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# Pedagogical Competence of Chemistry Education Student to Implement Guided Inquiry Learning Model in Lesson Study Learning Community Based Microteaching Course

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Abstract. This research was conducted to describe the application of Lesson Study for Learning Community (LSLC) and pedagogical competence of Chemistry Education Student. It was conducted on the Micro Teaching course in the Department of Chemistry, Faculty of Mathematics and Natural Sciences, Universitas Negeri Padang. The LSLC research was carried out through 6 cycles namely plan, do and see. Research begins by looking at the implementation plan stage by LSLC group members followed by observing model teachers and the students' activities in the do stage. The observation results in the do stage was reflected to the see stage. In addition, the results from the see stage were used as reference points to carry out the plan in the next cycle. The pedagogical ability was assessed based on their performance in applying the LSLC from the beginning to the end of the cycle. A standard questionaire was used to determine pedagogical competences of chemistry education students. The results of the research show that there is a significant increase in micro teaching students' competence in implementing the Guided Inquiry Learning model using Lesson Study for Learning Community. It obtained the "good and very good" categories. Meanwhile, the implementation of the learning process in accordance with the GIL model has also increased to the "very good" category. This is due to the increasing frequency of students activities in reflecting and planning according to the cycles in the LSLC method. So, it can be concluded that LSLC is highly recommended to be applied to the learning process either in the high school level or in the university.

# **INTRODUCTION**

Chemistry education students who will become teacher candidates are not only used to make students learn or just transfer knowledge, but also used to learn for themselves in improving pedagogical competences. The abilities are managing student learning, including understanding students, designing and implementing learning, assessing learning outcomes, and developing students to realize their various potentials. The importance of the teaching capacity of teachers, the Ministry of Education and Culture (Kemendikbud) has implemented a policy of administering the Teacher Competency Test (UKG). The purpose of UKG is to determine the level of competence of Indonesian teachers. In 2015 the average national UKG score was only 55, far below the standard score of 75. According to the provincial education balance data in 2019, in West Sumatra, especially in the city of Padang, the UKG average was 59.91. This shows that the teaching capacity of teachers is still relatively low [1]. Chemistry Education study program has important role to train the future chemistry teachers through many courses including micro teaching course. Microteaching is a learning approach that prepares and improves the skills of prospective teachers through a program of learning exercises. This learning is said to be efficient because it takes place in a classroom where students learn in a relatively short time [2]. In this course, students practice their pedagogical ability in teaching learning process using various learning models.

One of the models is Guided Inquiry Learning Model that is student-centred learning that makes students learn in small groups under teacher's guidence. The teacher's role is to ensure that all students are involved in the learning process. This type of learning can improve the understanding and skills of scientific processes [3]. Hanson explained

The 2nd International Conference on Chemistry and Science Education AIP Conf. Proc. 2673, 110002-1–110002-8; https://doi.org/10.1063/5.0125132 Published by AIP Publishing. 978-0-7354-4452-2/\$30.00 that the design of the guided inquiry-based learning process has activities consisting of five stages, namely orientation, exploration, concept formation, application and closing [4]. The implementation of Guided Inquiry Learning (GIL) through Lesson Study for Learning Community (LSLC) in general is formulating the steps of the GIL model according to the problems discussed, Designing LSLC activities, Applying the GIL model in the stages of LSLC, and evaluating the implementation in Grade [5]. The application of the guided inquiry model based on Lesson Study makes students pay more attention to learning and are confident in the learning process. The stages of the guided inquiry model make students active. In the plan activity, member of the community analyzes the material, prepares lesson plans based on guided inquiry models, discuss learning scenarios that have been prepared by model teacher based on the results of the previouse cycle [6].

Lesson Study (LS) is an effective way that can improve the quality of teacher teaching and student learning activities [7]. Learning Community (LC) is a group of people with the same interests and passion to deepen their knowledge and skills in a particular field and how to interact constantly. LC is a forum that encourages all members to learn from each other and creates an interactive and collaborative learning environment [8]. LSLC allows students to plan and learn in their group or community at the (plan) stage, carry out learning based on planning (do) and reflect on the implementation learning is implemented (see) which is carried out in a structured, cyclical and sustainable manner [9].

# LITERATURE REVIEW

Zhou, G. & Xu, J. [10] Micro Teaching Lesson Study: An approach to prepare teacher Candidates to Teach Science through Inquiry. International Journal of Education in Mathematics, Science and Technology (IJEMST). This study shows that Micro Teaching Lesson Study (MLS) in the context of course methods is a promising way to develop teacher candidates' understanding and inquiry-based science teaching skills. Through MLS, teacher candidates increase their understanding of the inquiry approach to science teaching. All participating teacher candidates view MLS as an effective tool for their professional learning. This research shows that MLS is a promising approach to develop prospective teacher's ability to teach science through inquiry. Unfortunately, this method has not been widely used in other methods courses. Zanaton H ikhsan, et al [11] conducted *Lesson Study In* micro teaching not only in the evaluation process but also in improving teaching skills in teacher training. This approach provides a more detailed discussion of mastering the right skills so students can teach better. The element of reflection in teaching is a good approach because students have the opportunity to reflect on what is good or bad in their teaching, or rather the extent to which it is in accordance with what was planned and what was delivered in the teaching session. It can be concluded that the integration of learning and learning in micro-teaching classrooms is possible and should be used in pre-service teacher training on a regular basis.

Elvinawati [12] concluded that the application of Lesson Study in chemistry subjects at school not only help the students to understand concepts but also have a positive impact to students. Rena Lestari's research [13] also revealed that the implementation of the Lesson Study learning model could effectively increase the teaching capacity of Biology Department students, FKIP, Pasir University Pangaraian. Moreover, Susilo's [14] argues that Lesson Study is a kind of on-the-job training that can improve the skills of educators, namely teaching skills, professional abilities, personality abilities, and social skills abilities. Learning by applying Lesson Study is one of the means to develop teacher professionalism, because Lesson Study learning is based on the principles of collegiality and mutual learning, and is a model of teacher professional development (training) through collaboration and continuous learning assessment. So that a learning community is formed. Therefore, Lesson Study is also referred to as a form of CPD (Continuous Professional Development) and upholds the principle of Continuous Improvement or sustainable, so that Lesson Study can foster learning that has a high enthusiasm for learning so that Lesson Study should be developed in learning [15].

#### **RESEARCH METHODS**

The type of research is a descriptive qualitative. According to Sugiyono[16] qualitative research is a post positivist research that is used to examine a natural object. Researchers in qualitative research become the key instrument in sampling data sources whose final results from qualitative research will emphasize the descriptive "meaning" of the research compared to generalizations. The research was conducted by applying Lesson Study for Learning Community to the Guided Inquiry Learning model. The implementation was carried out on 12 students who were divided into 2 large groups, each group consisting of 6 students who jointly designed the implementation of the Guided Inquiry

Learning model through the LSLC stages, namely plan, do and see for 6 cycles. "Plan" consists of designing teaching materials, chapter design, future mapping and lesson design which will later be applied to the learning process in the classroom called the "Do" stage by the first model teacher. After the Do stage is completed, the see stage was conducted. At the see stage the model teacher is asked for his/her opinion when applying the learning model that has been designed in the previous plan stage and other members provide suggestions based on the do stage that has been done, this stage is called the reflection stage. The results of the reflection are used to design a plan at the next stage to be applied by the next model teacher. For more details, Figure 1 is the stage of the lesson study carried out.



FIGURE 1. Stages of LSLC Implementation in Micro Teaching courses

# **Data Processing**

Result of ability assessment pedagogic prospective teachers using the 2020 Teacher Training Program of Padang State University in implementing the Guided Inquiry Learning model based on Lesson Study for Learning Community are grouped according to Table 1 below:

TABLE 1. Ordinal Scale Criteria	
Ordinal Numeric Value	Criteria
9 -10	Very good
6 - 8	Well
3 - 5	Not enough
1 – 2	Very less

# **RESEARCH RESULT**

#### **Conventional Microteaching**

Study begun by observing the implementation of learning in the opening activities, core activities and closing activities using the Guided Inquiry learning model. The results of observations that have been made in the opening, core and closing activities, are categorized as poor with reference to the Teacher Professional Development Teacher (PPG) competency instrument in 2020. The implementation of learning using conventional methods or individually is considered less capable of training skills pedagogic teacher candidates, especially in carrying out the Guided Inquiry Learning model. This is caused by poor lesson planning so that in implementation learning Students do not have a good reference in carrying out the learning process. The implementation of learning using conventional methods has an impact on the effectiveness and efficient learning process. Some of the shortcomings that occur in the learning process can be seen from the opening activities such as the delivery of motivation, apperception and learning objectives. The obstacle experienced in implementing the learning process in the next opening activity is that most teachers do not check the students' initial abilities and connected the previous lesson to the objective material.

In core activities, students who carry out learning using conventional methods seem less able to carry out learning in accordance with the Guided Inquiry Learning syntax, this can be seen from the PPG UNP 2020 teacher assessment

instrument at point B15 means that the teacher is able to carry out learning according to the GIL syntax. The next problem is that students who will become prospective teachers are less able to relate chemistry material in real life so that students are a little less aware of the benefits of learning chemistry in their daily lives. Linking chemistry material in everyday life in learning is needed so that students have no difficulty in understanding the material being taught.

Closing activities on conventional methods of implementation micro teaching individually have some shortcomings in the point of assigning assignments, it seems that most of the prospective teacher did not given any homework to students and also do not inform about the next material. Related to this, giving homewok and informing material for the next week is needed so that students can prepare for the material to be taught the next meeting. In addition, reflection has important role to correct deficiencies that occur during learning. The effect of the implementation of learning by applying the Guided Inquiry Learning model based on Lesson Study for Learning Community on competence pedagogic Chemistry education students can be seen in Figures 1 and 2 below.



FIGURE 2. Prospective Teacher's ability in Conventional Micro Teaching



FIGURE 3. Prospective Teacher's ability in LSLC Micro Teaching

# **Microteaching LSLC**

#### Plan

Based on the problems and data from Figure 1, the research was continued by applying Lesson Study for Learning Community (LSLC) in the learning process according to the Guided Inquiry Learning (GIL) syntax. Implementation of the Plan is the initial stage implementation SLC. This stage is designing teaching materials by the community using the GIL learning model. They designed teaching materials, teaching methods, learning models and learning strategies that will be used when the learning process is implemented (do phase). The teaching materials can be seen in outline consisting of Future Mapping, Lesson Design and Chapter design. The plan is carried out for 6 cycles according to the number of LSLC group members who apply the GIL learning model, sequentially each of the LSLC group members will appear starting from the first model teacher in cycle 1 to the last model teacher in cycle 6. Proven by getting an assessment of the "good and very good" category.

In the other side, the students have difficulties in compiling and designing their teaching materials when they follow the Conventional Micro Teaching so that "less and very poor" categories are obtained. Based on this, it can be seen that LSLC has a significant role in the ability of chemistry education students who will become prospective teachers in designing and compiling teaching materials.

Furthermore, based on the results of interviews conducted with chemistry education students who took micro teaching courses and applied LSLC, it was concluded from several questions that had been asked that these students felt very helpful by applying LSLC, this was because by using LSLC students became easier in compiling and designing teaching materials that will be used in learning. The use of LSLC can also assist students in knowing the shortcomings that exist in the teaching materials that have been designed and suggestions from group members also help the prospective teachers in carrying out learning.

#### Do Stage

The implementation of learning activities in the field or in the classroom is called the Do stage in the LSLC. Learning at the Do stage is a form of implementation application of teaching materials that have been prepared in the previous Plan stage. The implementation of the Do stage is carried out by one model teacher from the LSLC group members while the other members act as observers or make observations on the activity student learning as well as observing how the model teacher teaches. The implementation of Do in the learning process is carried out in 6 cycles according to the number of group members. The implementation of cycles 1 to 6 is carried out alternately by group members.

In the opening stage or the orientation stage on learning by applying the GIL, there are several points that are of concern to researchers because there has been a significant increase. At this stage students are able to carry out opening activities starting from doing apperception, praying, providing motivation, checking attendance lists and conditioning the class and conveying competency achievement indicators (GPA) and learning objectives. Competency assessment pedagogic students in the opening activity obtained different category scores in the implementation process before applying the LSLC to after applying the LSLC such as the delivery of apperception which was still halting and forgetful. Then Condition Class, providing motivation and conveying learning objectives are very important points in the teaching and learning process so that students' abilities can be better in accordance with the expectations of the national education goals and 2013 curriculum.

Furthermore, the core activities, which consist of the exploration phase, concept formation and application of the applied GIL learning model. In this activity there was an increase in the implementation of learning where there was a "good and very good" category value. The data can be seen in Figure 2 and adjusted to the ordinal scale in table 1. At the exploration stage and concept formation, the model teacher has started using models that aim to provoke students' curiosity about the material being taught and the provision of key questions given by the model teacher is very helpful for students in learning to explore information it receives to get a new concept. New concepts formed from the results of student analysis need to be tested and trained in deepening and understanding, then learning is continued at the application stage, before the application stage the teacher has first divided students into several small groups which aim to carry out discussions and deepen the material and concepts that have been formulated previously. The point of concern is the implementation of learning according to syntax, confusion material, understanding the material from the teacher's model and the relationship of the material to real life. With the help and suggestions of team members, it is easy for students to find ideas that will be used in linking teaching materials to real life, conveying

material in a coherent manner and carrying out learning that is in accordance with syntax so that students find it easier to carry out active learning.

Based on the three GIL syntaxes at the core activity stage there are very significant differences compared to when students carry out conventional learning or individually, this results in many shortcomings when carrying out learning such as learning that is not in accordance with syntax, less coherent material and lack of explanation. The linkage of the material with real life causes students to feel that it is not too important to study the chemical materials being taught because students cannot imagine directly what these chemistry lessons will look like in their daily life in real life. By implementing LSLC students become more active and enthusiastic in participating in the learning process.

In the closing activity or the last syntax of the GIL model, each group is asked to convey or present the results of their group discussion in which the model teacher will guide and strengthen the concept at the end of the lesson. In this closing activity, there are several points that have changed for the better, namely the implementation of reflection at the end of learning, evaluation and assignments where before implementing LSLC almost all teacher candidate students who take micro teaching courses do not implement these three points.

The implementation of learning using LSLC has a significant impact on the teacher's teaching process and student learning processes such as the implementation of learning that is in accordance with the GIL syntax, this cannot be separated from the influence of the plan stage carried out by group members before carrying out the Do stage. Overall, all group members are "good and very good" in carrying out learning according to the syntax they use. Although there are some students who carry out learning not as expected, this can be caused by the personality and mentality of each student in carrying out their role as a teacher. The results showed an increase in student activity and ability of pedagogic teachers in the teaching and learning process before the implementation of LSLC. As for the results of research conducted on microteaching courses when applying conventional methods or before applying LSLC, the value of the category "less and very less" can be seen in Figure 1 with reference to the ordinal scale in table 1.

The application of learning using the LSLC-based Guided Inquiry Learning learning model can be interpreted as a fairly effective way for students to improve teaching methods and how to become good teachers, or often referred to as pedagogical competence. This is not only proven by the PPG UNP 2020 instrument, it is also proven based on the results of researchers' interviews with students who carry out learning using the LSLC-based Guided Inquiry Learning learning model.

Based on the results of interviews, the application of LSLC is very helpful for students in carrying out the learning process. This can happen because the process of preparing teaching materials at the plan stage is considered to have a very large influence in the implementation of the learning process that takes place. So that students have a qualified provision to carry out an active or student centered learning process in accordance with the demands of the 2013 curriculum. Furthermore, based on the results of interviews, the implementation of learning by applying the LSLC-based GIL learning model helps students in solving a problem or an undesirable condition in the classroom or events. Unexpected things, such as trapping critical questions given by students and also how to deal with students who are quite naughty.

#### See Stage

At the see stage, an evaluation of the implementation of learning that has been carried out previously in the Do stage is carried out. The first thing to do at the see stage is to ask students who become model teachers at the Do stage to convey their impressions and messages as well as the difficulties they experienced in implementing the model from the previously designed teaching materials inStepplans. Furthermore, after the students who became model teachers conveyed their impressions and messages, they continued with the delivery of the results of the assessments carried out by other group members as observers so that the shortcomings and advantages of the results from the appearance of the model teacher could be used as a reference in carrying out the next learning process and designing teaching materials for the next stage. Plan for the next cycle.

The implementation of See is considered to have a major influence on improving the way a teacher teaches because the see stage can be likened to a community sharing teaching and learning experiences or what is often called a Learning Community. With the See stage in LSLC, students can evaluate themselves in carrying out the learning process to be even better. This process will never happen if the learning process does not apply LSLC so that there is no plan and see stage which serves to provide more mature preparation for students who will carry out the teaching and learning process.

Based on the results of interviews conducted with students in general, students in implementing learning activities using the LSLC-based GIL model concluded that with LSLC students can arrange better and more effective teaching

materials to apply in the classroom so that the LSLC process is suitable to be applied at each learning process both at school and at the university or college level.

#### Implementation of the Guided Inquiry Learning Learning Model

The research was continued by assessing the implementation of the Guided Inquiry Learning (GIL) learning model based on the syntax suitability of the GIL model; this process was assessed through the PPG UNP 2020 instrument at point B15. The learning process will run well if the learning model used can be applied by the subject teacher to the maximum. Competence Pedagogic a teacher will depend on how he implemented an effective learning model and in accordance with the existing syntax.

The assessment of the guided inquiry learning model is carried out by conducting observations and research when students take courses micro teaching by conventional. The research was continued by observing the same students when the LSLC method was applied in carrying out the teaching and learning process, this process required students to design teaching materials in groups at the Plan stage and carry out the learning process at the Do stage and evaluate the learning process at the See stage. For more details, see Figure 3 below.



FIGURE 4. Implementation of GIL in MC Courses Conventional and LSLC

Figure 3 is the result of observations of chemistry education students who took micro teaching courses which were previously carried out conventionally and then changed by applying the GIL model based on Guided Inquiry Learning. LSLC is applied to the same students and the same material in carrying out the micro teaching learning process. An example is student F who uses the material Reaction rate in the learning process directly, replaced by using SLC in the learning process that affects the competency value of student teachers, especially the implementation of learning in accordance with the syntax used (point B15).

Based on the data from Figure 3, it can be concluded that the implementation of the Guided Inquiry Learning syntax by students in the learning process is micro teaching by conventional considered still in the poor category, while when LSLC was applied to the learning implementation process it resulted in significant changes in the implementation of the learning process in accordance with the GIL model. This significant increase was due to the LSLC process which requires students to prepare teaching materials in groups, carry out learning and evaluate the implementation of the learning they do, causing students to become accustomed to carrying out the learning process in accordance with the significant shows a bar chart that show they experienced an improvement in understanding the syntax which is applied every LSLC cycle.

#### CONCLUSION

Based on the results of research that has been carried out on the implementation of Lesson Study for Learning Community (LSLC) in the Guided Inquiry Learning learning model, it should be applied to the learning process both in schools and universities. Besides being able to improve the pedagogic competence of prospective teachers, indirectly LSLC which is implemented in the GIL model can also have an impact on students' 21st century skills or 4C abilities. This increase can be caused by the more skilled teachers in managing learning, whether it is compiling teaching materials, implementing learning, evaluating learning, the learning outcomes of students will also increase.

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