The 3P model with lesson study for learning community (LSLC) in the professional development of mathematics teachers on three-dimensional shape material

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Abstract. There have been many government policies to improve the quality of teachers. However, the results of the 2017 Teacher Competency Test (UKG) show that the national average professional ability is at 55.91 and the national average pedagogic ability is at 50.71. This shows that all these scores are below the minimum standard, namely 70. In the process of learning Mathematics in schools, the quality of teachers must be continuously fostered. Therefore, this study aims to develop the professionalism of high school mathematics teachers, through the 3P Model (Training, Guidance and Assessment) with the Lesson Study For Learning Community (LSLC) system. This study involved 25 teachers from four high schools in Palembang City. This research uses two types of design research, namely development studies and validation studies. The result of this research is a learning environment using the 3P model (Training, Assistance, and Assessment) with the LSLC system. So that with the 3P model and the LSLC system can be a bridge that connects teachers by focusing on learning strategies in improving professional and pedagogical mathematics teachers comprehensively. These results show a significant increase in the professional development of mathematics teachers in the city of Palembang.

1. Introduction

Government policies that have been carried out to improve the quality of teachers in Indonesia, such as some curriculum changes that certainly follow the development of the globalization era. Currently, the government applies the 2013 curriculum, and even then, it has undergone several revisions, one of which departs from the view that the curriculum used so far has not taught the material tested in international assessment studies so that the 2013 curriculum also experiences some improvements to Common Core Standards: Content Standards, Process Standards and Assessment Standards [1]. In the 2013 curriculum, it emphasizes on the Higher-Order Skill (HOTS) learning based on the Anderson and Krathwohl taxonomy. Learning carried out by the teacher must implement the learning starting from analyzing, evaluating and creating. Teachers must also perform 21st-century skills, namely 4C (critical thinking, creative, collaboration, communication). Mathematics learning has to start from analyzing, evaluating and creating, in addition to it also performs 21st-century skills namely 4Cs (critical thinking, creative, collaboration, communication).

However, concerning the issue of teacher development at the international level, according to the results of the United Nations Educational, Scientific and Cultural Organization Survey [2], on the
quality of teachers in developing countries in the Asia Pacific, Indonesia is ranked 10th out of 14 countries. As for teachers, the quality is at level 14 out of 14 developing countries.

The 2015 Teacher Competency Test (UKG) results show the national average professional ability at a value of 53.05 and the national average pedagogical ability at a value of 48.94. This shows that all of these values are below the minimum standard of 55. The still low quality of education in Indonesia, one of the causes is the teacher's problem related to the inadequate quality of teacher professionalism [3]. Even though a teacher is considered to be very influential on student learning outcomes.

One effort that can be done in addressing the problem is by improving how the learning process carried out by the teacher, in this case, is the mathematics teacher and how efforts can be made to improve the quality of learning. To improve the quality of learning process, in terms of collaboration between fellow mathematics teachers is the LSLC system (Lesson study for learning community), where a teacher can work together with other teachers to discuss solving common problems in the learning they experience. As conveyed by Ilma [4] LSLC consists of four stages: Plan / Design, Do (implementation), See (reflection), and Re-design. However, teachers still have problems mastering the latest knowledge (updated knowledge) from the training they have attended: knowledge about how, learning by doing, or learning how to learn, and the application of teachers after attending training into their daily routine work at school [5]. To improve the quality of teacher learning to be more optimal and professional, this study uses the Model 3 P strategy (Training, Guidance and Assessment) through the development of three-dimensional materials, through the LSLC system. Sato Masaki [6] said that to improve the quality of teachers, it is necessary to have a learning club that is beneficial for fostering a habit of conducting learning activities and learning among teachers. Therefore, the purpose of this study is to develop a professional high school mathematics teacher learning environment, through the LSLC system with a 3P model (Training, Assistance, and Assessment).

2. Methods
This study is a design research study that uses two types, namely development studies and validation studies [7]. At the development studies stage, researchers developed teacher learning materials (Lesson plan, Student Worksheet, and PPT Sources) using the LSLC system. The prototype is validated by experts. Meanwhile, at the validation studies stage, researchers developed instruments used to observe teachers’ performances while teaching. Results taken from observation were analysed using the Formative Evaluation design [8] as in figure 1.

![Figure 1. Design formative evaluation.](image-url)
3. Results and discussion

This research has been carried out in 3 stages which include the following activities:

3.1. Stage 1

Researchers took research subjects by making a research permit from the South Sumatra Province Education Office to be given to the subject of research, consisting of 25 mathematics teachers. In preliminary research stage researchers prepare research trial to schools, namely SMA N 3, SMA Plus N 17, SMA N 22, and SMA N South Sumatera, as places for conducting training, mentoring, and assessment, the implementation of learning for the teachers studied.

3.2. Stage 2 research implementation

Research implementation consists of training, supervising, and assessing. In training process mathematics teachers in four schools that have been scheduled in turn conduct teacher training on the LSLC system, starting from the planning of making lesson plans, sharing tasks, and jumping tasks to simulations/practices. In the supervising process, teaching experiences they obtained from training were applied in their schools and tested in class by all mathematics teachers involved as a subject of research. Researchers routinely assist all mathematics teachers who become model teacher, with a predetermined schedule, to find out issues that have not been understood as a whole by the teachers, especially about the LSLC system. In the assessing process, researchers conducted an assessment of all mathematics teachers who were the research subjects, using teacher performance observation then be processed as a basis for determining professional mathematics teachers in carrying out the learning process from planning to classroom learning with the LSLC system.

3.3. Design of the 3P model

The design of the 3P model can be seen in figure 2 below.

![Figure 2. Mathematics teacher training design.](image-url)
3.4. Discussion

3.4.1. Training Implementation. At this stage, describing the implementation of training in four schools that have been scheduled in rotation were described in figure 3, the activities of each school are carried out in 2 days:

![Figure 3. Training 3P with LSLC.](image)

The speakers of this training were Prof. Dr. Ratu Ilma Indra Putri, M.Si and the researchers themselves. In this stage, mathematics teachers are trained to develop lesson plans/plans, design shared task and jumping tasks to simulate/practice how the learning environment through the LSLC System [4].

3.4.2. Implementation of learning in class. At this stage, the learning environment is created/Implementation of teacher learning in the classroom through the LSLC system can be seen in figure 4.

![Figure 4. Implementation of teacher teaching in the classroom.](image)

The existence of the "Silent Revolution" where the students do not talk much but work a lot but if they do not understand it is expected that students say "please teach me" to a group of friends, observers and teachers minimize sound when learning takes place. LSLC consists of four stages, namely Plan / Design (Doing), Do (implementation), See (reflection), and sustainable Re-design, these stages are:

3.4.2.1. Stages of the planning. Teachers who are members of the LSLC Team collaborate to develop lesson plans that reflect student-centred learning. Planning begins with the activity of analyzing the needs and problems faced in learning. In this study teachers design three-dimensional shape material. Furthermore, teachers altogether also find solutions to solve all problems. The conclusion from the analysis of needs and problems learning materials, lesson plan, student worksheet, and ppt sources. figure 5 and figure 6 show student tasks and comments from the validator.
3.4.2.2. Stages of Do (Implementation). At this stage, there are two main activities, namely: 1) learning implementation activities carried out by one of the agreed teachers or at their request to practice the lesson plans that have been prepared together, and 2) observation or observation activities conducted by other LSLC team members. By documenting via video, photos, and filling instruments that have been prepared previously.

Figure 5. Validation results of the development of three-dimensional questions (share task).

Figure 6. Validation results of the development of three-dimensional questions (Jumping task).
Figure 7 represents one of the students' answers to the share task questions. Students have been able to understand the command of the questions clearly and students have been able to answer according to their experience and understanding.

Figure 7. The results of student work answering three-dimensional questions (Share task).

Figure 8 represents one of the students' answers to the Jumping Task questions. Students were able to understand the command questions clearly and the students were able to answer according to their experience and understanding.

Figure 8. The results of student work answering three-dimensional questions (Jumping task)

3.4.2.3. Stages See (Reflection). The third stage is very important [9] because efforts to improve the subsequent learning process will depend on the sharpness of the analysis of the participants based on observations of the implementation of learning that has been carried out. Reflection activities are carried out in the form of discussions that are followed by all Lesson Study participants guided by the
resource person or other designated participants. The discussion starts from conveying the impressions of the teacher who has practiced learning, by conveying comments or general impressions as well as specific impressions of the learning process he does [10]. Next, the observer submits his responses or suggestions wisely to the learning process that has been implemented. In delivering its suggestions, the observer must be supported by evidence obtained from observations, not based on his opinion.

3.4.2.4. Stages of Re-Design (follow-up). The conclusions from reflection can be obtained by some new knowledge to improve and enhance the learning process, both individually and in groups [11][12]. Various valuable findings and input delivered during the discussion certainly become the basis for teachers, both those who act as instructors and observers to develop a better learning process. Then all the input results become a concern for the preparation of the next lesson plan by following under the mutually agreed input.

3.4.3. Implementation of assistance. After the implementation is carried out as described in figure 9, the researcher monitors teachers' performances using the teaching performance instrument that has been previously designed [13][14], to see the progress of the mathematics teacher who is the subject of the study. If the monitoring results are still not showing the maximum score, the researcher assists at the stages of the LSLC system that is not understood by the teacher.

![Figure 9. Implementation of assistance.](image)

3.4.4. Implementation of assessment. Through Open Class (see figure 10), the model teacher practices learning using learning tools that have been designed and validated beforehand. Meanwhile, researchers, experts, observers and all invited mathematics teachers attended the class to assess the model teacher. The results were analyzed based on the standard of whether the teacher had mastered the substance and pedagogy professionally in carrying out the learning process.

![Figure 10. Implementation of teacher learning (Open Class).](image)

The results of the observations on the Open Class activities show that 25 mathematics teachers get an average score of 89. This means that the teacher has met the criteria for a professional teacher. Meanwhile, from the analysis of the results of the assessment instrument using a questionnaire, it can be seen that before getting training, the teacher's ability to master pedagogy was only 44% and professional 46%, then after receiving supervision it increased to 66% for pedagogy and 69% for
professionals. The final assessment in this open class shows that the teacher's performance score increased to 84% for pedagogy, and 97% for professionals (see table 1). This means that the teacher has reached the criteria for professional teacher competence as expected:

|          | Educator's Professional Questionnaire Understanding LSLC |
|----------|----------------------------------------------------------|
|          | Before Training (%) | After Training (%) | After Assistance (%) |
| Pedagogic| 44                | 66               | 84                   |
| Professional | 46         | 69               | 97                   |

From the results of the assessment conducted when the teacher conducts open class, the assessment results show that grades have increased from before the 3P Model was carried out with this LSLC system.

4. Conclusion

From the whole series of research stages in the 3P Model with the LSLC system on three dimensional material, the results of the teacher's assessment show that the teacher has been able to develop learning materials in the form of lesson plans, student worksheets, and contextual learning of three dimensional material according to the stages of the LSLC system. This can be seen from the results of teacher pedagogical assessments, namely 84% and teacher professional assessments of 97%. If the 3P model with the LSLC system on this three-dimensional material is carried out continuously, it will have a very good potential effect in the future to become a professional teacher. This research should continue to be developed, especially in the scope of research subjects and professional teacher assessment instruments.

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