Self-Efficacy and Reflective Thinking Skills Attributes of Pre-service Mathematics Teachers

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Abstrak

Kemampuan berpikir reflektif merupakan salah satu kemampuan yang perlu dimiliki oleh calon guru matematika agar dikemudian hari menjadi guru yang profesional. Pengembangan karakteristik berpikir reflektif ini dipengaruhi oleh banyak faktor. Penelitian ini bertujuan mengkaji apakah terdapat hubungan antara efikasi diri sebagai variabel bebas, terhadap Kemampuan Berpikir Reflektif mahasiswa calon guru matematika sebagai variabel terikat. Penelitian ini menggunakan pendekatan kuantitatif dengan metode korelasional. Instrumen yang dipergunakan dalam pengumpulan data berupa angket efikasi diri dan angket kemampuan berpikir reflektif. Penelitian ini melibatkan mahasiswa Program Studi Pendidikan Matematika semester VII yang berlokasi di Jawa Barat. Analisis data yang dilakukan dengan melakukan uji korelasi dan regresi linier. Hasil analisis menunjukkan adanya pengaruh positif efikasi diri terhadap Kemampuan Berpikir Reflektif calon guru matematika.

Kata Kunci: Pendidikan Matematika; Kemampuan Berpikir Reflektif; Efikasi diri.

Abstract

Reflective thinking is one of the abilities the pre-service mathematics teachers need to have to become professional teachers in the future. The development of this reflective thinking characteristic is influenced by many factors. This study examined the correlation between self-efficacy, as an independent variable, on the reflective thinking attributes of pre-service mathematics teacher as a dependent variable. This quantitative study utilized the correlational method. The instruments used in data collection were self-efficacy and reflective thinking attributes questionnaires. This study involved teacher students of the seventh semester of the Mathematics Education study program. The data analysis was carried out by performing correlation and linear regression tests. The results of the analysis showed that there was a positive effect of self-efficacy on the reflective thinking attributes of pre-service mathematics teachers.

Keywords: Mathematics Education; Reflective Thinking; Self-Efficacy.

I. INTRODUCTION

The vision of Indonesian education roadmap 2020-2025 is to encourage the character building of a lifelong learner that continuously develops, gains prosperity, and lives with noble characters infused with Indonesian cultural and Pancasila values. The goals of learning objectives refer to the vision including the learning process of mathematics study programs in higher education. To underline the vision of being a lifelong learner, the mathematics study programs adjust the learning process to the desired values, to provide pre-service mathematics teacher who have a willingness to learn continually.

Reflective thinking skill is necessary in learning because the ability allows the individual to assess of what he has done to make an improvement, and, thus, it encourages the individual to be a lifelong learner. This willingness to learn could be nurtured by reflective thinking as Hursen and Fasli, (2017) stated that the reflective learning is appropriate to encourage the lifelong learner character among pre-service teachers. For instance, the reflective learning could be conducted after performing micro teaching or delivering presentation in the classroom.

Reflection is necessary to be promoted in education program studies in higher education as it prevents the pre-service teachers to perpetuate the traditional school of thought in education (Korthagen, Kessels, Koster, Lagerwerf, & Wubbels, 2001). However, reflective thinking is not always encouraged as the previous studies discovered that higher education instructors assumed that students received the support for reflective learning outside of the class, the instructors do not incorporate it into the learning process. A study by Azeem in Pakistan reported that in most teacher education institutions, pre-service teachers were not properly trained for their first teaching experience (Zahid, 2019).

In fact, reflection in the learning process has an important role. For instance, in learning mathematics the students often encounter problems related to previous experience or knowledge so that students are required to be able to solve these problems using concepts that they have previously learned. Among the existing concepts, students are required to choose an effective and appropriate one. Reflection in the context of learning is a general term for intellectual and affective activities in which individuals engage to construct their experiences to lead to advanced understanding and appreciation (Khalid, Ahmad, Karim, Daud, & Din, 2015; Rohmawati & Afriansyah, 2022).

Mathematical reflective thinking skills include a range of logical thinking, analysing process, and non-algorithmic problem solving. Reflective thinking skills are considered as higher-order mathematical skills that involve extracting meaning with multiple criteria. In addition, reflective thinking should be considered a major part of teacher education and training programmes (Aldahmash, Alshalhoub, & Mohammed, 2021). This implies that reflective thinking is important to increase the awareness of lifelong learning of pre-service mathematics teachers with the ultimate goal of providing professional pre-service mathematics teachers. According to Ur (Mathew, Mathew, & Peechattu, 2017), the main aspect of supporting teachers'

professional progress lies in the reflection process of their teaching activities and practices every day.

Reflective thinking in the learning process aims to increase teachers' awareness of teaching. In addition, it contributes to teacher training students to develop new experiences by using their previous skills. The implementation of reflective thinking could increase teachers' awareness of teaching and influence positively in early teaching practices (Hursen & Fasli, 2017).

Reflective thinking is one of the aspects that is emphasised in teaching (Koçak & Onen, 2014). In addition, reflective thinking has a significant correlation with teaching awareness, self-confidence and self-assessment (Choy, Yim, & Tan, 2017). The self-assessment in this context is the ability to assess an individual's capacity, strengths and weaknesses. Self-assessment is closely related to self-efficacy in which a person needs to assess himself to gain the confidence needed to successfully complete a task or successfully achieve a certain goal. Self-efficacy is the belief or perception that an individual is able to organise and carry out the actions needed to succeed at a given task (Bandura, 1997; Berliana & Sholihah, 2022). This attitude promoted by Albert Bandura is related to a person's belief that he can solve all the tasks or problems with his potential and abilities. Self-efficacy is still an issue that has been widely studied in recent years (Asakereh & Yousofi, 2018; Ayotola & Adedeji, 2009; Goulão, 2014; Tutticci, 2017; Uzunboylu & Selcuk, 2016; Prajono, Gunarti, & Anggo, 2022). The studies over the past 30 years revealed that

there was a positive relationship between self-efficacy beliefs and academic performance and perseverance (McCoach & Siegle, 2017). (McCoach & Siegle, 2007). The results of another study on adult learners showed that the level of self-efficacy was high and there was a significant relationship between self-efficacy and academic achievement (Goulão, 2014). Stevens, Olivárez, Lan, and Tallent-Runnels (2004) found a relationship between prior student achievement and higher self-efficacy for Hispanic students than Caucasian students (McCoach & Siegle, 2007).

The correlation analysis showed a positively significant relationship between the common factors of teachers' reflection and their self-efficacy (Babaei & Abednia, 2016). According to the studies, there was also a positive correlation between self-efficacy and academic achievement (Loviasari & Mampouw, 2022). However, there were few studies exploring the correlation between self-efficacy and reflective thinking among pre-service teachers. As previously stated that reflective thinking could prevent pre-service teachers to perpetuate the traditional school of thought in the teaching process, which is often inappropriate with the current education goals (Korthagen et al., 2001), this study concerned on observing the profile of the reflective thinking ability of pre-service mathematics teachers, and explored the relationship between the self-efficacy and reflective thinking skill. It aimed to diagnose the reflective thinking level of the pre-service teachers that later would benefit the improvement and development of teaching skills in shaping professional

teachers. The previous studies on self-efficacy did not examine the influence of self-efficacy on the mathematics teachers' reflective thinking ability (Koçak & Onen, 2014; Mirzaei, Aliah, & Kashefi, 2014; Mirzaei, Phang, & Kashefi, 2014). To determine the reflective thinking ability, this study utilized RTA developed by Taggart Wilson based on Van Manen's framework. The test was designed to measure the level of reflective thinking of experienced and inexperienced teachers (Mirzaei, Aliah, et al., 2014).

II. METHOD

This study aimed to determine the effect of self-efficacy on reflective thinking ability. This quantitative study used a correlational method. The participants were 78 teacher training students in the fifth semester of mathematics education study program in a university in Bandung. The instruments included self-efficacy and reflective thinking questionnaires adapted from RTA (Reflective Thinking Attribute) developed by Taggart Wilson. The self-efficacy questionnaire consisted of 30 items divided into 15 positive items and 15 negative items. There were three indicators of the self-efficacy, namely strength, generality, and level. Each indicator was represented by 10 items, with 5 positive items and 5 negative items.

Meanwhile, the RTA consisted of 30 items, Sedangkan untuk angket RTA terdiri atas 30 item pernyataan, 15 positive items and 15 negative items. The indicators encompassed 1) encountering problems, 2) preparing the learning process, 3) conducting the learning process, 4) assessing the learning process. The first indicator was represented by 8 items; the second and the third 7 items; the fourth indicator 8 items.

To get a valid and reliable instrument, the questionnaires were tested to students. The reliability score of the self-efficacy questionnaire was 0.85, while the RTA was 0.77. The questionnaires were distributed in September 2021 to the participants. Out of 78 participants, there were only 36 participants who fully answered the questionnaires. Therefore, this study analysed the 36 questionnaire results. The data was considered to be representative as it met the requirement of the quantitative research design, and the distribution test score was close to the normal curve. The data analysis was carried out with the Spearman rho correlation test and linear regression test to discover the effect of the independent variable, namely self-efficacy, on RTA as the dependent variable. The data was process using the SPSS application.

The correlation criteria referred to the criteria developed by Shahriari (2018) as showed in table 1.

Table 1.
Correlation level criteria

Interpretation	Correlation level
Strong	0.50 − 1.0
Medium	0.30 − 0.49
Low	0.10 − 0.29

III. RESULTS AND DISCUSSION

According the analysis results of self-efficacy questionnaire, the average self-efficacy score of the participants was 88.33, and the average score for each item was 2.94. The average score of the participants then was used as the reference to classify the self-efficacy level of the participants. The classification criteria of self-efficacy

followed the framework from Sawari and Mansor (2013) as showed in table 2.

Table 2.
Self-efficacy classification criteria

Average score	Self-efficacy categoy	Frequency
1.00 – 2.00	Low	-
2.01 – 3.00	Moderate	22
3.01 – 4.00	High	14

According to the criteria on table 2, 61.11% of the participants was classified as moderate self-efficacy, and 38.89% was high self-efficacy. Less than 40% of the participants had a high commitment to keep learning after encountering difficulties, believed that they could overcome the problems, had a high commitment to utilize all their strength to succeed or complete their work.

Meanwhile, the results of RTA questionnaires revealed that the average score of the participants was 87. The lowest score was 79, and the highest was 98. These scores were adjusted to the criteria developed by Taggart and Wilson (2005) as showed in table 3.

Table 3.
Reflective thinking levels

Level	Score
Pre-reflective	< 83
Contextual	$83 \leq X < 91$
Dialectic	$91 \leq X \leq 120$

There were 4 participants categorized as pre-reflective, which meant they obtained the knowledge through direct observation. Pre-reflective individuals could perceive concrete and simple problems.

The participants in contextual level were 27 in total, and the dialectic level was 5. In the contextual level, an individual tried to investigate alternative solutions by considering existing contexts and possibilities to investigate. Meanwhile, an individual in the dialectic level demonstrated problem solving abilities, which explored the reasons underlying the decision making in solving the problem. On the other hand, the participants in the highest level of the reflective thinking were expected to go beyond the reflection stage.

The results of the questionnaires were tested using Spearman's rho correlation test. The test was conducted to obtain an ordinal scale. The assumption tests such as normality test was not performed for non-parametric statistics. The correlation test scored 0.60 categorized as a strong correlation based on Cohen's correlation efficient (Shahriari, 2018). The test was followed by the linear regression test to determine the amount of self-efficacy influence towards students' reflective thinking abilities.

The results of SPSS calculation showed R square ≈ 0.36, which means that self-efficacy had an influence on RTA by 36%. Further test investigated the significance of the influence which scored sig. 0.000. It meant that self-efficacy as the independent variable significantly influenced RTA as the dependent variable.

The correlation coefficient between self-efficacy and RTA was 0.60, included into a strong correlation. Based on the statistic results, self-efficacy positively influenced RTA that represented the students' reflective thinking abilities. The percentage of self-efficacy influence on RTA was 36%. It revealed that 64% RTA of the students were influenced by other variables. The results also showed that 75% of the mathematics teacher training students were still in the

contextual level. Thus, the students should improve their reflective thinking abilities to the desired level, namely dialectic level. The number of the students in the dialectic level were far fewer than those in the moderate level. Improving the students' reflective thinking was necessary.

The findings in the study were different from the previous studies. Tuttici revealed that there was a positive correlation with small to moderate correlation between critically reflective self-efficacy and general self-efficacy (Tutticci, 2017), whereas the correlation of self-efficacy and reflective thinking ability in this study was included into strong category.

IV. Conclusions

According to the results of the study, there were several things to suggest. Firstly, the attempt to improve students' self-efficacy was necessary to conduct in the classroom as the percentage of the students with high self-efficacy was 38.89%. Secondly, further studies were suggested exploring other factors that may influence reflective thinking ability.

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