Prosiding SI MaNIs (Seminar Nasional Integrasi Matematika dan Nilai Islami)
Vol.1, No.1, Juli 2017, pp. 21-25
p-ISSN: **2580-4596; e-ISSN: 2580-460X**

Mathematics Anxiety and Self-efficacy among Secondary School Students

Risma Nurul Auliya
Department of Technical Information, University of Indraprasta PGRI, Jakarta
Email: rismauliya@gmail.com

Article Info

***Article History*:**

Received: 15 Mei 2017
Revised: 1 Juni 2017
Accepted: 31 Juli 2017

Keyword:

Mathematics anxiety
Mathematics self-efficacy

ABSTRACT

The aims of this research are intended to examine the effect of mathematics anxiety towards mathematics self-efficacy among secondary school students. The research utilized a survey method with quantitative approach. The population in this research are all of students from one of junior high school in Depok. As concern, the sample are grade eight students., who selected by using purposive sampling technique. The quantitative analysis is used linear regression analysis. The result shows the negative effect of mathematics anxiety towards mathematics self-efficacy.

1. INTRODUCTION

In recent years, students' ability to learn mathematics in school has been extensively explored by researchers. This is because mathematics in school is very important in enhancing the quality of human resources. Realizing the importance of learning mathematics in school, the national education system of Indonesia regulated by Law Number 20/2003 (UU RI No. 20 Tahun 2003) affirms that mathematics is one of compulsory subjects for elementary and secondary school students. In addition, mathematics is a part of our life, anyone who is a member of society should know basic concepts of mathematics. Unfortunately, mathematics learning is disrupted by students' negative perception towards mathematics. Most students consider that mathematics is difficult subject, due to the nature of mathematics that is abstract, full of symbols and formulas that make students confused easily. The negative perception about mathematics can lead to the emergence of feeling depressed, anxiety, and panic when solving mathematics problem, and that feeling is known as mathematics anxiety.

Bursal and Paznokas [1] defined mathematics anxiety as the helplessness and panic one experiences when asked to solve mathematics problems. Furner and Berman [1] stated mathematics anxiety as "I can't syndrome", mathematics anxiety can be caused from a humiliating mathematics experience or inability to applied understanding and application of mathematical concepts. To be specific, mathematics anxiety refers to such unhealthy mood responses which occur when students come upon mathematics problems and manifest themselves as being panicky, depressed and helpless, nervous and fearful, and at the same time, it is accompanied by some physiological reactions, such as perspiration of the palms, holding tight the fists, being sick, vomiting, dry lips, and pale face [2]. These definitions described that mathematics anxiety is a situation wherein the individual encounters during mathematics learning and causing the individual to develop negative attitudes towards mathematics (Bursal, Paznokas; Gresham; Hembree; Kelly, Tomhave; Tobias; Zettle, Raines, in [3]).

Students who experience higher levels of mathematics anxiety has an unreasonable fear towards mathematical operations and mathematical classes [3] and lead to develop negative attitudes and emotions towards mathematics [4]. This fear causes self-esteem, disappointment, and academic failure [3]. [5] found that students who suffer from mathematics anxiety often try to avoid from math-related situations, and consequence may include poor performance in math-related problem solving (Hembree) and difficulties in basic numerical processing (Imbo and Vandierendonck). The avoidance from math-related situation would cause students to continue performing poorly in mathematics [4] There is also a tendency to develop a negative attitude to the students' mind in assessment and evaluation system [6]. Scarpello [6] stated over reliance on high-stakes tests has reinforcement development of negative attitudes towards mathematics and rose students mathematics anxiety levels.

Jain and Dowson [6] mentioned mathematics anxiety as psychological construct interferes in low self-confidence and negative mindset towards mathematics learning. Bandura stated that the judgements about our potential to learn successfully, the belief in our own capabilities, and how long we persist are influences by self-

efficacy [7]. Mathematical self-efficacy can described as an individual's confidence about completing a variety of tasks, from understanding concepts to solving problems in mathematics [4].

Betz and Hackett [4] found that students' mathematics self-efficacy are a better predictor of their educational and career choices than the students' previous mathematics performance. According to Pajares and Miller's social cognitive theory, self-efficacy is instrumental in determining how individuals will use the knowledge and skill they have [8]. Siegle [9] stated that self-efficacy indicates how students strongly believe that they have capabilities to do well. Furthermore, person who maintain resilient sense of self-efficacy set challenging goals for themselves, make good use of analytic thinking skills, and have a firmer commitment to reach their goals [10]. Kahle [11] stated that self-efficacy directs an individual's choice regarding any personal ability, job success and attainment, and course selection for higher education, because these things are directed by an individual's beliefs in his/her own abilities. Kahle [11] also emphasized that self-efficacy constitutes a large part of educational setting that impact to academic goals, motivation, effort, interest, and self-concept.

Bandura [11] mention that there are four main sources of influence self-efficacy. These are mastery experiences, vicarious experiences, social persuasions, and physiological factors, such as stress or anxiety. When individual experiences negative mindset about his own capabilities or feeling anxiety when completing tasks in mathematics, those affective reactions can lower self-efficacy [11]. Huitt and Tallon [7] stated that one way to gain insight into how students feel, think, and act, about and towards mathematics is to examine their psychological domains of functioning: the affective and cognitive. Tanner and Jones [7] explained that the affective domain includes students' belief about themselves and their capability to learn mathematics; their self-esteem and their perceived status as learners, their beliefes about the nature of mathematical understanding, and their potential to succeed in mathematics. And the cognitive factor describes thinking processes and the use of knowledge, such as associating, reasoning, or evaluating to solve mathematics problems [7].

Ho [12], in her research investigated that high levels of mathematics anxiety may not have directly affected students' mathematics achievement but may have reduces the self-efficacy inturning possibly to affect their mathematics performance. [3] suggest that students' self-efficacy are very necessary to be increased, students with higher levels of self-efficacy belief that he or her has competence to successfully perform a given task and more persistence in pursuing the task in the face of obstacles. Collins [3] indicates that students whose self-efficacy is higher are more accurate in mathematics computation and show greater persistence to solve difficult tasks that do students whose self-efficacy is low. Students underestimating their capabilities are more likely to limit their actions and restrict themselves from acquiring potential experience and accomplishing tasks [8]. Mathematics self-efficacy and mathematics anxiety can affect students'performance in mathematics learning, so it is important to understand how mathematics self-efficacy and mathematics anxiety related to each other.

2. RESEARCH METHOD

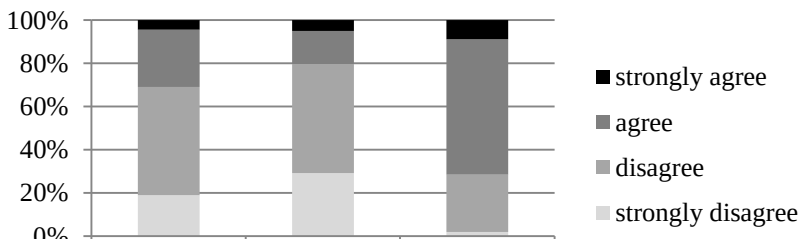
The main interest of this study was to examine the effect of mathematics anxiety towards mathematics self-efficacy among secondary school students. This study utilized a survey method with quantitative approach. The population was students of a junior high school in Depok. The sample consisted of 158 students in grade-8 of the school year 2015-2016. The sample students responded to the Mathematics Self-efficacy and Anxiety Questionnaire. The Mathematics Self-efficacy Questionnaire was adapted from [7], containing 14 statements sorted into two domains: affective and cognitive. And, the Mathematics Anxiety Questionnaire was adapted from a questionnaire developed by [13]. A number of 25-item were chosen and grouped under four sub-headings of somatic, cognitive, attitudinal, and mathematical understanding. Each item on the scales represent a situation which may arouse mathematics anxiety and self-efficacy by indicating "strongly agree", "agree", "disagree", and "strongly disagree".

3. RESULTS AND ANALYSIS

The first set of findings discussed are from the mathematics self-efficacy questionnaire that each student completed and the second set are the findings from the analysis about the effect of mathematics anxiety towards mathematics self-efficacy.

Affective Domain of Self-efficacy Questionnaire

The affective statements asked the students to consider what they velieved and examined their perceived status as learners. Figure 1 shows the percentile results of the students' responses to statement 1 to 3. As a group, the students disagree that some people just cannot do mathematics (S1 50%) and people cannot change how good they are at mathematics (S2 51%). From these two findings it would appear that the students believe that everyone could success in mathematics if they put a hard work. Sixty-three percent of the students agreed that they know if they are going to get mathematics question right (S3), this would imply that the students have self-confidence to do well in accomplish the tasks.



chool Students

Figure 1. Student (N = 158) affective domain of self efficacy questionnaire results.

Cognitive Domain of Self-efficacy Questionnaire

The cognitive domain is the students' awareness of their mathematical knowledge, their strengts and weaknesses, and their ability to make connection with, and within the curriculum. Figure 2 illustrates the percentile results of the students' responses to statements 4 to 8.

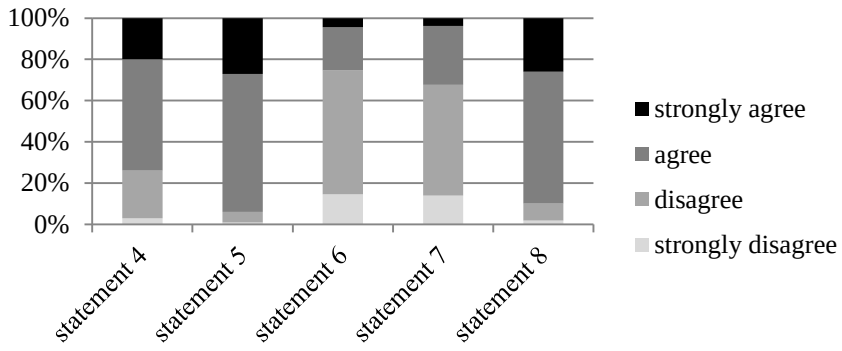


Figure 2. Student (N = 158) cognitive domain of self efficacy questionnaire results.

According the results in figure 2, it can be clearly seen that the students belief that success and failure in mathematics performance related to working hard (S4) and they knew which parts of mathematics they didn't understand (S8). In addition, the students' disagreement with statements which included reasons for doing badly in mathematics such as lack of memory (S6) and natural ability (S7). These are positives findings as students who attribute their success or failure in mathematics to uncontrollable factors are unlikely to apply effective learnings (Tanner and Hones, in [7]).

The Linear Regression Analysis

Quantitative data gathered from the surveys were analyzed utilizing linear regression using SPSS. The linear regression analysis which was appropriate to investigate the relationship between a single independent and dependent variable. Independent variable was mathematics anxiety and independent one was mathematics self-efficacy. Previously, the assumptions of regression must be fulfilled, such as normality, linearity, autocorrelation, and heterocedasticity.

Kolmogorov-smirnov test was used for testing the normality of data. As could be seen in Table 1, the data fulfilled normality assumed (sig > α).

Table 1. Normality test

	Kolmogorov-Smirnov		
	K-S Z	**N**	**Sig.**
Mathematics anxiety (X)	1.348	158	0.058
Mathematics self-efficacy (Y)	1.329	158	0.058

Table 2 showed that the relationship between variables was linear (sig > α). It meant the regression model has linearity assumption.

Table 2. Linearity test

	Mathematics Self-efficacy	
	F	**Sig.**
Mathematics Anxiety	0.702	0.904

The results in Table 3 indicates the model of regression has no autocorrelation, because the value of d lies between d_U and $(4 - d_U)$.

Table 3. Autocorrelation test

	Durbin-Watson	**DW critical value**
Mathematics self-efficacy (Y)	2.249	$d_U = 1.748$ $d_L = 1.720$

The result of heterocedasticity test in Table 4 reported that the regression model has a constant variance (homocedastic) with sig > α.

Table 4. Heterocedasticity test

	Sig.
Mathematics Anxiety	0.169

In Table 5, it can be clearly seen that the significance value for t test and F test is equal to zero. The result indicates that the null hypothesis is rejected. In other words, changes in the predictor's (mathematics anxiety) value are related to changes in the response variable (mathematics self-efficacy). And the equation of regression model has the form:

$$\hat{Y} = 26.050 - 0.233X$$

The equation showed that the coefficient of students' mathematics anxiety was -0.233. The coefficient indicated that for every reduction score in mathematics anxiety can be expected self-efficacy scores to decrease by an average 0.233.

Tabel 5. t test and F test

Uji Statistik	**Nilai hitung**	***Sig.***	**Keterangan**
t-test	32.716	0.000	H_0 ditolak
F-test	148.045	0.000	

In addition, the coefficient of determination (see Table 6) explained that 48.7% of variation in the mathematics self-efficacy score is reducing by mathematics anxiety score, and 51.3% remaining is explained by the others.

Table 6. The coefficient of determination (R^2)

	***Self-efficacy* Matematika**
Koefisien determinasi	0.487

Discussion

Affective and Cognitive Domain of Self-efficacy Questionnaire

The students' responses in affective domain statements described a strong relationship between motivation, effort, and success. The responses imply that students have confidence of their own capabilities and capacity where mathematics is concerned. This could be impact positively on the students in the future as they know how to effectively monitor or regulate their responses. According to McDonald and Boud monitoring is the hub of self-regulated task engagement and the internal feed-back it generates is critical in shaping the evolving pattern of learners [7].

Analysis of the cognitive domain statements showed that the students related mathematical success to hard work and their recognized the need to have knowledge and strategies to bring to their mathematics learning [7]. Therefore, the results prove that students' mathematics self-efficacy may be defined as their judgements about their potential to learn the mathematics successfully. Students with higher mathematics self-efficacy levels set higher goals, apply more effort, persist longer in the face of difficulty and are more likely to use self-regulated learning strategies (Wolters and Rosenthal, in [7]).

The Linear Regression Analysis

According to the result of linear regression analysis, students' mathematics anxiety has a negative effect to students' mathematics self-efficacy. This result explains that mathematics anxiety could be the indicator of mathematics self-efficacy, so higher mathematics anxiety is related to lower self-efficacy levels. When they are under pressure, their stress levels increase and they feel more anxiety, and this could have negative effect on their mathematics performance (Wigfield dan Meece, in [14]). Many students who do not necessarily lack of skills or content knowledge to be able succeed in mathematics, but rather their high anxiety and low self-efficacy lead to doubt their ability to complete the mathematics tasks [14]. A student who feels anxious about mathematics can feel incapable of doing mathematics [3]. According to Bandura [3], self-efficacy is individual's belief in his/her

capability to perform a specific task, and then assess their skills prior to perform certain action to complete the task. Poor mathematics self-efficacy often decreases students' motivation to learn and eventually can lead to low mathematics achievement [4].

Reaserchers indicate that the affective factors such as mathematics self-efficacy and anxiety play a crucial role in mathematics achievement [10]. Across OECD countries, a 28% in students' performance can be explained by the differences in students' levels of mathematics anxiety and self-efficacy [10]. Therefore, the implementation of effective learning strategies is one way to overcome mathematics anxiety and develop mathematics self-efficacy. Learning strategies that can make students to be more motivated to learn than their peers and more likely to persist when presented with challenges (Pajares dan Graham; Pajares dan Kranzler; Zeldin, Britner, dan Pajares, in [4]). In addition, a friendly teaching approach which includes how to relate the mathematical problems with a daily life activities and process-oriented teaching method emphasizing conceptual understanding rather than drill and practice will mitigate understanding [6]. Von Glasersfeld and Vace [6] also suggested that encouraging students to discuss mathematical situation among themselves may have better consequences in terms of mitigation of anxiety.

4. CONCLUSION

This study concerns with the effect of mathematics anxiety towards mathematics self-efficacy among secondary school students. The result reveals that there is a negative effect of mathematics anxiety towards mathematics self-efficacy, with the coefficient of determination is 0.487. So, it means that 48.7% of variation in the mathematics self-efficacy score is reducing by mathematics anxiety score, and 51.3% remaining is explained by the others.

REFERENCES

[1] Gresham, G. (2010). A Study Exploring Exceptional Education Pre-service Teachers' Mathematics Anxiety. *IUMPST: The Journal*, *4*(December), 1–14.

[2] Luo, X., Wang, F., & Luo, Z. (2009). Investigation and Analysis of Mathematics Anxiety in Middle School Students. *Journal of Mathematics Education*, *2*(2), 12–19.

[3] Akin, A, Kurbanoglu, I. N. (2011). The Relationships between Math Anxiety, Math Attitudes, and Self-efficacy: A Structural Equation Model. *Studia Psychologica*, *53*(3), 263–274.

[4] May, D. K. (2009). Mathematics Self-efficacy and Anxiety Questionnaire. *Disertation. University of Georgia.*

[5] Chang, H., & Beilock, S. L. (2016). The Math Anxiety-Math Performance Link and Its Relation to Individual and Environmental Factors : A Review of Current Behavioral and Psychophysiological Research. *Current Opinion in Behavioral Sciences*, *10*, 33–38. http://doi.org/10.1016/j.cobeha.2016.04.011

[6] Das, Ranjan, Das, G. C. (2013). Math Anxiety : The Poor Problem Solving Factor in School Mathematics. *International Journal of Scientific and Research Publications*, *3*(4), 1–5.

[7] Tait-Mccutcheon, S. L. (2008). Self-Efficacy in Mathematics : Affective , Cognitive , and Conative Domains of Functioning. *Proceedings of the 31st Annual Conference of the Mathematics Education Researh Group of Australasia. M. Goos, R. Brown, & K. Makar (Eds.) Merga Inc.*, 507–513.

[8] Michaelides, M. (2008). Emerging Themes from Early Research on Self-Efficacy Beliefs in School Mathematics. *Electronic Journal of Research in Educational Psychology*, *6*(1), 219–234.

[9] Perez, E. D. (2013). The Relationship between Mathematics Self-Efficacy and Mathematics Achievement of Mathayomsuksa Students in The English Program of St. Joseph Bangna School. *Thesis*. 82–92.

[10] Kalaycıoğlu, D. B. (2015). The Influence of Socioeconomic Status , Self-efficacy , and Anxiety on Mathematics Achievement in England, Greece, Hong Kong, the Netherlands, Turkey, and the USA. *Educational Sciences: Theory & Practice*, *15*(5), 1–11. http://doi.org/10.12738/estp.2015.5.2731

[11] Etheridge, L. (2016). Mathematics Anxiety and Mathematics Self Efficacy as Predictors of Mathematics Teaching Self Efficacy. *Disertation.. Auburn University*.

[12] Etheridge, L. (2016). Mathematics Anxiety and Mathematics Self Efficacy as Predictors of Mathematics Teaching Self Efficacy. *Disertation. Auburn University*.

[13] Cooke, A., Cavanagh, R., Hurst, C., & Sparrow, L. (2011). Situational Effects of Mathematics Anxiety in Pre-service Teacher Education. *AARE 2011 Conference Proceedings*, 1–14. Retrieved from http://aare.edu.au/11pap/papers_pdf/aarefinal00501.pdf

[14] Hellum-Alexander, A. (2010). Effective Teaching Strategies for Alleviating Math Anxiety and Increasing Self-efficacy in Secondary Students. *Thesis. The Evergreen State College.*