 10 years of experience. Each of these groups has a shared commitment to help each other in the self-development process, especially in lesson study activities. This group is guided by the researcher as the supervisor who acts as group moderator. Explanation of the lesson study context in this study was carried out in class VII and class VIII students of SMP/MTs on the topic of classification of muscles and movement and the human excretory system. Lesson study stages are carried out by observing the initial condition of the school, the condition of the students and the learning process in the classroom. Several observation activities were carried out at the stage before this study, namely for three months students carried out field practices at school. Field practice activities as an initial initiation to observe and explore student conditions, student interactions and learning strategies that are usually given by class teachers. This field practice activity is very beneficial to prospective teachers to be able to continue on the final project research activities.
Ethics in research, that we give permission to the principal through conveying research objectives and also collecting data as research material. The participant subject appointed is written in pseudonyms.
The stages of this research were carried out through the stages of planning, implementing, observing and reflecting (Saito & Pham, 2019; Yakar & Turgut, 2017). The planning stage is carried out at the beginning to discuss learning planning at several meetings that will be held. Redesign is to improve the initial lesson plan in accordance with the improvements found during implementation. Redesign activities can be carried out simultaneously after the reflection stage which states the next plan.
The didactic parameters of prospective teachers consist of aspects of student's task analysis and student's learning difficulties (Gomes et al., 2022). The aspect of compiling student's task analysis is divided into aspects of predicting material or science concepts, and composing words and triggering questions as well as predicting student responses. The aspect of student learning difficulty analysis consists of students' prior material concepts and difficulties commonly encountered in the material. Didactic practice is the practice skills of prospective teacher open classes, observation skills and how to professionally reflect and appreciate and learn for themselves and their learning community (Durdu & Dag, 2017; Hidayat, 2019; Willermark & Pareto, 2015).

Results and Discussion

Didactic Skill on Student Task Analysis and Learning Difficulties

Lesson Study Group 1 Topic Mechanism of Muscle Action

The findings from the data were consistent with previous studies (Lathifah et al., 2021; Rahmawati et al., 2023). It was supporting that lesson study can function as a model for developing teacher and prospective teacher training and development. It has beneficial impact on practices teaching process in students' learning. As the data on learning skeletal and muscle material for class VIII students of SMP/MTs is expected to be able to analyze the movement system in humans and efforts to maintain the health of the movement system. Prospective Teacher tries to select appropriate way of student thinking with selection the question. The selection of the sub-materials to be taught also requires discussion time in the lesson study groups so that it is decided which essential materials need to be learned. At the learning meeting it was decided that the working mechanism of the muscles. The purpose of learning the mechanism of muscle action is to provide opportunities for students to analyze the mechanism of contraction and relaxation of the arm muscles through the practice of measuring the diameter and circumference of the arm muscles.
Students are expected to be able to obtain arm circumference data and arm muscle diameter, process arm muscle data during contraction and relaxation, is there a difference, why does the size of the arm

circumference differ when the arm is bent and when the arm is straightened. Students are also expected to conclude the mechanism of contraction and relaxation and find the concept of the mechanism of the movement system. The media used are student worksheets that contain arm measurement data tables and are given measuring instruments, namely raffia rope and ruler. Students are divided into several groups each consisting of four students. Student teacher candidates are given freedom in planning and supervisors are only directing and giving consideration. Group 1 consists of six female teacher candidates consisting of three members of the learning core team and three observers with the abbreviated names AM, VW, JH, RD, NT, SN. Students get the opportunity to discuss their feelings and where they stand. This is important to pay attention to as an effort to foster self-confidence (Haverly & Davis, 2023; Rawat et al., 2022; Saito, 2012; Smith et al., 2023).

Aspects of Student's Task Analysis

a. Results of the Analysis of the Preparation of Science Concept Materials

This stage was carried out long enough from the target time of one meeting, it turned out to require two meetings to decide on the core material to be studied. The chapter on the motion of objects and living things around is divided into four sub-chapters, namely the concept of motion, the movement system in humans, the movement system in animals and plants, and disturbances in the human movement system.

b. Compilation of words and trigger questions as well as predictions of student responses

Learning planning uses the future mapping technique, namely determining the stages of learning according to the desired end goal. The ultimate goal of this material is that students are aware of the importance of moving and the benefits of moving muscles. In order to obtain these objectives, learning activities are formed that support step by step backwards towards the core of learning and backwards towards the opening stage or with the Future Mapping method. For example, in the following excerpt of discussion, student groups of prospective teachers determine things that will help students learn. For example in determining the media or stimulus so that students can find concepts with concrete subjects (Figure 1).

Conversation 1. Knowledge in Preparing Student Assignments

RD: What is.. that could made students able to understand the process of moving?
SN: Shall we give a video, hm.. and then they sum up the mechanics of the muscles.
AM: hm..are you sure..? are they just watch the video? What's the next activity ?
NT: I think… we'll need to redesign, not necessarily video, maybe moving activities. Up and down scotjam like that. Or... but aren't they'll tired, how about you?
Teacher: it could be the scot movement, is there another way that is easier and related to the concept?
RD: Could it be.. I think the movement of the arm muscles sir. How about that?

Conversation 2: Knowledge in Preparing Student Assignments

RD: Actually we are still confused Sir, could that's question be answered by the students? (shows questions on the student activity sheet)
Teacher : yes.. how could students answer this question?
NT: They should practice it and then write down what happened on the activity sheet.
RD: Practice bending the arms, then the students are asked to press the muscles, what can you do. So know that the arm muscles will harden when bent.
AM: yes maybe it'll be, when the muscles are tight it means the muscles are contracting, while when the muscles are relaxed.
Teacher: Ok, but is there anything else that is more challenging for students, not just bending the arms.
NT: hmm… how about it ..
Teacher: Ok .. what if they were asked to measure arm circumference.
RD: yes.. it could be I think Sir.. what's your opinion guys?.. I think you can add different weights when bending the arms, then they measure whether there is a differences.

Figure 1. Compilation of words and trigger questions

Selected Key Questions and Statements from The Lesson Study Group Discussion Process:

1. *Do you like sports?*
2. *Who likes to exercise the most … (according to student answers)? What are the benefits of exercising?*
3. *What happens to our arms when we move them like this? (practice arm bending and opening)*
4. *Ok .. so we know how our muscles work, let's practice measuring the arm muscles.*

Determining the core stages of learning does not seem as easy as previously thought. Prospective teachers find it difficult with the lack of confidence shown during the discussion. However, there are class teachers who try to provide alternative choices of learning paths. What is expected is that at the core stage there is a construct discovery by a group of students. The following is an excerpt reflecting on the learning process of prospective teachers with an open attitude feeling doubts about deciding on the choice of steps in their learning strategy (Nilsson, 2008, 2022).

Piece of Reflection on the Learning Planning Stage:

I feel that I don't attract students' attention when I'm in front of the class, and I'm also afraid in delivering the material whether students don't understand it. I also feel so nervous and afraid whether it can be implemented according to plan (Reflection notes, SN).
I usually express support for our friend's ideas when they agree with mine too. I usually also consider whether the idea of learning steps can be implemented or not. Our target goal is how to make this learning indicator work well and also get results that are in accordance with the planning so that the research objectives are achieved (Reflection Notes, NT)

Activities selected for students from the results of the discussion:

1. Students carry out an experiment measuring arm circumference with a rope, then the length of the rope is measured with a ruler with several experiments: a. bending the usual arm, b. bending the arm carrying a light load, c. bending the arm carrying a heavy load, d. open arms.
2. Students tabulate measurement data on activity sheets
3. Students answered several questions related to the material through group discussions.
4. Students present the results of the discussion in front of the class.

Conversation 3:

Lecture: after observing the class yesterday, how would you respond to the enthusiasm of the students?
SL: I think a lot of students are falling asleep because it's already noon. But there are also those who are still working on assignments according to the teacher's instructions.
AM: yes .. I think only a few are not very active in group work.
do you think students will be able to follow the instructions that will be given?
AM: I think the students want it ma'am, we need to organize smaller size groups, and accompany the student groups with attention.

Piece of Reflection on the Learning Planning Stage:

The challenge is that there are some students who do not listen well to the model teacher. So I will make it better on another occasion with me having to give him motivation, always appreciating everything that is conveyed so that he continues to be enthusiastic and makes interesting slides so that he can be fun and not get bored (Reflection notes, RD as a model teacher).

Representation from Implementation Stages:

From the notes and pieces of discussion, it was stated that it was not easy for prospective teachers to be able to confidently carry out learning even though it had been carefully planned. Motivation and self-confidence are very dependent on student responses. Some expressed support for the success of planned learning instruction. Some still feel pessimistic that it will succeed as expected.

Aspects of Student Learning Difficulty Analysis

a. The concept of student material previously owned

The result of the previous concept analysis is that students have learned the concept of motion. But what is studied in physics is a moving object. Students have also studied the speed of motion, both acceleration and deceleration. But the concept of mechanical motion has not been owned. This will be studied in biology on the human movement system which consists of muscles as a locomotor network and bones as a support for the limbs. Based on the discussion on the selection of essential material that students will study, students are no longer given rote material in the form of types and types of muscles that are informative in nature, instead students practice a lot about how biological network mechanisms regulate movement. This is also a difficulty for prospective teacher students in determining the essential material that needs to be studied. In planning activities, students will need more time because for the first time they are not used to mapping the material and also need to deepen the material (Follmer et al., 2023; Saito, 2023).

b. Difficulties that are commonly encountered in the matter of the movement system in humans

The general difficulty is that students are required to memorize information about the human skeleton from sources. This material is very difficult for students to remember for a long time. Several studies have stated (Fadhilah & Sabo', 2021; Ferdiansyah et al., 2022; Widayaningsih, 2018) movement systems are more meaningful when taught through simple and fun practices. Through simple practice students will feel the benefits of the movements being carried out and indirectly be able to dig up information from the types of limbs themselves.

Lesson Study Group 2 Topic Excretion System

Group 2 consists of five students in different schools from the previous group. This group has also conducted lesson study activities in field practice activities for two months. The essential material selected from the excretory system is the mechanism of filtering blood in the kidneys, excretion in the skin and lungs. Meanwhile, what is presented in this study is the mechanism of filtering blood in the kidneys. The specified learning objectives are that students are able to work together in compiling practical activities to prove the excretion system, students discuss the stages of excretion and the results of the excretion process. The teaching media used are practical tools consisting of colored water, flour, coated tissue paper, and glasses and funnels. Student groups are given the freedom to determine the flow of learning, the lecturer provides directions and considerations. Group 2 lesson study members consist of the initials BB, YN, MM, RD, and AB.

Aspects of Student's Task Analysis

a. Results of the Analysis of the Preparation of Science Concept Materials

The stages of analyzing the preparation of material from the excretory system in humans require the same time as the Lesson study group 1. Two meetings resulted in an agreement to map this material. It consists of constructive stages through group discussion Lesson Study and with supervisors and science teachers. As a result, students chose the topic of filtering mechanisms in the kidneys and excretion processes in the skin and lungs. In this article, the filtering mechanism of the kidney is presented.

Conversation 1: Team discussion activities with supervisors/lecture

BB: Alright .. I think this material will be divided into four groups, namely group 1 discussing the material on the lungs, group 2 discussing the material on the kidneys, group 3 discussing the material on the liver, and group 4 discussing the material on the skin ma'am..
Lecturer: ok .. but are you sure that students can achieve the learning objectives, by practicing snowball throwing, I think it tends to just transfer information from books to student worksheets. need more activity on my suggestion students
AB: Yes ma'am, I think so too. If students practice, they will have more experience and knowledge and be more memorable. (students are asked to redesign the lesson plan that was previously submitted)

Conversation 2: (discussion activity with class teacher and lesson study team)

MM: ok sir, madam .. In the following, we will show that later students will practice filtering colored water using a glass funnel and display a picture of a glass funnel arranged with a beaker glass and on a funnel covered with filter paper.
BB: then students will convey the stages of the filtration process in the kidneys by compiling a puzzle and compiling a description of the stages of the process.
Lecture: thanks for the explanation .. please respond from friends and maybe from the teacher.
Friends: ..no ma'am.
Teacher: I want to respond yes, I agree with using that practice. Students will easily understand that there is a filtration process in the glomerulus, then it is collected in the tubules all the way to Bowman's hoop. As students have done in previous classes it uses several layers of paper. So there are differences so students can see whether there are differences in results with different filter thicknesses.

b. Compilation of words and trigger questions as well as predictions of student responses

The difference with the lesson study 1 group is that this group does not use the future mapping technique to develop learning scenarios. The group arranges sequentially from the front but still connects it to the core learning activity, namely the activity of filtering blood.

Reflection note:
In my opinion, initially dividing groups with material would make it easier to divide a lot of material on the excretory system. At first I was quite confused about how to teach this material. I'm more focused on the

snowball throwing learning strategy whether it can run smoothly or not. I haven't thought about how concepts can be discovered by students (Reflection notes, BB)

Reflection note:
It is better if there is more assistance to students who are sometimes not focused during learning. I think that would be very helpful (reflection note, MM)

Reflection note:
At first I was doubtful about the plans made by my friends. I still support what our friends are doing. (Reflection note, YN)

The results of the reflection stated that the prospective teachers from group 2 predicted less students' responses to specific questions or words. This group pays more attention to classroom management strategies because there are problems with low student motivation in this class. In addition, the lesson study 2 group focused more on learning strategies and preparation of practicum media. Regarding starter questions, they were not planned specifically and focused on preparing an assessment rubric to measure aspects of collaboration, communication and critical thinking in students.
The questions that were self-composed by the model teacher were as follows: (1) Let's look at the following picture (pointing to a picture of a pile of trash), what 's on your mind, right? (2) What happens if this trash piles up? Well this is the same as the waste that is in our bodies.
Selected activities for students: (1) Students practice the process of filtering blood with the available media; (2) Students compare the filtering results between thicker layers of paper and fewer layers of paper; (3) Students work on worksheets privately through group discussions; and (4) Students are asked to come forward to answer questions on the worksheet with the help of throwing a snowball.

Aspects of Analysis of Student Learning Difficulties

a. The concept of student material previously owned

The concept of material about the excretory system previously students have studied the respiratory system which also discusses the gas exchange of oxygen and carbon dioxide. However, in the matter of respiration, there has not been much mention of the concept of waste products from metabolism or the respiratory system. So that in mapping the material, more difficulties are found in the process of filtering blood in the kidneys. Thus, this material is studied more and skin, liver and lung material is more for obtaining information. This is in accordance with the discussion at the time of planning which is a suggestion from the class teacher to do more practice in the association of the excretory system.

b. Common difficulties encountered in the excretory system material in humans

The general difficulty encountered is that if the teacher provides more one-way material and information then a low construction process is possible. Students need more time to understand real objects and associate them with physiological processes that cannot be seen directly (Efendi et al., 2021; Pratiwi et al., 2021; Hizqiyah et al., 2023). Several studies state general difficulties in excretory materials, namely the chemical process of filtering blood in the kidneys, the function of several excretory organs.
The following are Figure 2 and Figure 3 of the application of the excretory system learning carried out by model teacher students while being observed by observers. In this activity the lecturer also makes observations and plays a role in observing the learning process that takes place, as well as the interaction of students with teachers and vice versa.

Didactic Practice

In the aspect of pedagogic practice by using lesson study directly, team members gained some experience in developing pedagogic aspects (Durdu & Dag, 2017). These aspects include self-confidence, opportunities for collaboration, development of teaching skills, skills of observing student learning processes, and skills of reflecting on learning (Abraham et al., 2012; Nilsson & Karlsson, 2019). This is rarely encountered when students carry out other activities such as learning product development activities, developing learning tools, and other activities that are not commensurate with lesson study activities which introduce more to the real world of schooling.
Lesson study itself has been carried out by many teacher activities both domestically and abroad, both for professional teachers and prospective teachers (Durdu & Dag, 2017; Hidayat, 2019; Lathifah et al., 2021; Saito et al., 2020). This shows that this activity is a continuous learning process through a system or philosophy that is closely related to self-change to accept, appreciate and learn to improve. Reflection notes from group 1 Prospective Teacher, reflection shows doubt or lack of self-confidence.

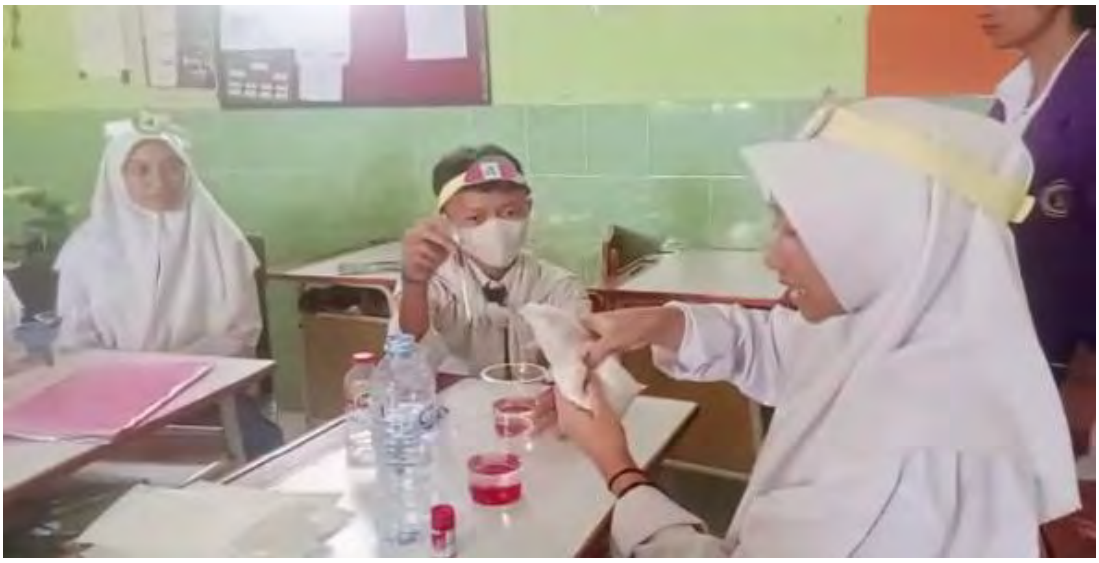

Figure 2. Students try to practice according to the instructions from the worksheet

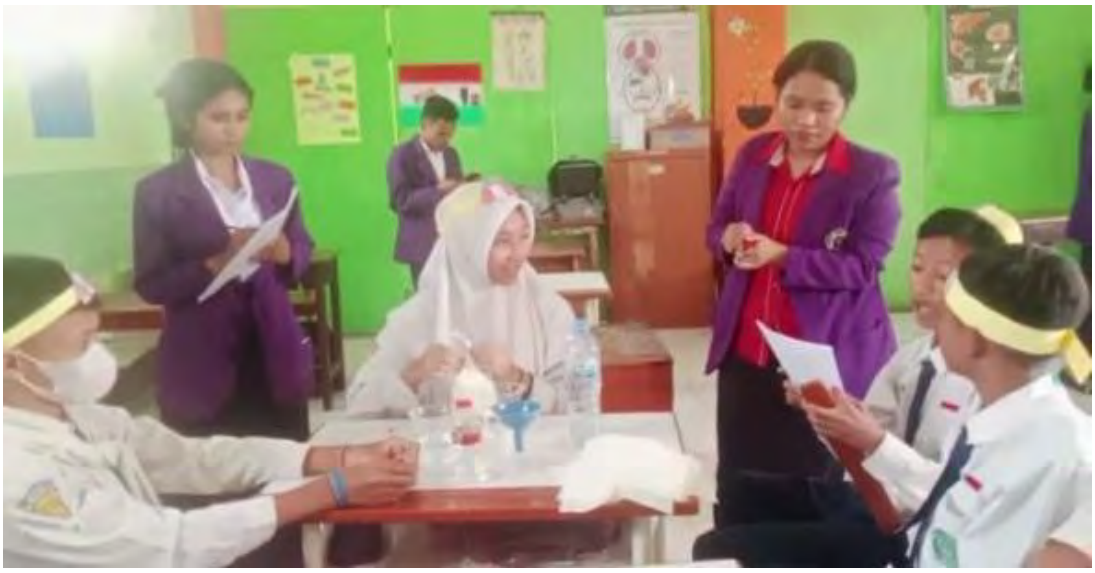

Figure 3. Students do practice and are accompanied by the teacher model, and two other student prospective teachers make observations of learning

Representation of Group 1 and 2 on Didactic Practice

Group 1 is a fairly dynamic group. This group consists of students who are quiet and passive as well as students who are active and dominant. However, with lesson study activities, they inevitably have to contribute to the group. The role of each group member is valuable and is an aid to other friends. In the reflection activity they will provide opinions and views on the results of their observations. Initially there were those who doubted whether their observation glasses were the same as those of other students. Self-confidence can fade if there is no respect for every member in the group. This is also in line with research (Gomes et al., 2022; Saito, 2012) appreciation plays an important role in group collaboration. Reflection notes from group 2 Prospective Teacher, Reflection shows doubt or lack of self-confidence. In the process of preparing lesson plans, discussions did not always run smoothly. Student teacher candidates also experience stages of insecurity, doubt and whether other friends have the same views as the ideas in their minds. Group 2 is different from group 1 in terms of self-confidence. Group 2 is a team that is very confident in being able to provide good learning. This is because most of them have done teaching practice at the school for 2 months. They'll understand the character of students and personal teachers as well. They are well able to communicate learning research steps with teachers as tutor teachers. Communication within the group of prospective teachers plays an important role (Bharad,

2020; Nilsson, 2008; Rahmawati et al., 2023). where they will feel support whether they are in the same position or more, so they can communicate the difficulties they are facing.
Support from the team is very meaningful for each team member. They smoothly give appreciation and are not awkward in expressing disapproval if they feel they don't share their ideas. This is something that deserves appreciation from group 2. Didactically the pedagogical practices are almost the same as group 1, which requires the same amount of time to develop the expected learning together. But the results obtained by the two groups were not much different and achieved perfect didactic practice. The aspects obtained include self-confidence, opportunities for collaboration, development of teaching skills, skills of observing student learning processes, and skills of reflecting on learning. Based on the reflection activities and reflection notes presented, it shows that the didactic development process for prospective teacher students has well done (Nilsson, 2022).

Conclusion

This research develops the practice of prospective science teachers in didactic practice through lesson study activities. Didactic knowledge and practice includes aspects of knowledge in the preparation of student assignments and analysis of student learning difficulties. Based on the research discussion, it was concluded that the development of science teacher candidates' knowledge and practice in didactic practice through lesson study had a major impact. Qualitatively, this study emphasizes the findings of the process of forming the personality of prospective teachers in good group collaboration. The process of dynamics is the finding of this study. Lesson study stages greatly impact the didactic learning of prospective teachers through discussion and transfer of knowledge between the groups and also the tutor teacher colleagues and supervisors. Especially specifically on the reflection note is as a point of self-discovery of prospective teachers towards the actualization of knowledge, understanding and also the practices carried out. In the analysis of students' assignments through snippets of discussion, it was found that the value of the language process between colleagues was neat and dynamic. This process is constructive which is meaningful and answers the development of the didactic aspects of prospective teachers.

Acknowledgement

Thanks are conveyed to the lesson study research groups who have completed the research at the school. Hopefully the results of this work can be useful as a provision for the development of didactic skills in the next school.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

Author Contributions

Y. Istikomayanti: methodology, writing idea, and documentation. **Z. Mitasari:** Methodology and data analysis. **A. S. Lathifah:** participatory data collection, data analysis. **M. Mashuri:** Lesson Design. **P. Desy:** Lesson Design and participatory data collection.

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