

How undergraduate students of mathematics education perform microteaching with the topic of the incircle and the area of a triangle for grade VIII

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ABSTRACT: This study aimed to describe how undergraduate students of a mathematics education study program performed microteaching with the topic of the incircle and the area of a triangle for VIII graders. The study involved descriptive qualitative research. The population included all sixth semester undergraduate students of a mathematics education study program, in the academic year 2016/2017, with students being randomly selected. The data were collected through observation, interview and documentation, and descriptively analyzed. The results showed that through a lesson plan guiding process, revision, and teaching practice using guided inquiry learning based on a scientific model, undergraduate students could actively construct their knowledge of the topic under study.

1 INTRODUCTION

A teacher is one of the main components in the efforts to improve Indonesian educational quality and has a main role in the educational process (Saban & Coklar, 2013). In this case, a teacher does not only serve as the designer and the executor of learning activities but also as the designer and executor of training and guidance activities, research, development and program management school activities (Universitas Negeri Yogyakarta, 2011). Consequently, in order to support the teacher's role, which is very complex, a teacher's competencies should be continuously developed.

Based on Law Number 14, Year 2005 (RoI, 2005a) and Government Regulation Number 19, Year 2005 (RoI, 2005b), all teaching staff must have some competencies, namely pedagogical, personal, professional and social competencies. The teachers who have all of these competencies will be good facilitators in the classroom. Some competencies that are important for supporting classroom learning activities are the ability to develop lesson plans, organizing learning groups, arranging and conditioning classrooms (Baştürk, 2016), facilitating classroom discussions and the ability to deal with multiple situations or conditions that might appear within classrooms (Baştürk, 2016). These capabilities are necessary for the teachers in order to support their important roles as students' guides in constructing and developing their knowledge (Saban & Coklar, 2013).

To reach competence and professionalism, teachers should have well-planned preparation. This preparation starts from the educational degree for the teacher candidates. Undergraduate students should be supported with multiple skills and competencies. One of the activities for undergraduate students' preparation that might be performed is to establish their basic teaching capabilities both theoretically and practically. This activity might be trained through microteaching activities (Universitas Negeri Yogyakarta, 2011). In these activities, undergraduate students should be able to show teaching ability comprehensively.

Some studies have shown that the main problem in implementing learning activities for both teachers and undergraduate students is the imbalance between theory and practice.

Many teachers or undergraduate students who master the theories of how to teach are unable to implement these theories into their learning activities (Karckay & Sanli, 2015; Baştürk, 2016). Microteaching can be one of the main alternatives to solve this problem. Not only the theories of how to teach, but also the opportunity to plan and implement the learning strategies that undergraduate students have understood are provided (Saban & Coklar, 2013). Undergraduate students are divided into small groups with less than 20 people in a group and are given opportunities to perform teaching–learning activities of about 5–20 minutes (Saban & Coklar, 2013). The environment in the microteaching activities is deliberately created in order to facilitate undergraduate students to perform and get feedback and assessment of their performance using the result of reflection to develop their teaching ability (Ralph, 2014).

Through microteaching, it is expected that undergraduate students' emotional intelligence and interpersonal capabilities might be well-developed (Campos-Sánchez et al., 2013). Thereby, undergraduate students have enough time to prepare themselves well before teaching in classrooms. Concerned with the implementation of learning activities, some teachers had not understood about the assessment system in the implementation of Curriculum 2013 (the Indonesian national curriculum) so they had difficulties in developing instruments for it (Retnawati et al., 2016). Microteaching could train undergraduate students' capabilities in setting the learning time effectively and in deciding the assessment model that they will implement later in the classroom (Saban & Coklar, 2013), so this problem can be solved.

In addition, undergraduate students can identify and attain information about teaching skills and knowledge, and mutually criticize and give suggestions about their peers' performance (Amobi & Irwin, 2009; Ralph, 2014). For the undergraduate students, the feedback provided by both their peers and their academic supervisors might help them to: 1) see their strengths and weaknesses in teaching so that they have opportunities to evaluate and develop their teaching capabilities (Fernández & Robinson, 2006; Kpanja, 2001); and 2) decrease the negative impacts that might occur during the actual learning activities such as low self-confidence, noise and depression during learning activities (Arsal, 2015; Fernández, 2005; Kpanja, 2001; Peker, 2009; Şen 2010). Undergraduate students who perform microteaching activities have minor difficulties during their teaching assignment in comparison to those who do not perform microteaching activities. Therefore, microteaching should be attended by all undergraduate students to equip them with various skills which are necessary in designing and implementing learning activities.

Related to learning activities, it will be effective if students can be provided with opportunities to contemplate what they have been learning (Bruning et al., 2011). This matter is in accordance with the concept of constructivism learning. For the students of higher educational degrees, they should have been able to regard mathematics as something interesting and useful and as a medium for displaying their creativity (National Council of Teachers of Mathematics, 2000). Certainly, the teachers should have to create a learning process that could facilitates students to construct their knowledge and develop their creativity.

One of the topics in mathematics for VIII grade students is the incircle and the area of a triangle. Many constructivism-based learning models might be implemented for teaching this topic. Through constructivism-based learning models, students are directed to understand how to determine the incircle and the area of a triangle. The models of learning are selected based on the characteristics of the topic and the characteristics of the student. One of the models of teaching, which is appropriate to the characteristics of this topic, is guided inquiry based on a scientific method. This model could facilitate students to construct their knowledge actively (Rochani, 2016), find their understanding about the topic of learning (Hidayati, 2017) and motivate the student to solve their problem actively (Setianingsih, 2016). It will be meaningful learning (Siregar, 2015). This article will describe the studies that related to how undergraduate students perform microteaching with the topic of the incircle and the area of a triangle. It will describe how undergraduate students used a constructivism-based learning model, namely guided inquiry based on a scientific method in microteaching activities.

2 METHOD

This study involved qualitative descriptive research. This article describes how the undergraduate students prepared microteaching activities using guided inquiry based on a scientific model with the topic of the incircle and the area of a triangle for VIII grade students. The population of this study were all sixth semester undergraduate students of a mathematics education study program in Yogyakarta State University, Indonesia. From this class, students were randomly selected as participants.

Research data were collected by observation, interview and documentation. Observation was used to identify how undergraduate students performed their activities during microteaching, especially their abilities to design the learning process, explain the learning materials, implement the learning models, implement the learning methods and implement learning media. Interviews were used to clarify the results of observation and identify the difficulties or the obstacles that undergraduate students perceived when designing the learning process, implementing learning models, implementing learning methods or implementing learning media. Documentation was used to get pictures of the implementation of microteaching activities.

Descriptive analysis was employed to identify the preparation and the implementation of undergraduate students' activities in microteaching. The procedures of qualitative data analysis were reducing data, presenting data and drawing conclusions. The description of this study refers to the stages of microteaching activities as follows: (1) Supervision 1, including the process of consulting learning materials, models, methods and media that the teacher-candidate university students would implement in the microteaching activities with their academic supervisor; (2) Learning Set Development, including the process of developing the syllabus, lesson plans, student worksheets and learning media that would be implemented; (3) Supervision 2, including the process of presenting the learning sets that were developed with the academic supervisor; (4) Revision, including the process of revising the developmental results based on the feedback and the suggestions that were provided by the academic supervisor; and (5) Teaching Practice.

3 RESULTS AND DISCUSSION

3.1 *Results and description of the study*

The data were collected by observation, interview and documentation. The results of this study were described based on the phase of microteaching activities that undergraduate students attended, including (1) Supervision 1; (2) Learning Set Development; (3) Supervision 2; (4) Revision; and (5) Teaching Practice. A description of each stage is provided in the following sections.

3.1.1 *Supervision I*

Before entering Supervision I stage, undergraduate students prepared the preliminary microteaching activities. They must do a literature study first, to select some alternative topic of learning that would be employed in the teaching practice. Additionally, undergraduate students must select the model and learning media which is appropriate to the topic selected and review the fitness between the characteristic topic of learning with the model and media. After that, undergraduate students performed guidance and consultation activities with the academic supervisor. These activities were later regarded as the Supervision I stage.

In the Supervision I stage, undergraduate students consulted the fitness between the topic of learning with the model, method and learning media that they had reviewed and selected previously. After that, undergraduate students selected one design to implement in their teaching practice in the last stage of microteaching. Preservice teachers must select the model/method which is relevant to the implementation of Curriculum 2013.

The sample of this study chose guided inquiry based on a scientific method to teach the topic of the incircle and the area of a triangle. In the design of learning, the implementation of the guided inquiry learning model was elaborated into learning steps using scientific

methods, namely observing, raising questions, gathering information, associating and communicating, so the students could construct their knowledge about how to determine the incircle and the area of a triangle by themselves within the learning activities.

3.1.2 *Learning set development*

In this stage, the topic and model of learning that had been selected and approved in the Supervision 1 stage become the foundation of this stage. Undergraduate students developed a syllabus detailing the topic of learning. After the syllabus development was completed, they developed a lesson plan and student worksheet.

Undergraduate students designed a lesson plan according to the characteristics of guided inquiry based on a scientific method. Guided inquiry activities were integrated into the activities that referred to the steps of the scientific method, namely observing, raising questions, gathering information, associating and communicating. In each step, teacher and student activities were detailed.

In the apperception phase, undergraduate students prepared a quiz which is contained with the question to determine the characteristics of rectangles and parallelograms. Each student must complete the quiz to recall their knowledge of that topic. In core activities, students were divided into small groups as discussion groups. Through discussion activities, the students were expected to be able to discover how to determine the incircle and the area of a triangle. These activities would be facilitated by the student worksheets. The teacher guided the students to construct their knowledge during the learning activities.

Undergraduate students also designed a student worksheet to support the learning process. It was administered as the guideline for the students' learning activities within the discussion process. Student worksheets were designed according to the characteristics of guided inquiry based on a scientific method. The student worksheets provide illustrations and guiding questions to assist the students to construct their knowledge about how to determine the incircle and the area of a triangle. The students were directed to find the concept of the incircle and the area of a triangle using the concept of rectangles and parallelograms. Then, they were asked to identify the relationship between the incircle and the area of a parallelogram and that of a triangle. After discussing and completing the worksheet, the students were expected to be able to conclude how to determine the incircle and the area of a triangle. Each activity in the student worksheet was designed based on the learning steps in the scientific methods. Undergraduate students also prepared learning media that the students would use during the learning activities.

3.1.3 *Supervision 2*

In this stage, undergraduate students presented the results of the development learning kit to their academic supervisor. This stage aimed to evaluate the results of the learning kit that undergraduate students had developed. In this stage, undergraduate students with the academic supervisor evaluated the fitness between the syllabus, the lesson plan and the student worksheet with the characteristics of the learning models. In this stage, undergraduate students and the academic advisor also evaluated the readability of the worksheet.

Overall, the learning kit that undergraduate students developed belonged to the "Good" category. The learning activities designed in the lesson plan were in accordance with the learning characteristics of the guided inquiry learning model, while the learning stages referred to the scientific methods. Similarly, the student worksheet and learning media were also in accordance with the characteristics and might be employed in the learning activities. There were only several notes for minor revision that the academic advisor provided for improving the lesson plan and the student worksheet.

3.1.4 *Revision of the developed product*

In this stage, undergraduate students revised the learning kit based on the feedback and the suggestions that had been provided by the academic advisor. The learning kit that resulted from the revision would be employed in teaching practice.

3.1.5 *Teaching practice*

After the learning kit had been revised, undergraduate students performed their teaching practice. Teaching practice took place for around 30 minutes with the assumption that it was one learning period. In teaching practice, one student served as the teacher while the others served as the students. After undergraduate students finished performing their teaching practice, the academic advisor guided all preservice teachers to reflect on the activities. Every undergraduate student in the class was provided an opportunity to comment on their friend's performance as a teacher and the comment might be provided as questions, suggestions or feedback. Then, the academic advisor provided feedback and suggestions in relation to the overall learning activities within the teaching practice.

In the lesson plan, it was written that the learning activities started with the teachers who gave greetings and apperception, explained the learning objectives and provided learning motivation. However, after explaining the learning objectives, undergraduate students forgot to provide learning motivation; instead, they directly gave a quiz. During the clarification at the end of the activities, this incident occurred because the preservice student was nervous and had low self-confidence because he had to act as a teacher in front of his own friends and academic advisor. This was a matter that caused the preservice teacher to have low concentration and miss that part in the learning activities.

In the apperception phase, it was written on the lesson plan that the time allocated for the students to complete the quiz was three minutes. However, in the implementation, the students took more than three minutes to complete the quiz. After the students had completed the quiz, the teacher invited them to discuss the results of their quiz. After that, the teacher divided the students into small groups which consisted of three students. Then, the teacher distributed the student worksheet and learning media to each group. The students had discussion activities with their peers in a group to complete the worksheet. During the discussion activities, the teacher went around the classroom in order to see the process of the group discussion and guided the students who had difficulties by illustrating the examples and by providing triggering activities.

In the observation step, students read their worksheet. By using the learning media, students discussed the problems in the worksheet in their group. Then, the students wrote the results of the observation step into the available columns in the worksheet. After the observation step had been conducted, the students wrote the questions in their worksheet about the relation between the triangle and parallelogram that had been illustrated in the worksheet within the question raising step. These questions would be used by the students as their starting point in the information gathering step. In this step, the students discussed and looked for information from multiple learning sources namely books, the Internet or teachers.

The next step was the associating step. The students processed the information that they had attained in order to answer the questions related to the relationship between a parallelogram and a triangle to determine the incircle and the area of a triangle. After answering all questions in this step, students wrote their conclusions. During the discussion activities, the teacher went around the classroom to guide the students who had difficulties in completing the worksheet that had been distributed.

In the conclusion writing step, the time that was allocated for the implementation of the learning activities was not in accordance with what had been set in the lesson plan. The time that had been allotted for the students' discussion activities was still insufficient and there were some groups who could not complete their activities. It caused a time addition for discussion activities. Time addition caused a change in time allotment for subsequent activities. Consequently, the time for presenting the discussion results in front of the class and for the reflection activities should be decreased.

The last step in these learning activities was the communicating step. The students presented the results of their discussion and the conclusion of their group in front of the class. The students from the other group were provided with an opportunity to respond or provide different answers. In this step, the students also had a class discussion session. The teacher here served as a moderator.

After the class discussion session had been completed, the teacher guided the students to perform their reflection and provided reinforcement of the concept of the incircle and the area of a triangle. Then, the teacher assigned the students' homework as a means of reinforcing their understanding of the topic. Finally, in closing activities, the teacher informed the next topic that would be studied for the next meeting so that the students might study this first. Then the teacher asked the students to end the learning activities by praying together.

At the end of the teaching practice, the academic advisor gave opportunities for the other undergraduate students to provide their comments, questions, suggestions or feedback in relation to the performance of the undergraduate students who served as the teacher. Several suggestions were provided by these students and one of these suggestions was that the teacher still had to learn how to put the class into a conducive situation. Sometimes the teacher focused too much on one group, so the other groups potentially started to be noisy. However, in terms of learning material mastery and delivery, the teacher had been quite good. The use of learning media in the form of student worksheets had also been quite useful for the students. Overall, the learning process using a scientific method-based guided inquiry was effective in activating the students to construct their own knowledge.

After the discussion and the evaluation had been done, the academic advisor provided feedback in the form of overall conclusions and suggestions. Based on the results of the evaluation, the main problem for undergraduate students in performing learning activities was the occurrence of nervousness and the lack of self-confidence during the teaching activities. That main problem might trigger undergraduate students to frequently look at the lesson plan in order to make sure that they would not miss the learning stages again. In relation to the peer feedback, undergraduate students still had difficulties in organizing the classroom. They also had difficulties in using the learning time allocation effectively because the teaching duration in the teaching practice had been relatively shorter than the actual time allocation.

In general, the results of the observation showed that undergraduate students had been able to design and implement the learning process using guided inquiry based on a scientific method in teaching the incircle and the area of a triangle. This matter was apparent from the learning kit that was designed and its implementation in the classroom. Almost all learning activities implemented were in accordance with the design although there were some learning activities whose implementation demanded additional time.

Moreover, the undergraduate student's mastery of the learning material was good. They were able to explain the materials well and clearly to the students both in the discussion and reflection activities, though once in a while they still looked at the material summary. The feedback and suggestions provided by the academic advisor and the peers might be of benefit in order to improve the performance in implementing the learning activities designed.

3.2 Discussion

Microteaching facilitated undergraduate students to practice the theory that they have studied in a real learning process. This is in accordance with the opinion of Baştürk, (2006) and Karckay and Sanli (2015) who stated that microteaching becomes one of the alternatives for undergraduate students to combine the theory that they have studied and practice. Through the stages in microteaching, including consultational activities on designing the learning kit that consists of the syllabus, lesson plan and student worksheet along with the academic advisor's supervision, undergraduate students have opportunities to design the learning activities according to the theory that they have studied and practice the theory in a learning activity.

Evaluation activities with peers and the academic advisor are beneficial for undergraduate students both directly and indirectly. From feedback and suggestions from peers and the academic advisor, undergraduate students can witness their skills and improve them. Then, microteaching activities can also be a means for improving the lesson plan and the student worksheet that has been designed. These activities help undergraduate students to identify their strengths and weaknesses and develop their teaching skills (Arsal, 2015; Fernández, 2005; Kpanja, 2001; Peker, 2009; Şen, 2010). Similarly, Ralph (2014) stated that the feedback

and reflection results that have been provided in microteaching activities might be used for improving undergraduate students' teaching skills.

Based on the results of the study, it is apparent that the obstacle that undergraduate students still have to deal with in performing their teaching practice is the self-mastery of nervousness and lack of confidence. In order to overcome these problems, the students can be provided with more opportunities to perform their teaching practice. The more the undergraduate students perform their teaching practice, the more negative impacts will decrease (Kpanja, 2001; Peker, 2009; Şen, 2010; Arsal, 2015). In addition, with the increasing activities within the teaching practice, the problems that have been related to the capabilities of organizing classrooms and allocating time might be minimized (Saban & Coklar, 2013).

In relation to the competencies that an educator should have, a teacher is required to have several teaching staff competencies that include pedagogical, personal, professional and social competencies in accordance with the statement in Law Number 14, Year 2005 (RoI, 2005a) and Government Regulation Number 19, Year 2005 (RoI, 2005b). One of the concrete forms of pedagogic competencies that a teacher should have is the skill in designing and implementing good learning processes, which departs from the learning model that will be implemented in the classroom.

In this study, undergraduate students selected guided inquiry based on a scientific method in teaching the incircle and the area of a triangle to VIII grade students. Based on the results of the model design and the implementation in the classroom, it might be concluded that the learning process using guided inquiry based on a scientific method is able to facilitate effective learning because this model provides opportunities for the students to contemplate what they have been studying (Bruning et al., 2011), the active teaching and learning can improve students' higher order thinking skill (Apino & Retnawati, 2017) and turn the mathematics learning into something interesting, useful and beneficial in displaying their creativity (National Council of Teachers Mathematics, 2000). Learning activities with that model can facilitate students to discover their own knowledge. It can have a positive effect on students' cognitive abilities and achievement (Hidayati, 2017; Rochani, 2016).

In this model, students have the opportunity to investigate and solve the problem actively. This activity supports the process of constructing or modifying their knowledge (Setianingsih, 2016). Therefore, it will be meaningful learning. By strengthening students' mathematical understanding through meaningful learning, student difficulties with mathematics can be overcome (Retnawati et al., 2017) and students' achievement will increase (Siregar, 2015). The main characteristics of the guided inquiry model (Garton, 2005) are questioning (raising questions at the beginning of the learning process), student engagement (engaging the students actively in the learning process where teachers serve as a motivator and facilitator), cooperative interaction (inter-student interaction in group discussions), performance evaluation (artwork exhibition) and variety of resources (using various learning sources); these characteristics might facilitate and activate the students to construct their own knowledge. In addition, the scientific model prioritizes the meaningful learning process, the curiosity, the creativity exercise and students' independence as well as training students' deductive and inductive thinking skills in the process of drawing conclusions (RoI, 2013).

A learning process will be effective if the learning situation is conducive, interesting and fun. This is the basis of selecting various learning models. With that consideration in mind, the learning process will be effective and the materials that have been delivered will be well understood by the students (Mulyasa, 2007). The selection of a guided discovery learning model has been appropriate for teaching the incircle and the area of a triangle. Through this model, the students not only retrieve learning materials from the teachers but also can actively construct their knowledge through the discovery activities that have been designed under the learning steps and the student worksheet. Then, the possibility that the students will feel bored might be minimized because they keep being active during the learning process (Faturrahman & Sutikno, 2007). It might be concluded that guided inquiry based on a scientific method is effective in facilitating students to actively construct their own knowledge.

The use of media in learning activities also has an important role. The learning media can be the means for assisting the students in retrieving and understanding the concept that they

have been studying. Several studies have shown that learning media eases the students in understanding the learning materials. In addition, interesting learning media might improve students' learning motivation (Faturrahman & Sutikno, 2007). It is important for teachers to improve learning motivation of students, because a lack of learning motivation can cause difficulties for students to understand mathematics (Retnawati et al., 2017). Another kind of media used in teaching to improve students' motivation is computer utilization, both in teaching activities and testing (Retnawati, 2015).

4 CONCLUSIONS

Based on the results and the discussion of this study, it can be concluded that microteaching was effective in facilitating undergraduate students to implement the learning theory that they have been studying. Through all stages of microteaching, undergraduate students had complete opportunities to design their learning activity according to the theory that they have been learning and perform it in learning activity simulation. Using guided inquiry based on a scientific method, undergraduate students were able to implement a learning process that facilitated the students to actively construct their own knowledge about the topic of the incircle and the area of a triangle.

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