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ACHIEVEMENT MOTIVATION, SELF-EFFICACY, AND MATHEMATICS ANXIETY AMONG STUDENTS IN ELEMENTARY SCHOOL

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ABSTRACT

This study examined mathematics anxiety associated with achievement motivation and self-efficacy among students in elementary school. This study also aims to clarify the effects of these two variables on mathematics anxiety. Participants in this research were comprised of 100 students of 5th-6th grade in public elementary school. Regression analysis was used to determine association among two factors for mathematic anxiety. An independent t-test was utilized also to determine if there were differences based on demographic characteristics. Results indicate that only achievement motivation contributed to mathematic anxiety. These results call for the need to explore more about mathematics anxiety in mathematics learning in school.

INTRODUCTION

Mathematical anxiety is a phenomenon found in elementary school students. The culmination of all this is when students experience school exams and National Exams (UN) because of the many mathematical formulas students must remember. In addition, the learning process of mathematics in the classroom is often identified with a tense and frightening atmosphere. This can affect the emergence of tense and anxious students. Mathematical anxiety is one of the obstacles that is considered very serious in education as well as in the development of children and adolescents when they are in the school environment (Cooper & Robinson, 1991). Mathematical anxiety refers to unhealthy mood reactions, which occur when a person faces a mathematical problem, which shows they panic and lose their mind, resign, anxiety, fear, and accompanied by some physical reactions such as sweating on his face,

pain, vomiting, and pallor (Eccles, 1987). Research conducted by Eccles et al. (1985) also shows that mathematical anxiety is negatively correlated with mathematical performance.

Various studies have linked math anxiety to increased worries about math failure, an avoidance of math and or numerical tasks (Eccles & Jacobs,1986) and to an increased cortical response when performing math tasks (Ferla et al., 2009). Even the prospect of doing math has been found to be enough to elicit a negative emotional response among students with high math anxiety (Ferry et al., 2000). Math anxiety is worrisome because it negatively impacts mathematical knowledge, math grades, and standardized test scores in young adults (Gierl & Bisanz, 1995; Gutbezahl, 1995). Math anxiety is likely to impact the achievement of many students and report having negative experiences with math as early as elementary school (Halpern et al., 2007).

Although math anxiety has been extensively studied, little is known about the emergence of math anxiety in young children. Indeed, most studies of math anxiety have focused on middle school or high school students, and the few published studies investigating math anxiety in elementary school. In the present study, we examine whether math anxiety is present in elementary school, in fifth and sixth grade students. It is important to address math anxiety in elementary school ages because early math anxiety may ‘‘snowball’’ in ways that lead to increased anxiety, dislike, and avoidance of math (Harter, 1982). Further, identifying math anxiety early is the first step in designing interventions to ameliorate these anxieties, which in turn may contribute to higher achievement in the population.

Student's achievement motivation plays a significant role in the existence of mathematics anxiety. Research found that affective outcomes have correlations with achievement. Students shown that favourable affective outcomes such as enjoyment of mathematics, general motivation in learning mathematics, confidence in solving mathematics problems, assignment of high value to mathematics, and positive motivation demonstrate positive correlation with one another and also with mathematics achievement. The reverse would be expected for perceived negative outcomes such as mathematics (Hembree, 1990). Achievement motivation, developed by Atkinson and McClelland, is defined as the required tendency of the individuals in task (for achievement) to achieve success and avoid unachievement (Hopko et al., 2003). Individuals, who have mathematics anxiety, may not perform their potential performance. In mathematics lessons, the student's required achievement motivation may play a significant role on student's achievement without experiencing mathematics anxiety. To emphasize the importance of this role, it is important to highlight the features of achievement motivation variables.

Cates and Rhymer (Howell, 2007) associate also mathematics anxiety with self-efficacy. One of personal factor in relation to math performance has been self-efficacy. Schunk’s (1981; 1984; 1987) work with elementary school children has shown the importance of self-efficacy as a factor in children’s math performance. He has provided support for the idea that lower levels of

self-efficacy are related to lower levels of math performance and attitudes while increased efficacy leads to increased persistence, higher levels of performance, and more intrinsic interest in math, even in young children. Math self-efficacy works in a cyclical relation with math performance. Previous math performance has been shown as the strongest indicator of math self-efficacy (Lopez & Lent, 1992; Ozyurek, 2005), and level of math self-efficacy is a strong predictor of math performance in teens and college students (Pajares, 1996; Siegel et al., 1985). A negative relation has been found between self-efficacy and math anxiety. Cooper and Robinson (2002) found that overall, individuals high in math self-efficacy tended to have low math anxiety. Likewise, Meece et al. (1990) found that students who expected to do well in mathematics during that school year, and thus had high self-efficacy, had lower math anxiety the following year (Jameson & Furso, 2014).

This study aims to clarify the effect of achievement motivation and self-efficacy on mathematics anxiety. Which variables reliably predict the presence of elevated levels of math anxiety in children in elementary school? Whether elementary school student's mathematics anxiety differentiates or not, according to their low and high achievement motivations, and their level of self-efficacy.

METHODOLOGY

Participants

The participants for this study were recruited from schools in East Jakarta. The schools were an urban school that service a more diverse population. Participants in this research from fifth and sixth elementary school students. Data were completed by 100 fifth-sixth grade (age range = 10 to 12 years). Of the 100 children, 41 were boys and 59 were girls.

MEASURES

The Math Questionnaire

The Math Anxiety Questionnaire for elementary school students initially, defined six possible dimensions of anxious or negative reactions to mathematics for assessment: dislike, lack of confidence, discomfort, worry, fear and dread, and confusion/frustration. Items were constructed or adapted from existing math anxiety scales to assess these different dimensions. It consists of 11 items. Each item was answered on a 7-point scale. Initial analyses of these items showed that all had adequate variability. These items focus on negative affective reactions to doing math activities in school and on students' concerns about their performance in mathematics.

General Self-Efficacy Scale

The General Self-Efficacy Scale (GSES) is a 10-item multiple-choice scale that is designed to assess perceived general self-efficacy with the goal of

predicting coping with daily difficulties and stress. Perceived self-efficacy reflects positive beliefs about self (Schwarzer, 1992), which represents the belief that an individual can accomplish a task, easy or difficult, and cope with challenges brought on by day-to-day activities. Respondents use a 4-point Likert scale to rank their agreement with statements regarding perceived self-efficacy ranging from not at all true to exactly true, with scores ranging from 10 to 40. Sample GSES items include "I can solve most problems if I invest the necessary effort" and "I can usually handle whatever comes my way." The GSES is unidimensional with a single factor that indicates respondents' perceived self-efficacy. The GSES has been used internationally and has established internal consistency with Cronbach's alphas ranging from .75 to .91 (Scholz et al., 2002; Schwarzer & Jerusalem, 1995).

Achievement Motivation Inventory

The Achievement Motivation Inventory (Muthee & Thomas, 2009) consists of 32 items. This scale measures the achievement motivation of students who are expected to have high achievement motivations. The reliability coefficient (Cronbach's alpha) of the scale is calculated as .75.

Procedure

Participants were recruited through contact with school in East Jakarta areas. Questionnaires were delivered by google form. Participants in this research from fifth and sixth elementary school students. Only students completed the questionnaires completed were included in this study. The researcher shared link of google form of data collection from the teachers in fifth and sixth grades. Students completed the Math Anxiety Questionnaire, Achievement Motivation Inventory, and General Self-Efficacy Scale. If students needed assistance about the items, the teacher explained that item to all participants. Children were asked to write their name, grade, gender, and age in beginning assessment. All data were collected in one session that lasted approximately 45-50 minutes.

Research Approach

In this study, the researcher used a quantitative approach. This quantitative approach allowed the researchers to include a large number of subjects. These quantitative data enabled the researchers to determine whether significant associations between independent variables (achievement motivation and self-efficacy) and dependent variables (mathematics anxiety) exist, using statistical techniques, such as regression analysis.

Analysis of the Data

The data collected for this study were coded with the SPSS 16.0 package program for statistical data analysis. Later, the mean scores obtained from Achievement Motivation Scale were examined to classify (low and high) the achievement motivation of the students. The scores below the mean were

classified as low and the ones above it was classified as high. The mean of these scores obtained from Self-Efficacy was calculated. Students, whose scores were below the mean, were classified as individuals possessing low self-efficacy, while the others, whose scores were above the mean, were classified as students with high self-efficacy. Regression analysis was used to determine association among two factors (achievement motivation and self-efficacy) for mathematic anxiety. An independent t-tes was utilized also to determine if there were differences based on demographic characteristics (grade, gender, and ages).

RESULTS OF RESEARCH

Demographic analysis and statistical analysis described below:

Table 1. Correlation of Mathematic Anxiety to Achievement Motivation and Self-Efficacy Among Elementary School Students

Variables		Correlation	p
Math Anxiety	Achievement Motivation	-0.231	0.010
	Self-Efficacy	0.038	0.353

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Table 2. Elementary School Students' Mathematics Anxiety According to Achievement Motivation

Math Anxiety	Achievement Motivation	N	Mean	Stand. Dev.	t	p
	Low Level	51	0,05	0,57	2,65	0,009
	High Level	49	-0.18	0,29		

Table 3. Elementary School Students' Mathematics Anxiety According to Self-Efficacy

Math Anxiety	Achievement Motivation	N	Mean	Stand. Dev.	t	p
	Low Level	62	-0,03	0,54	0,582	0,562
	High Level	38	-0,09	0,32		

Mathematics Anxiety and Achievement Motivation

To test mathematics anxiety of elementary school students in terms of achievement motivation level, an independent t-test was used. The results of this analysis (see Table 2) showed that mathematics anxiety of students possessing low achievement motivation is significantly higher than those students possessing high achievement motivation ($t = 2.65$; $p < 0.05$). Also achievement motivation correlates to mathematics anxiety ($r = -0.231$; $p < 0.05$). The correlation is negative (see Table 1).

Mathematics Anxiety and Self-Efficacy

An independent t-test technique was used to test mathematics anxiety in terms of students' self-efficacy. The results of this analysis revealed that mathematics anxiety of the students possessing low and high self-efficacy is not significant ($t = 0.582$; $p > 0.05$) (see table 3). Also correlation between achievement motivation and self-efficacy is not significant ($r = 0.038$; $p > 0.05$) (see table 1).

Demographic Data

Demographic Analysis in Math Anxiety, Self-Efficacy, And Achievement Motivation:

Table 4. Demographic Data According to Math Anxiety

		Math Anxiety		Total
		Low	High	
Gender	Male	24	17	41
	Female	31	28	59
Ages	10 year	22	10	32
	11 year	27	28	55
	12 year	6	6	12
	13 year	0	1	1
Grade	5 primary school	25	19	44
	6 primary school	30	26	56

The lowest math anxiety profile is in the male sex category, in the age category of 11 years, and in the class category namely 6th grade elementary school. The highest math anxiety profile is in the male sex category, in the age category of 11 years, and in the class category namely 6th grade elementary school.

Table 5. Demographic Data According to General Self-Efficacy

		General Self-Efficacy		Total
		Low	High	
Gender	Male	29	12	41
	Female	33	26	59
Ages	10 year	25	7	32
	11 year	30	25	55
	12 year	7	5	12
	13 year	0	1	1
Grade	5 primary school	25	12	44
	6 primary school	30	26	56

The lowest general self-efficacy profile is in the female sex category, in the age category of 11 years, and in the class category namely 5th grade elementary school. The highest general self-efficacy profile is in the female

sex category, in the age category of 11 years, and in the class category namely 6th grade elementary school.

Table 6. Demographic Data According to Achievement Motivation

		Math Anxiety		Total
		Low	High	
Gender	Male	27	14	41
	Female	24	35	59
Ages	10 year	15	17	32
	11 year	29	26	55
	12 year	6	6	12
	13 year	1	0	1
Grade	5 primary school	20	24	44
	6 primary school	31	25	56

The lowest achievement motivation profile is in the male sex category, in the age category of 11 years, and in the class category namely 6th grade elementary school. The highest achievement motivation profile is in the female sex category, in the age category of 11 years, and in the class category namely 6th grade elementary school.

DISCUSSION

A growing body of evidence highlights the importance of taking into account both cognitive and affective factors in understanding students' academic achievement. Importantly, the association between math anxiety and math achievement is found in research participants in this research. The most striking finding of this study is the effect level of achievement motivation on mathematics anxiety is medium and the group with high mathematics anxiety consists of those students with high achievement motivation. Cates and Rhymer (2003) indication that people, who have a high need for achievement, attributed successes to their own ability and efforts, and failures to task difficulty; whereas, people, who have a low need for achievement, felt responsible only for failures. This discovery is important in terms of interpretation of the striking finding of this study.

Schunk and Ertmer (2000) states that mathematics competence consists of computational skills and problem-solving skills; thus, mathematics has task difficulty, and students with high achievement motivation can experience mathematics anxiety because of this task difficulty. Since students with high achievement motivation feel more task difficulty in mathematics. The encumber less internal factors, such as ability and effort, under successful conditions and more to external factors, such as task difficulty, under failure conditions than people who have a low need for achievement (Whyte & Anthony, 2012). It is important to take responsibility, like the students with high achievement motivation, to be successful at numbers, calculations, and problem solving, the subjects in which mathematics anxiety may occur. However, students with low achievement motivation take responsibility for

their failures. It found also that self-efficacy not related with mathematics anxiety.

CONCLUSION

In conclusion, students should increase their achievement motivation and do their best to recognize the task-difficulty of mathematics. They can increase their success at mathematics and decrease mathematics anxiety, if they have high achievement motivation to learning in school. Further research can also consider others factors influence mathematics anxiety, for example self-concept, teaching style, etc.

REFERENCES

Cates, G. L., & Rhymer, K. N. (2003). Examining the relationship between mathematics anxiety and mathematics performance: An instructional hierarchy perspective. Journal of Behavioral Education, J2, 22-34.

Cooper, S.E., & Robinson, D.A.G. (1991). The relationship of mathematics self-efficacy beliefs to mathematics anxiety and performance. Measurement & Evaluation in Counseling & Development, 24, 4–12.

Cooper, J. L., & Robinson, P. (2002). The Argument for Making Large Classes Seem Small. New Directions for Teaching & Learning, 81, 5-16.

Eccles, J. S. (1987). Gender roles and women's achievement-related decisions. Psychology of Women Quarterly, 11, 135–272.

Eccles, J. S., Adler, T. F., Futterman, R., Goff, S. B., Kaczala, C.M., Meece, J.L., & Midgley, C. (1985). Self-perceptions, task perceptions, socializing influences, and the decision to enroll in mathematics. Women and Mathematics: Balancing the Equation, 7(2); 95–121.

Eccles, J. S., & Jacobs, J. E. (1986). Social forces shape math attitudes and performance. Signs: Journal of Women in Culture and Society, 11, 367–380.

Ferla, J., Valcke, M., & Cai, Y. (2009). Academic self-efficacy and academic self-concept: Reconsidering structural relationships. Learning and Individual Differences, 19, 499–505.

Ferry, T. R., Fouad, N. A., & Smith, P. L. (2000). The role of family context in a social cognitive model for career-related choice behavior: A math and science perspective. Journal of Vocational Behavior, 57, 348–364.

Gierl, M.J., & Bisanz, J. (1995). Anxieties and attitudes related to mathematic grades and. Journal of Experimental Education, 63, 139–159.

Gutbezahl, J. (1995). How negative expectancies and attitudes undermine females' math confidence and performance: A review of the literature. Amherst: University of Massachusetts.

Halpern, D. F., Benbow, C. P., Geary, D. C., Gur, R. C., Hyde, J. S., & Gernsbacher, M. A. (2007). Sex, math, and scientific achievement. Scientific American Mind, 18, 44–51.

Harter, S. (1982). The Perceived Competence Scale for Children. Child Development, 53, 87–97.

Hembree, R. (1990). The nature, effects, and relief of mathematics anxiety. Journal for Research in Mathematics Education, 21, 33–46.

Hopko, D. R., Mahadevan, R., Bare, R. L., & Hunt, M. K. (2003). The

Abbreviated Math Anxiety Scale (AMAS): Construction, validity, and reliability. Assessment, 10, 178–182.

Howell, D. C. (2007). The treatment of missing data. In W. Outhwaite & S. Turner (Eds.), The Sage Handbook of Social Science Methodology. pp. 208–224. London: Sage.

Jameson, M. M., & Fusco, B. R. (2014). Math Anxiety, Math Self-Concept, and Math Self-Efficacy in Adult Learners Compared to Traditional Undergraduate Students. Adult Education Quarterly, 64(4), 306-322.

Lopez, F. G., & Lent, R. W. (1992). Sources of Mathematics Self-Efficacy in High School Students. The Career Development Quarterly, 41(1), 3-12.

Meece, J. L., Wigfield, A., & Eccles, J. S. (1990). Predictors of Math Anxiety and Its Influence on Young Adolescents' Course Enrollment Intentions and Performance in Mathematics. Journal of Educational Psychology, 82, 1, 60-70.

Muthee, J. M., & Thomas, I. (2009). Predictors of Achievement Motivation Among Kenyan Adolescents. The Psychespace, 3(2), 39-44.

Özyürek, R. (2005). Informative sources of math-related self-efficacy expectations and their relationship with math-related self-efficacy, interest, and preference. International Journal of Psychology, 40(3), 145–156.

Pajares, F. (1996). Self-Efficacy Beliefs in Academic Settings. Review of Educational Research, 66, 4, 543-578.

Scholz, U., Doña, B. G., Sud, S., & Schwarzer, R. (2002). Is general self-efficacy a universal construct? Psychometric findings from 25 countries. European Journal of Psychological Assessment, 18(3), 242–251.

Schunk, D. H. (1981). Modeling and attributional effects on children's achievement: A self-efficacy analysis. Journal of Educational Psychology, 73, 93-105.

Schunk, D. H. (1984). Sequential attributional feedback and children's achievement behaviors. Journal of Educational Psychology, 76, 1159-1169.

Schunk, D. H. (1987). Peer models and children's behavioral change. Review of Educational Research, 57, 149- 174.

Schunk, D. H., & Ertmer, P. A. (2000). Self-regulation and academic learning: Self-efficacy enhancing interventions. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), Handbook of Self-Regulation. pp. 631–649. Academic Press.

Schwarzer, R. (1992). Self-efficacy in the adoption and maintenance of health behaviors: Theoretical approaches and a new model. In R. Schwarzer (Ed.), Self-efficacy: Thought control of action (p. 217–243). Hemisphere Publishing Corp.

Schwarzer, R., & Jerusalem, M. (1995). Generalized Self-Efficacy scale. In J. Weinman, S. Wright, & M. Johnston, Measures in health psychology: A user's portfolio. Causal and control beliefs (pp. 35-37). Windsor, UK: NFER-NELSON.

Siegel, R. G., Galassi, J. P., & Ware, W. B. (1985). A comparison of two models for predicting mathematics performance: Social learning versus

math aptitude–anxiety. Journal of Counseling Psychology, 32(4), 531–538.

Whyte, J. & Anthony, G. (2012). Maths Anxiety: The Fear Factor in the Mathematics Classroom. New Zealand Journal of Teachers' Work, 9(1), 6-15.