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Self-efficacy of Primary School Teachers in Mathematics Teaching: A Comparative Research on Teacher Training Program Products

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Abstract. This research aims at comparing the self-efficacy of primary school (SD, *Sekolah Dasar*) teachers who had taken teacher training program (PPG, *Program Pelatihan Guru*) on Mathematics teaching and vice versa in which it was seen from the personal belief sub-factors in teaching Mathematics and the expectation of mathematics teaching outcomes. This research employed quantitative approach with comparative research design. In addition, the samples were 198 alumni of Primary School Education Program at one of the universities that held PPG in Indonesia. The data analysis was processed by SPSS version 23. Based on the calculation of T-test result, it has been indicated that there were no significant self-efficacy differences between primary school teachers who had taken PPG on mathematics teaching and vice versa. Therefore, the results of this research concluded that self-efficacy was an important variable in a pedagogical competence as it could influence the way teachers managed the classroom in order to attain maximum students' achievement.

Keywords: mathematics teaching, primary school teacher, self-efficacy, teacher training program (PPG).

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INTRODUCTION ~

"The subject I like the least is math."

"I am afraid of math. I am afraid of being scolded by the teacher if I cannot answer the questions."

"My math score is always bad."

The three sentences above are some of the statements most often expressed by primary school students who show their anxiety and dislike of Mathematics. This phenomenon has resulted low academic score and excessive fear. This kind of anxiety is difficult to overcome, because it does not always appear, unless it is explored with an interpersonal approach. Since it reduces interest towards Mathematics learning, this anxiety will lower academic performance, which causes poor future job prospects (Ramirez, Chang, Maloney, Levine, & Beilock, 2016). Such internal (psychological) factors hamper the purpose of Mathematics teaching, which is to provide the logical and analytical thinking experience in solving daily life problems (Nurlu, 2015) Meanwhile, for citizens of the modern world, the understanding and the ability to apply mathematical concepts to solve contextual problems is one of the most important things (OECD, 2017), such as the urgency of mastering Mathematics competencies for school students.

Furthermore, mathematical anxiety has become an international issue (Wilson, 2014). This means that this is a common obstacle experienced by teachers in Mathematics teaching at the primary school level, considering that the students tend to be emotionally unstable.

Some studies stated that the most responsible party to determine the success of mathematics teaching is the teacher. For example, Frakes & Kline (2000) believe that students' understanding on Mathematics will improve when the teacher gives an opportunity for students to investigate and find mathematical ideas. Some other studies reveal that teachers' self-efficacy is one of the teacher's affective factors that influence and play a major role in Mathematics teaching (Chang, 2015; Giles, Byrd, & Bendolph, 2016; Gür, Çakiroğlu, & Çapa, 2012; Nurlu, 2015).

Self-efficacy is a belief in a person's ability to regulate and implement the actions needed to manage the expected situation (Bandura, 1997). For teachers, self-efficacy plays a role as a variable that affects individual differences, and has a strong relationship to learning and achievement (Chang, 2015) as it involves two types of expectation, namely efficacy expectation and outcome expectation. Efficacy expectation is the belief that a person can successfully conduct the behaviors needed to produce a result. Meanwhile, the outcome expectation is one's estimation that the performed behavior will lead to certain results (Bandura, 1978). Practically, teachers' self-efficacy is a belief in their abilities to plan, organize, implement, and evaluate teaching activities to achieve optimal students' competence. The planning and evaluation activities are based on the results of what is expected to be achieved, and what activities are believed to help achieving these expectations.

The ideas from the two experts above emphasize the importance for teachers to have self-efficacy in their teaching activity (including Mathematics teaching). As stated in Chang's research results (2015), the greater the teacher's self-efficacy means the greater the students' achievement in mathematics learning. The Government of Indonesia, in this case, relies on the Teacher Training Program (PPG, *Program Pelatihan Guru*) to intensify education program on the Teacher Training Institute (LPTK, *Lembaga Pendidikan Tenaga Kependididkan*) campuses. This program is intended for Bachelor of Education and Bachelor of non-education program (who wants to become a teacher).

As per Permendikbud No. 87 of 2013 Article 2, the purpose of PPG is to produce prospective teachers who have competence in planning, implementing, and assessing learning. Through the program, participants are exposed to certain competencies and are expected to be able to help students reach their

best potential. Therefore, graduates of this program are expected to obtain professional educator certificates, as a proof of their professionalism and reliability in teaching. Therefore this research aims at seeking whether PPG program produces better teacher qualities and self-efficacy on Mathematics teachers at the primary level or not.

This research compares the self-efficacy between primary school Mathematics teachers who had taken PPG and those who had not. It was measured by two subfactors, namely personal belief in Mathematics teaching and the expected mathematics teaching outcomes. The urgency of this research needs to be considered because the results of this comparative research can be used as an evaluation to improve the quality of mathematics teaching in primary school and in the implementation of the upcoming PPG program on teachers' self-efficacy. Based on the objectives, the proposed hypothesis is: There is a significant difference between primary school teachers who taken PPG on mathematics teaching and those who have not, where primary school teachers who have taken PPG on mathematics teaching is greater than those who have not.

There is no research in Indonesia that compares the self-efficacy of primary school teachers who had taken PPG on mathematics teaching and those who had not. Some research that discuss the same topic, primary school teachers' self-efficacy in mathematics teaching is done outside of Indonesia, as follow. First, a research by Nurlu (2015) in Ankara, Turkey, discusses the characteristics of primary school teachers by comparing teacher self-efficacy in mathematics teaching. The research used a qualitative descriptive approach to see the differences in self-efficacy characteristics. The results showed that teachers with high self-efficacy had several characteristic differences compared to teachers with low self-efficacy. The diferences were: showing a higher level of effort (persistence) towards students' achievement; being more open to new ideas and methods, believing in students' achievement and being responsible for students' success; and being more concerned with building warm relationships with students than with their parents.

Secondly, a research by Manzar-abbas & Lu (2015) was conducted to investigate the self-efficacy of primary school teachers in relation to gender in Chinese and Mathematics, which were taught during practicum in primary school. The result showed that overall, female teacher candidates had a higher level of self-efficacy than male teacher candidates. Moreover, there were no significant differences on the basis of the subjects taught (Mathematics and Chinese).

Thirdly, the reserach by Giles et al. (2016) in a southeastern city of the United States aims at investigating the self-efficacy of

prospective primary school teachers in Mathematics teaching. Furthermore, the results showed that primary school teacher candidates had a positive level of self-efficacy in mathematics teaching ability, and a positive level of self-efficacy in the expected mathematics teaching outcomes. Giles et al. (2016) also confirmed that teacher training programs should naturally be able to identify opportunities to positively influence the teaching competencies of prospective teachers.

METHODS

This research used quantitative research methods with a type of comparative research. The numbers of participant were obtained using cluster sampling techniques. The data obtained were then processed using the Statistical Package for Social Sciences (SPSS) program 23.

The Subject of Research

Participants in this research were alumni of class 2010-2013 of Primary School Education Program (PGSD, *Pendidikan Guru Sekolah Dasar)*at one of the universities conducted PPG in Indonesia. It was conducted from December 2018 to January 2019. The cluster sampling was used to determine which classes to sample. After selecting classes, a proportional sampling was used to determine the sample size in the form of primary school teachers who had taken PPG, and those who had not. Furthermore, the sample in this research amounted to 198 people, including 48 primary school teachers who had taken PPG and 150 primary school teachers who had not. In this research, primary school teachers who had taken PPG were those who had taken and passed the program and primary school teacher/candidates who were taking the PPG program, but had conducted a Field Experience Program (PPL, *Program Latihan Lapangan*) at a predetermined primary school. While primary school teachers who had not taken PPG were teachers who had not taken the PPG program, and was already teaching at primary school. The research sample was primary school teachers who had around 0-5 years teaching experience.

Data Collection Technique

This research collected the data using questionnaires distributed to predetermined samples (primary shcool teachers who had taken PPG and those who had not). The questionnaire consisted of 21 items using a 5-point Likert scale, the range of the sclae is strongly disagree, disagree, slightly agree, agree and strongly agree. Strongly disagree answers indicated the lowest points (1), while strongly agree answers indicated the highest points (5).

The Instrument of Researh

The research data were obtained using the Mathematics Teaching Efficiency Beliefs Instrument (MTEBI) scale developed by Enochs, Smith, & Huinker (2000). MTEBI consists of two subscales, namely the Personal Mathematics Teaching Efficacy

(PMTE) and the Mathematics Teaching Outcome Expectancy (MTOE). PMTE consists of 13 items, namely question items 2, 3, 5, 6, 8, 11, 15, 16, 17, 18, 19, 20, and 21. Whereas, MTOE consists of 8 items, namely questions item 1, 4 , 7, 9, 10, 12, 13, and 14. The scores of the PMTE scale ranged from 13 to 65, while the MTOE ranged from 8 to 40. The reliability test was conducted using the Cronbach's Alpha method, and the Cronbach's Alpha value for the MTEBI scale was equal to 0.787 which meant that the instrument is reliable.

Data Analysis Technique

Before the data were analyzed, question items number 3, 6, 8, 15, 17, 18, 19, and 21 must be reversed to produce consistent values between the negative and positive statements. If a respondent answered "strongly disagree", then the score will be 1. Then, the score must be reversed to the highest score, which is 5. Score 2 is reversed to 4, while score 3 is fixed, score 4 is reversed to 2, and score 5 is reversed to 1. Having being obtained, the data were analyzed using the Statistical Package for Social Sciences (SPSS) version 23 program for Windows using an independent T-test technique.

RESULTS

Before conducting the T-test, the data obtained must be tested using normality and homogeneity tests. The tests were conducted to see whether the obtained data were normally distributed and homogeneous or not. Normality test was conducted with Kolmogorov-Smirnov corrected by Lilliefors and Shapiro-Wilk. The results of the normality test is presented in Table 1 below.

Table 1. Normality Test.

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	**df**	**Sig.**	**Statistic**	**df**	**Sig.**
PPG	.076	48	.200*	.992	48	.983
NON-PPG	.069	150	.081	.990	150	.355

The results of the MTEBI normality test for primary school teachers who had taken PPG using the Kolmogorov-Smirnov test showed a significance value of 0.200, and the Saphiro-Wilk test showed a significance value of 0.983. This proved that the MTEBI data of primary school teachers who had taken PPG were normally distributed because the significance value of the Kolmogorov-Smirnov test results was more than 0.05 (0.200 > 0.05). In addition, the normality test using the Saphiro-Wilk test also showed a value of more than 0.05 (0.983 > 0.05).

The results of the MTEBI normality test for primary school teachers who had not taken PPG using the Kolmogorov-Smirnov test showed a significance value of 0.081, and the Saphiro-Wilk test showed a significance value of 0.355. This proved that the MTEBI data of primary school teachers who had not taken PPG were normally distributed because the

significance value of the Kolmogorov-Smirnov test results was more than 0.05 (0.081 > 0.05). In addition, the normality test using the Saphiro-Wilk test also showed a value of more than 0.05 (0.355 > 0.05).

For the next step, this research employed a variance homogenity test. Table 2 shows that P (sig) of MTEBI data for primary school teachers who had taken PPG and those who had not taken PPG were more than 0.05 (0.140 > 0.05). Since the two data had a significance of more than 0.05, the MTEBI data of primary school teachers who had taken PPG and those who had taken PPG were declared homogeneous.

Table 2. Homogenity Test.

	Levene Statistic	df1	df2	Sig.
Based on Mean	2.197	1	196	.140
Based on Median	2.182	1	196	.141

After the data were declared normal and homogeneous, then the T-test was conducted to determine whether there were differences in the self-efficacy of primary school teachers who had taken PPG in Mathematics teaching and those who had not. The results of the T-test calculations using SPSS version 23 is presented in Table 3.

Table 3. The Result of MTEBI T-test.

		MTEBI	
		Equal variances assumed	**Equal variances not assumed**
Levene's Test for Equality of Variances	F	2.1971	
	Sig.	.140	
t-test for Equality of Means	T	1.164	1.054
	Df	196	68.680
	Sig. (2-tailed)	.246	.295
	Mean Difference	1.20083	1.20083
	Std. Error Difference	1.03189	1.13894
	95% Confidence Interval of the Difference Lower	-.83420	-1.07149
	Upper	3.23587	3.47315

The results of Levene's Test were used to prove whether the assumptions of the two variances were equal or not with the hypothesis $H_0 : \sigma_1^2 = \sigma_2^2$ to $H_a : \sigma_1^2 \neq \sigma_2^2$ where σ_1^2= group variance 1 and σ_2^2= group variance 2. The Levene's Test results showed the value of p = 0.140, which was greater than 0.05 so that $H_0 : \sigma_1^2 = \sigma_2^2$ could not be rejected. Therefore, the assumption of two equal variances assumed was fulfilled.

Since the results of Levene's Test stated that the assumption of the two variances were equal, the T-test of two independent samples was used with the assumption that the two variances were equal (equal variances assumed). Table 3 presents that the t-count value obtained by assuming

equal variances assumed showed a score of 0.246 (2-tailed). This showed that P (0.246) > 0.05 (2-tailed), so that H_0 could be rejected. Then, by using the one-tailed T-test for hypothesis $H_0 : \mu_1 < \mu_2$ against $H_\alpha : \mu_1 > \mu_2$, then the results of the 2-tailed T-test needed to be divided into two, resulting in $\frac{0.246}{2} = 0.123$. Since the P value (sig one-tailed) > 0.05, then H_0 said that "there is no significant difference between the self-efficacy of primary school teachers who had taken PPG in Mathematics teaching and those who had not" was accepted. Therefore, the hypothesis proposed in this research which reads "there is a significant difference between primary school teachers who had taken PPG in mathematics teaching and those who had not, where the self-efficacy of primary school teachers who had taken PPG was greater than primary school teachers who had not taken PPG", was rejected. The results of this calculation showed that the teacher's self-efficacy in mathematics teaching was not significantly different, even though there were differences in the status and experience in taking PPG.

DISCUSSION

The results showed that there was no significant difference of self-efficacy of primary school teachers who had taken PPG in mathematics teaching and those who had not. Primary school teachers who had taken PPG and primary school teachers who had not taken PPG have the same self-efficacy in mathematics teaching, both in personal beliefs and the teaching result expectation in mathematics teaching as described in the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI) scale.

Overall, primary school teachers who had taken PPG and primary school teachers who had not taken PPG had personal beliefs in mathematics teaching. Thus, they had high hopes for the mathematics teaching result in attaining students' learning achievement from the teaching given by the teacher. This was indicated by the number of data scores calculated by primary school teacher respondents who had taken PPG and those who had not taken PPG. The average score calculated by each primary school teacher who had taken PPG was 84.02. If the average score was divided by the number of item statements on the questionnaire, then the average scale answered by each teacher was equal to 4.0. The same was with primary school respondents who had not taken PPG, the average calculation result of the selected points was 82.8200. If the average score was divided by the number of items statement on the questionnaire, then the average scale answered by each teacher was equal to 3.94. This showed that each primary school teachers respondent who had taken PPG and those who had not "agree" that they had personal beliefs in mathematics teaching and the expected mathematics teaching outcomes.

This was in contrary to the research conducted by Bedİr (2015) and Palmer

(2006) stating that teachers who take professional training had a higher level of teaching self-efficacy than teachers who did not take professional training. The results showed that there was no difference in self-efficacy between primary school teachers who had taken PPG and those who had not could be caused by two factors. The first factor was the similarity of the teaching experience of primary school teachers who had taken PPG and primary school teachers who had not taken PPG, in the range of 0-5 years. The length of teaching experience made self-efficacy in mathematics teaching the similar. This result was in accordance with the research of Giles et al. (2016) stating that primary school teacher candidates had high self-efficacy in Mathematics teaching abilities and a positive level of expectation on the mathematics teaching outcome even though they did not have much teaching experience. Gür et al. (2012) also said that years of teaching experience were not related to teacher performance in mathematics teaching. Furthermore, Tschannen-Moran, Hoy, & Hoy (1998) explained that teachers with little teaching experience who had high self-efficacy was assumed that they have more mature teaching preparation and fewer teaching difficulties.

In this research, primary school teachers who had taken PPG and primary school teachers had have not taken PPG came from different classes, namely from the 2010 to 2013 classes. It could be also said that primary school teachers who had taken PPG had fewer teaching experiences than primary school teachers who had not taken PPG, because teachers who had PPG must follow a series of lessons in a few months at a particular university. So that within this period, the primary school teacher who had taken PPG did not practice the teaching process in the classroom (school). Although the teaching experience practiced is less than primary school teachers who had not taken PPG, the self-efficacy in mathematics teaching could be said to be the same. The research conducted by Gür et al. (2012) stated that the length of teaching experience was not a factor that influenced the self-efficacy of class teachers, science teachers and mathematics teachers. However, another research stated that the prospective teacher's self-efficacy in mathematics teaching was influenced by seniority factors at the class level, where the higher the level of the class, the higher the self-efficacy in mathematics teaching (Bedİr, 2015; Çakiroglu & Işiksal, 2009). Therefore, in regards to whether the length of teaching experience influenced self-efficacy could not be explained through this research; further research that focused on the length of teacher experience in teaching was still needed.

The second factor was the participants came from the same research program and university. Hence, the curriculum provided was the same between primary

school teachers who had taken PPG and those who had not taken PPG. This generated the same outcomes in the teaching methods. This could be confirmed by the results of Çakiroglu & Işiksal (2009), that the experience of prospective teachers in teacher education programs could influence their self-efficacy and attitudes towards mathematics; also, previous experience (mastery experience) and verbal persuasion were several sources of self-efficacy (Bandura, 1997). Bandura (1997) explained that previous experience (mastery experience) was the most influential source of self-efficacy because it provided evidence of the individuals effort to gain success. While verbal persuasion had a big role in strengthening one's belief that thay were able to do something they wanted (Bandura, 1997). That was the two sources of self-efficacy (mastery experience and verbal persuation) obtained in educational programs during post-graduate program had a greater weight and portion, than those obtained from the PPG. It could even be said that there was almost no contribution of PPG to the formation of self-efficacy. Since technically, the teaching practice in the PPG program was mostly done with peer teaching. Furthemore, whether differences of universities affect the teacher's self-efficacy in mathematics teaching could be answered in the next research.

The implication of the results confirmed that self-efficacy was an important variable in pedagogical competence, because it could affect the way the teacher acted in managing the class in order to attain maximum students' achievement. Therefore, universities providing primary school teachers education programs (especially for LPTK campuses) must be able to provide learning and teaching experience for prospective teachers to be able to teach mathematics well. More than that, a good relationship was also needed between the university and primary school teacher education to provide practical and theoretical knowledge and experience on how to improve the quality of primary school teachers in mathematics teaching.

Given the importance of self-efficacy for teacher competency and student learning achievement, there are at least two things that should be considered based on the results of this research: 1) PPG should provide more teaching practices in schools than peer teaching practices and deepen the theory of learning in the location where the program is implemented (generally on the LPTK campus). The first consideration is that more elements of the formation of self-efficacy (mastery experience and verbal persuation) are obtained at the lecture level than in the training program. While the second consideration is that self-efficacy between teachers who have had PPG and those who had not is equally

good if their teaching experience is relatively the same. It is very unreasonable if PPG continues without emphasizing the aspect of self-efficacy in its learning program; 2) Since PPG is an ongoing program for the past few years, there are several possibilities why PPG is not able to form graduates' self-efficacy better than teachers who did not participate in the program, including: PPG deliberately overrules self-efficacy (curriculum and material inappropriate), inadequate teacher competence, and personal characteristics of PPG participants (research subject).

CONCLUSION

The results showed that there was no significant difference between the self-efficacy of primary school teachers who had taken PPG in mathematics teaching and those who had not. The results were caused by two factors. The first factor was the similarity of the teaching experience of primary school teachers who have taken PPG in mathematics teaching and those who have not with a range of the 0-5 year. The second factor was that participants came from the same research program and university.

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