Does math mini laboratory improve pedagogical content knowledge for prospective teacher of madrasah ibtidaiyah?

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Abstract. Pedagogical content knowledge is the ability to convey learning on a specific content that each student of prospective teacher must have. To develop pedagogical content knowledge of the students we can use math mini laboratory approach. The aim of this study is to obtain a pedagogical content knowledge of prospective teacher for Madrasah Ibtidaiyah by using math mini laboratory in the mathematics education in Madrasah Ibtidaiyah focusing on course geometry. This research used pre-experimental methods. The population was all fifth semester students majoring in Madrasah Ibtidaiyah Teacher Education at UIN Sunan Gunung Djati Bandung. The sample obtained from 36 students of class A taken by purposive sampling. Data collected used tests performed t-paired tests with regard to the assumption of normality. The results showed there was differences in the average pedagogical content knowledge of students before and after learning with a math mini laboratory. Pedagogical content knowledge of students increased by 0.48 in the medium category. By using math mini laboratory, students not only learn the content of the material, but also they do practice for teaching.

1. Introduction
Learning process is a main activity in education system. In a learning process there are interaction among teachers, students, and learning resources [1]. In these interaction, the students can explore their potential interests and talents by providing direction, guidance, and teaching. Learning and teaching occur simultaneously, but learning can be done without a teacher. Meanwhile, teaching where all the activities carried out by teachers inside and outside of the classroom so that the students carry over to the learning situation [1].

The teacher is the main element in teaching process. The role of the teachers do not only provide information or knowledge, but also direct and provide learning facilities [2]. Learning development is the main way for educational goals. Therefore, both teachers and prospective teachers are required to be able to develop learning to be more interesting and fun. The main achievement in learning process is expected to be a sign of success in achieving educational goals.

Department of Madrasah Ibtidaiyah Teacher Education is an institution that provides prospective teacher for the level of basic education, both in primary schools and Madrasah Ibtidaiyah (Islamic-based elementary schools). As a prospective teacher, students of Department of Madrasah Ibtidaiyah Teacher Education have to develop and prepare for the real world of education. In the other say, that the teacher as the important role who will bring the students from “not knowing” to “knowing something” from the
learning process carried out privately or publicly [3]. Competence becomes the main capital to determine whether or not students as prospective teacher become real teacher [4]. Therefore, to form a dynamic mindset and can develop skill as prospective teacher to develop learning process by learning content and how to teach it to students.

Thus, teachers and prospective teachers are required to have supporting competencies. Competencies that must be possessed by all teachers are pedagogical competencies, personal competencies, professional competencies, and social competencies [5]. Pedagogic competencies are competencies related to how teachers manage and deliver learning material or plan and implement learning. Therefore, before delivering learning material, teachers and prospective teachers must understand how to teach it.

However, the ability of each prospective teacher is different so there are some obstacles in understanding the material to be delivered and the techniques of delivering the learning material. The ability to create new things, solve problems will differ depending on how their respective perspectives and knowledge [6]. Therefore, each material can be described in different ways depending on the point of view of the teacher understanding it. Moreover, elementary school-age children are in a time when abstract things are unacceptable or Piaget's cognitive theory mentions 7-12 years of age in a concrete operational period [7]. Consequently, in describing abstract material, the teacher must provide an explanation that can be accepted by students by concreting something abstract.

The ability to convey learning in a specific content is called pedagogical content knowledge [8]. In addition, this pedagogical content knowledge is conceptualization as a result of the transformation of knowledge from other domains [9]. Pedagogical content knowledge is knowledge that is developed from the teacher's experience from time to time about how to teach certain content in certain ways to increase student understanding and interest [10]. The indicators of pedagogical content knowledge are knowledge of learners, knowledge of planning and designing, and knowledge of classroom instruction [11].

The relationship between content and pedagogic can be seen from the way the delivery of learning in a material. Submission of material varies depending on the uniqueness and point of view of the teacher [10]. Therefore, each teacher has different pedagogical content knowledge. However, it has the same goal, namely to deliver material so that students achieve their learning goals correctly. In addition, although each teacher and prospective teacher has different ability, the both must have pedagogical content knowledge.

Math mini laboratory is one of the approaches in applying pedagogical content knowledge in learning mathematics. Mini laboratory is a model of practical activities with simple equipment that can be done in the classroom [12]. Math mini laboratory learning invites students and teachers to actively and cooperatively participate so that meaningfulness arises in learning. Math mini laboratory activities can increase student participation in learning. Thus, that learning by using math mini laboratory can also increase student participation as prospective teacher to deepen understanding of a material. This happens because there are activities that manipulate concrete objects to get a lasting understanding [13].

Students of prospective teacher use the math mini laboratory for teaching practice, then the students can improve their pedagogical competencies. Thus, the math mini laboratory learning on prospective teachers can simultaneously tie understanding to content and understanding how to teach it. The ability of different prospective teachers can be formed and enhanced in laboratory learning, especially in learning material that requires concrete elaboration. For example, the learning of mathematical geometry that requires a concrete description causes students to be able to understand the actual concepts. Therefore, in addition to increasing the understanding of math mini laboratory learning, it can also see the level of pedagogical content knowledge possessed by Madrasah Ibtidaiyah prospective teachers.

Based on the explanation above, the researchers conducted a study with the aim of obtaining pedagogical content knowledge of Madrasah Ibtidaiyah prospective teachers after learning by using math mini laboratory approach in the Mathematics Education in Madrasah Ibtidaiyah course. The title of this research is "Does math mini laboratory improve pedagogical content knowledge for prospective teacher of Madrasah Ibtidaiyah?".
2. Methods
This study used a pre-experimental method. It is called pre-experimental because it is not a real experiment and does not meet the requirements for the achievement of a complete experiment that is the absence of control variables [14][15]. The research design used was one-group pretest-posttest design, where a group was given treatment then compared the conditions before and after the treatment [14]. The population in this study were all the fifth semester students of the Department of Madrasah Ibtidaiyah Teacher Education of UIN Sunan Gunung Djati Bandung in the 2019-2020 academic year who signed 112 Mathematics Education in Madrasah Ibtidaiyah courses. The research sample was 36 class A students. The sample selection is done purposively and not randomized. Researchers wanted to compare pedagogical content knowledge of students before and after applying math mini laboratory learning. The research instrument used a test in the form of description. The instrument used was firstly tested by the construct validity expert to measure the readability and level of success of each question so that it was in accordance with the characteristics of students [16]. Meanwhile, the data were analyzed using paired t-tests by observing the normality of the data. As for knowing the magnitude of the increase in pedagogical content knowledge students use the N-gain formula.

3. Result and Discussion
The students of Department of Madrasah Ibtidaiyah Teacher Education must take Mathematics Education in Madrasah Ibtidaiyah course. In this course one of the focuses of the study is geometry. The aim of this research is to obtain a pedagogical content knowledge of Madrasah Ibtidaiyah prospective teachers after participating in learning with a math mini laboratory approach. Pedagogical content knowledge data is taken before and after students practice learning using math mini laboratory approach through tests. The following is a descriptive statistic of the scores of the students' pretest and posttest results.

| Table 1. Descriptive Statistic of Students’ Pedagogical Content Knowledge |
|-----------------|---------|---------|--------|
|                 | N      | Minimum Score | Maximum Score | Average |
| Pre test        | 36     | 7        | 70     | 35.36  |
| Post test       | 36     | 18       | 100    | 66.39  |

Table 1 shows the results of students' pedagogical content knowledge tests before and after treatment. Based on the results of the analysis found that there is an increase in pedagogical content knowledge of students after participating in learning with a math mini laboratory approach. To find out the magnitude of the increase in pedagogical content knowledge is calculated using the N-gain formula. The increase of 0.48 is in the medium category.

Researchers conduct a normality test as one of the assumptions that must be met when going to do a t-paired test. Researchers found that the pretest and posttest data were normally distributed. Next the researchers conducted a t-paired test to determine the differences in the average student test results before and after participating in learning with a math mini laboratory approach. Based on the calculation results, the researcher obtained the Sig (2-tailed) value = 0.000 smaller than the significance level $\alpha = 0.05$. Thus it shows that there are differences in the average pedagogical content knowledge of students before and after participating in learning with a math mini laboratory approach.

Referring to the data above, it shows that the pedagogical content knowledge of the students has increased after participating in learning with a math mini laboratory. The study was conducted in lectures with a focus on geometry studies. The material studied is problem solving, properties, and concepts of volume and surface area of cubes, beams, prisms, pyramid, tubes, cones, and spheres, as well as learning strategies on the material for building space. The process of implementing learning begins with students conducting group discussions about the properties of space and proof of volume and surface area formula. Students conduct evidence using teaching aids in mini laboratories. After that, students are given problem solving problems related to the volume of buildings and working on the problem. That activities are step in knowing the condition of students. Aspect observed in the knowledge of
learners are knowledge of the right approach to understanding students and implementation of learning assessments [17]. Furthermore, students are asked to make appropriate learning designs applied to students of Madrasah Ibtidaiyah relating to the concept of building space and examples of evaluation questions. This activity is a representation of knowledge of planning and designing indicators. Pedagogical content knowledge consists of four constructs, namely: a) students’ common misconceptions, b) specific curriculum knowledge, c) teaching strategies for specific topics, and d) teaching objectives [18]. One group was asked to practice the design of learning designed for classmates who acted as students. Students do reflection on teaching practice activities. In this case knowledge of teaching in the classroom is needed, including teaching management and teaching implementation [17]. Learning experiences with a math mini laboratory approach such as this make students understand the content of the material in space and can practice how to teach the material to students. Thus, presenting content knowledge and pedagogical knowledge explicitly is more effective in developing pedagogical content knowledge [19].

This research shows that there are advantages in its use so that it can improve pedagogical content knowledge of Madrasah Ibtidaiyah prospective teacher. Learning with a math mini laboratory is based on the simplicity of the tools used and the activities that are carried out in the classroom function to instill and solidify the concepts learned [20]. Student can explore knowledge directly by practice in math mini laboratory. In addition, students can use simple learning media to demonstrate the material. In demonstrating the learning media, teacher will be gained speaking skill and teaching skill. The training is also supported by learning material that has been concrete by the media contained in a math mini laboratory. Mini laboratories can increase student participation in learning, because students are directly involved in building their knowledge through physical/demonstration activities so that students have their own experience to directly embed ideas, concepts, and skills in their long-term memory [21]. As Daniel Lucy, et al who put forward the advantages of a mini laboratory, including a) can do practicums with simple equipment, b) increase understanding with direct learning, c) knowledge gained by discovering themselves, and d) improve critical thinking skills [22].

Math mini laboratory approach can help overcome the limitations of knowledge and minimize misconceptions. By using math mini laboratory, students can use a variety of simple teaching aids directly. Direct learning is proven to help improve learning activities [23]. Activities carried out either directly or indirectly can affect the pedagogical content knowledge of student, because in it there is knowledge that is obtained by themselves. The knowledge gained alone can provide a strong understanding because it is supported by empirical evidence. According to Jensen that experience and the environment will meet students in understanding the material [24]. This certainly can improve students' understanding of the material.

As prospective teacher, students also practice their ability to deliver material that has been learned using teaching aids which facilitated in math mini laboratory. Students feel delightful because they can practice to develop their potential in teaching process. Prospective teachers feel much better to understand the formula of volume through proofing activities, making it easier for them to explain to students in the real classroom. Furthermore, using math mini laboratory not only to improve students' understanding as prospective teacher but also to improve their pedagogical content knowledge.

4. Conclusion
Learning process by using math mini laboratory approach facilitates Madrasah Ibtidaiyah prospective teacher to develop their pedagogical content knowledge through teaching practice activities. The results indicate there are differences in pedagogical content knowledge of students before and after applying a math mini laboratory in the Mathematics Education in Madrasah Ibtidaiyah course focusing on geometry studies. The increase in pedagogical content knowledge is in the medium category. During the learning process, students prove the volume formulas and surface area of the building that are learned in elementary schools/madrasah ibtidaiyah through teaching aids. Furthermore, students discuss with their groups to make learning designs and evaluation questions to be applied to students in primary schools/madrasah ibtidaiyah. One group was appointed to practice the teaching simulation of the
learning design that had been designed. Through learning with math mini laboratory, knowledge of learners, knowledge of planning and designing, and knowledge of classroom instruction can be achieved. Thus, teacher prospective can understand the material content about geometry and can practice how to teach the material to students.

5. References
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