Level of pre-service mathematics teacher’s reflective thinking

R L Ariany¹, ²*, R Rosjanuardi¹, and D Juandi¹

¹Departemen Pendidikan Matematika, Universitas Pendidikan Indonesia, Jl. Dr. Setiabudi No. 229, Bandung 40154, Indonesia
²Departemen Pendidikan Matematika, UIN Sunan Gunung Djati Bandung, Jl. A.H. Nasution No. 105, Bandung 40614, Indonesia

*rivalestaariany@upi.edu

Abstract. Reflective thinking has been promoted in universities in recent years, is no exception for prospective mathematics teachers. Reflective thinking ability of prospective teachers needs to be identified as consideration for finding the right formula to improve reflective thinking skills in learning. The purpose of this study is to classify the reflective thinking abilities of prospective mathematics teachers. The research method used was a survey method. This research involved mathematics education students who had attended practical teaching courses. The instrument used was a reflective thinking questionnaire distributed online. As many as 85 students filled out the questionnaire through the Google form. Data analysis was performed by quantifying the results of the questionnaire, then calculating the frequency and interpreting it using predetermined criteria. The results showed that prospective mathematics teachers who had been categorized in reflective thinking were less than 50%. This shows that the improvement of reflective thinking ability for prospective mathematics teachers is still very much needed.

1. Introduction

The importance of reflective thinking ability is related to the spirit of long life education, meaning that learning and continuous improvement to improve quality is something that must go hand in hand. The ability of reflective thinking greatly supports one's professionalism, so that one of these higher-order thinking abilities attracts a lot of attention and various efforts are taken to develop this ability. Much research has been done to develop reflective thinking skills [1–5]. According to Dewey, Schon, and Mannen reflective practice in education is theoretically the foundation of education [6]. Reflective practice facilitates prospective teachers to be able to develop new knowledge, skills and dispositions by fostering a critical contestation for their actions [7]. In the field of education one of the efforts to develop reflective thinking skills is the microteaching method.

Microteaching is one of the courses held in the mathematics education study program, in the microteaching subject, prospective mathematics teachers are given the opportunity to practice teaching before they actually teach in real educational institutions. Microteaching is intended so that prospective mathematics teachers can develop reflective thinking skills, in microteaching prospective teachers can criticize each other and they are directly involved in the reflection process [8]. Prospective teachers can determine lesson plans, teaching approaches, methods, techniques, materials and assessment methods that are sufficient at the beginning of reflective practice [9]. The results of previous studies indicate that prospective teachers are of the opinion that microteaching and lesson plans are more effective than independent evaluations and producing reflective journals. Prospective science teachers who use
microteaching methods and lesson plans 69% are at the technical level, 31% at the implementation level [8]. Although there are no prospective science teachers included in critical reflection, this result is better than independent evaluation (75% technical) and reflective journals with 81% technical. These results indicate that the practice of microteaching is still likely to facilitate teacher candidates to be able to develop their reflective thinking skills.

Microteaching exists in all areas of teacher education, including mathematics education. This study was conducted to determine the level of reflective thinking of prospective mathematics teacher candidates who have followed teaching practices in microteaching courses, the results of this study are considered to develop appropriate learning models to develop reflective thinking abilities. There are many levels of reflective thinking. Van Mannen divides reflective thinking skills into technical, practical, critical reflection [6]. Mezirow revealed that reflective thinking is divided into habitual action, understanding, reflection, and critical reflection [10]. Baxter defines habitual actions as something that has been learned and is often used so that it becomes an activity carried out automatically even with a low level of awareness [11]. Understanding is meant is to use existing knowledge, without reconsidering that knowledge [12]. Reflection includes a critique of assumptions regarding the content and the problem solving process [11], [13]. Critical reflection is the highest level of reflective thinking where a person understands how he sees, thinks, feels or acts [12], [13].

2. Methods

The method used in this study is a survey, which aims to determine the reflective thinking skills of prospective mathematics teachers who have taken microteaching courses, then classify prospective mathematics teachers based on their level of reflective thinking. Students involved are students who have participated in practical teaching activities, as many as 85 students in the mathematics education study program in the 2019-2020 school year at one of the tertiary institutions in Bandung were involved in this research. The instrument used in the form of a reflective thinking ability questionnaire consisting of 22 items of statements that had previously been through a series of trials until finally feasible to be used in this study, an example of a questionnaire statement can be seen in Table 1. The statements are statements that represents the indicator taken that is how to think reflective prospective mathematics teachers when faced with a problem, when preparing, implementing and assessing learning. Reflective thinking questionnaire was adapted from Taggart and Wilson [9].

| No. | Item | Statement |
|-----|------|-----------|
| 1   |      | I consider contextual teaching |
| 2   |      | I see the problem from various perspectives |
| 3   |      | I plan, monitor and evaluate the learning done |
| 4   |      | I have a strong commitment so that all students can take lessons |
| 5   |      | I am responsive to student learning needs |
| 6   |      | I am open to criticism of my performance in class |
| 7   |      | I set short-term and long-term goals |
| 8   |      | I am looking for alternative learning methods |
| 9   |      | I evaluate the effectiveness of teaching |
| 10  |      | I continuously review the objectives, methods and learning material |

The reflective thinking questionnaire consisted of statements with 4 answer choices namely, very often, often, rarely and very rarely. Options are sometimes omitted to avoid respondents' biased answers. Questionnaire is distributed through online media by using Google Form application. The responses of prospective teachers recorded through a questionnaire were evaluated and classified by scoring each
student's answer on each statement item. For positive statements the highest score is 4 (very often) and the lowest is 1 (very rare), while for negative statements the highest score is 4 (very rare) and the lowest score is 1 (very often). Data analysis is done by calculating the frequency [8]. Then each teacher candidate is classified into 4 categories of reflective thinking ability.

3. Result and Discussion
Students' answers to the questionnaire were then scored according to the type of statement, then counted for the acquisition of individual scores. The data obtained were further classified into 4 categories, namely habitual action, understanding, reflective and critical reflection. Based on the data obtained, it was concluded that prospective mathematics teachers who had not reached the level of reflective thinking reached 54.1%, while those who had reached the level of reflective thinking and exceeded it reached 45.9%. The complete results of the classification of prospective mathematics teachers based on the level of reflective thinking can be seen in Table 2.

| Table 2. Classification of reflective thinking |
|-----------------------------------------------|
| Level of reflective thinking | Percentage |
|-----------------------------------------------|
| Habitual Action                         | 15.3%       |
| Understanding                           | 38.8%       |
| Reflective                              | 36.5%       |
| Critical Reflection                      | 9.4%        |

The presentations obtained illustrate that teacher candidates who have reached the reflective phase (reflective and critical reflective) are less than 50% of all students involved in this study. Prospective mathematics teachers who have arrived at critical reflection can not only use the knowledge they have previously obtained, in the case of students involved in microteaching classes, those who have entered the critical reflection phase can determine / find solutions to problems encountered in teaching practice for applied to the next practice. Prospective teachers who have the ability to think critically are characterized by the formation of new insights or views based on the practice that has been done, the direction from the instructor, input from fellow practitioners, and independent observations and evaluations conducted during teaching practice. Changes in students at this level for example changes in views about learning objectives, which initially refers to the scope of material that must be delivered turns into an emphasis on effective learning that facilitates all students to explore so that they have the experience to construct their understanding independently.

The results obtained from this study have similarities with the results of previous studies [7] that prospective teachers included in the category of critical reflection had lower presentations compared to the other 3 criteria consisting of 25% habitual action, 56% understanding, 18% reflection. Whereas for teacher candidates who have reached the stage of critical reflection only 1%. This indicates that it is necessary to improve the ability of reflective thinking of prospective teachers. Reflection involves intense introspection, but it also requires outside encouragement and stimulus at least in the initial stages, and reflection is not a natural ability that suddenly arises, not an easy thing to make reflective thinking become a habit [14]. So the practices of reflection both in lectures and in teaching practices need to be promoted at the tertiary level, especially in the teaching profession program. Reflective practice has a significant influence on the ability of pedagogy in teacher preparation programs [7].

4. Conclusion
The reflective thinking ability of prospective mathematics teachers drawn from the results of this study still needs to be greatly improved. It is a challenge for educational practitioners to find effective formulas for improving students' reflective thinking skills, so that at least reflective thinking becomes a habit for math teacher candidates. Because after all to score students who have reflective thinking ability, it needs to start by forming reflective mathematics teacher candidates.
Future research can be complemented by investigating effective methods to improve reflective thinking skills, in an effort to achieve a greater goal which is to produce professional mathematics teacher candidates. Other studies can comb what factors influence the ability to think reflective mathematics teacher candidates. However, talking about reflective thinking is part of lifelong education, so thinking skills need to be a priority in education.

5. References

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