

Investigation and Study on Mathematical Anxiety and Related Factors of University Students in Malaysia

马来西亚大学生数学焦虑和相关因素的调查研究

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Abstract: The objective of the paper is to study the relationship between mathematical anxiety and the corresponding factors affecting mathematics achievement among students at New Era University College, Malaysia. There were 94 students from the business school participated in the study. Suinn and Winston's (2003) Mathematics Anxiety Rating Scale was adapted and used in this study to measure students' mathematical anxiety. Pearson correlation analysis, two independent samples T-test and multiple regressions were used to analyse the data. The results revealed that there is no significant difference between gender and mathematical anxiety. However, it was found that mathematics test self-efficacy and prior knowledge on mathematics application concept are the factors that affect student's mathematical anxiety level. Therefore, educators should modify their teaching approach and psychological aid so that students can overwhelm their anxiety in mathematics.

Keywords: Malaysia, University Students, Mathematical anxiety, Gender

摘要: 数学焦虑一直是学术界关心的课题。它不仅影响学生在课业上的表现也无形中成为学生心理和思维的障碍。本文旨在研究数学焦虑与造成数学焦虑各因素之间的关系,从而找出焦虑产生的主要因素。本研究以新纪元大学学院94名大学生为研究对象,运用Suinn和Winston(2003)的数学焦虑评定量表来测量学生的数学焦虑。得到的研究结果如下:(1)独立样本T检定结果显示在数学焦虑问题上不存在着性别差异。(2)皮尔森积差相关分析和多元线性回归分析用于分析研究数据,发现考试焦虑和数学应用观念会影响学生数学焦虑的程度。因此,教育工作者应该改进他们的教学方法,在心理上帮助学生克服他们在数学上的焦虑感。

关键词: 马来西亚,大学生,数学焦虑,性别

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1. Introduction

Mathematics plays a vital role in the development of science and technology. It is useful in variety of field including measurement in fashion, algorithm in computer programs, technology, and economics. However, studies on the students' mathematics achievement based on international standards showed an alarming result for the participating countries, including Malaysia. Researchers and educators are examining closely the factors associated with this problem to come up with concrete plans to improve achievement in mathematics. For several years, factors influencing students' mathematical achievement were pointed out, and students' motivation and attitude in mathematics were considered to be significant predictors of learner's academic achievement.

Mathematical anxiety refers to the feeling of anxious when one is having difficulties in solving mathematical problem. Mathematical anxiety is the most common type of anxiety among other types of anxiety which occurs among students (Haralson, 2002). Mathematical anxiety is also the most ordinary type of mental illness among the undergraduates in which it can affect the emotional, mental and physical that is related to mathematical thinking (Arem, 2009). According to Hellum-Alexander (2010), mathematical anxiety usually occurred in at least 1 among 10 people. It is the feeling of tension and anxiety when individuals are interfered with the numbers manipulation and mathematical problem solving when they are in an ordinary and academic situation (Hellum-Alexander, 2010). Students who are suffering from mathematical anxiety will have the feeling of discomfort when they involved in mathematical tasks in which their self-esteem is being threatened and thus causing them to have negative attitude towards mathematics (Zettle & Raines, 2000).

Mathematical anxiety, being considered to have an attitudinal component, is also considered to be one dimension of attitude to mathematics (Manalaysay, 2019). According to him, this is a major problem for students in handing mathematics course. Many students do not understand why they experience mathematical anxiety. Sanna and Mohammad (2018) revealed that tests given under time-pressure and the fear of being embarrassed in front of the class were among the conditions that contribute to mathematical anxiety. They also argue that this type of anxiety could be a result of a student's negative learning mathematics experiences.

2. Literature Review

2.1 Definition of Mathematical Anxiety

According to Arem (2003), Ashcraft (2002) and Suinn (1972), mathematical anxiety refers to the emotion of fear and tension creates when students deal with mathematical problem solving

during the learning process. Research by Marzita (2002) shown that students who suffer with higher mathematical anxiety problem, have the feeling of rejection reactions and worry in the process of solving mathematics problem. This finding is consistent with the study of Lyons and Beilock (2012).

2.2 Relationship between Mathematical Anxiety and the Corresponding Factors

According to Buelow and Barnhart (2015), mathematics self-efficacy of an individual will influence student's test and physiological anxiety. In other words, it will directly affect positive results in mathematics. It seems that majority students, not only in elementary but also in college level, is affected by some form of mathematical anxiety as well as mathematics test and mathematics self-efficacy (Scarpello, 2007). Mathematical anxiety also related with the prior knowledge of students that lead to the poor understanding on the application concept (Acharya, 2017). According to study from Scarpello (2007), mathematical anxiety can start interrupting student's ability in the subject as early as in fourth grade and become mental block during the middle and high school as mathematics contents become more complicated and the learning depends a lot on prior knowledge of the subject.

Another studies also found that the decreasing in mathematics achievement is related to mathematics literacy and self-efficacy. When a student does not understand and has no confident in mathematics, the anxiety level is actually over his or her capability to resist (Lee, 2009; Mackenzie, 2002; Hamid et al., 2013). Julie and Glenda (2012) highlighted how teachers can assist on reducing mathematic anxiety of students and increase the level of mathematical literacy. Some researchers focused on the same factor and found that students avoid using problem solving strategy when they are in the high condition of mathematical anxiety, which might cause the negative effects on their performance (Ramirez, Gerardo, & Chang, 2015).

Acharya (2017) reported that mathematical anxiety of students highly related to aspect of learning environment factor. On the basic of the study, teacher who can create positive environment in the classroom to deliver mathematical knowledge will change student's behaviour at the same time. Firmender, Gavin and McCoach (2014) showed that suitable and friendly learning environment manage to produce better performance of students. Those schools practising this type of learning environment obviously will have students' mathematical anxiety at lower level with higher passing rate.

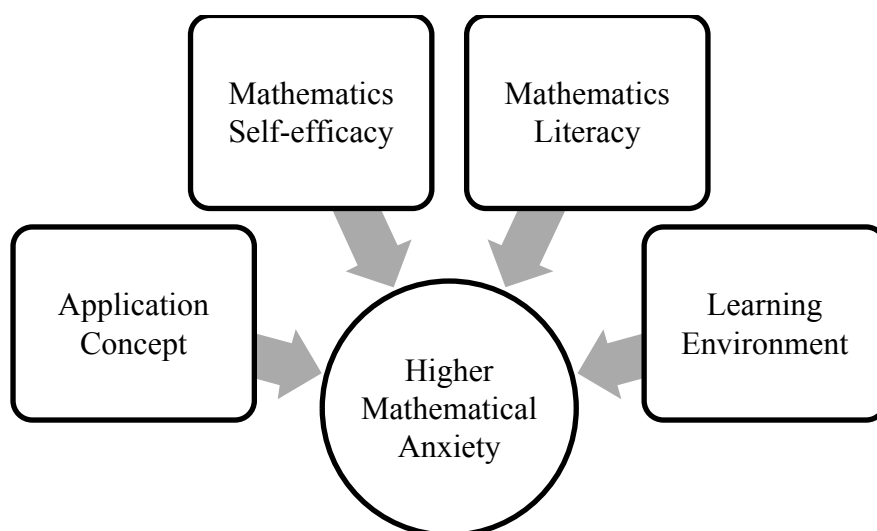


Figure 1 Path model for current mathematical anxiety

2.3 Gender and Mathematical Anxiety

One variable that has, over the years, received considerable attention in many studies on science achievement in general and mathematics achievement in particular is gender. Research found that gender is one of the factors cause the existence of anxiety among students. There were findings showed that the relationship between mathematical anxiety and gender is significant and is also considered to be predictor of achievement in mathematics (Wern et al., 2015). The relationship between gender and mathematical anxiety has also been studied extensively; but findings have not been consistent. Many studies found significantly greater levels of mathematical anxiety in females than males. However, there are also studies that show no gender differences in mathematical anxiety (Devine et al., 2012). There are indeed a few studies found that higher mathematical anxiety levels in males than in females (Manalaysay, 2019).

Moreover, several studies asserted that males have better mathematical achievement as compared to females even though students may perform the same in algebra in group according to gender, but males performed better in geometry than female (Manalaysay, 2019). Having similar findings, Amy et. al., (2012) study showed that level of mathematical anxiety were higher for female compare to male.

In a Meta –analysis of 77 studies conducted between 1980 and 1991 among middle and high school students, DeBaz (1994) found significant gender effect-favouring males in overall science achievement. Hedges and Newell (1999) discovered that boys outperform girls in science but in reading and writing girls have the advantage. Researchers have indicated that gender affects mathematics achievement. For example, Trends in International Mathematics and Science Study (TIMSS), found significant differences between male and female students in mathematics

achievement, with male students significantly outperform their female counterparts. Epstein, Elwood, Hey, Maw (1998) reported that females outperform males in mathematics. In their study, Hedges and Newell (1999) reported that girls perform better than boys in reading and writing. However, a Nigerian study by Abiam and Odok (2006) showed no significant gender-achievement relationship in number and numeration, algebraic process and statistics. There were other research showed similar results as Abiam and Odok, there is no significant difference in between gender and mathematics achievement (Habibollah, A., Arizan, S., and Kurma, 2009; Abubakar, A., 2010).

Given the mixed results in the field it is clear that further research, utilising reliable measures of mathematical anxiety, is necessary to investigate gender differences in mathematical anxiety and the relationship between mathematical anxiety and performance. Therefore, the objective of this study is to determine whether gender, mathematical anxiety, and the interaction between these two variables influence college students' mathematics achievement.

Hypothesis

- i. There are significant relationships between potential factors and mathematical anxiety among students.
- ii. There are significant differences between males and females student in mathematical anxiety.

Research Objectives

- i. To find out clear understanding of the relationship between level of mathematical anxiety and the potential factors among students in a higher learning institution in Malaysia.
- ii. To determine the influence of gender on student's anxiety towards mathematics in tertiary level education.

3. Methodology

The respondents for this study were students from diploma and degree program in the business school of NEUC. Data were collected from questionnaires distributed to all students who register for the business mathematics subjects in NEUC, Kajang. Mathematical Anxiety Rating Scale (MARS) is the instrument in this research study. Most of the questionnaire items are developed from MARS. The questionnaire contains 15 items on causes for mathematical anxiety. The questionnaire includes five point Likert scale rating, which is start from 5 (seriously anxious) to 1 (not anxious at all). Internal consistency was assessed using the Cronbach Alpha and correlation coefficient of 0.86 was found. Mathematics performance is

measure base on the results in business mathematics subject in the university at the end of the semester. The independent sample t test was conducted to determine significant for each factor towards maths anxiety base on gender. Meanwhile, the correlation and regression analysis used to identify the relationship between mathematical anxiety and the potential factors. SPSS was used for data analysis.

4. Results and Discussion

The results of this study gave us a better understanding of the factors influencing NEUC students' mathematical anxiety. The research revealed that the overall level of the students' mathematical anxiety was moderate. Hembree (1990) claimed that the trauma caused which required intensive intervention since the anxiety would accumulate each time the students perform poorly in this subject.

4.1 Comparison Based on Gender

Comparison analysis was conducted to determine the difference in mathematical anxiety based on selected demographic variables such as gender. To conduct this analysis, the researchers applied Independent T-Test as the most relevant statistical tools since the function of this tool is to compare the differences between 2 groups only. Table 1 explains the analysis based on the comparison in mathematical anxiety between genders. Based on Table 1 below, there were no significant differences in student's mathematical anxiety based on gender perspectives. The sig (.163) is larger than alpha (.05) which did not meet the requirement to reject the research null hypothesis. This indicates that the level of mathematical anxiety of diploma and degree students have the same level of mathematical anxiety between two gender groups, ($m=3.177$, $SD=0.651$) for male and ($m=2.983$, $SD=0.671$) for female.

Table 1 Comparison of Male and Female Students base on Mathematical Anxiety

Gender	n	Mean	Standard Deviation	F	Sig	t	Sig
Male	41	3.177	0.651	.008	.929	1.407	.163
Female	53	2.983	0.671				
Total	94						

The finding on gender comparison is supported by past researches conducted by Wern Lin Yeo *et. al.* (2015), Ozgur, B. (2014); Merritt (2011); Haynes, Mullins, and Stein (2004); Ho *et. al.* (2000), Gierl and Bisanz (1995) where all those studies revealed there were no significant differences in mathematical anxiety between gender. The present study also found that there is no significant difference between male and female in mathematical anxiety. This finding also

consistent with the study result of Tapia and Marsh (2004), mathematics has no direct relation between gender and mathematical anxiety.

This study involves approximately 43.6% of male students and 56.4% of female students. Four main factors that influence the dependent variable (mathematical anxiety) are being investigate in this study. The factors included mathematics literacy, mathematics self-efficacy on test, learning environment and application of mathematics base on the prior knowledge. Question one until four focused on problem solving or calculation for mathematics (mathematics literacy). Questions number five to eight focuses on mathematics self-efficacy. The following three questions focused on learning environment, and the last four questions were on application of mathematics base on the prior knowledge. No questions were removing from the scale yielding the overall Cronbach's Alpha equal 0.86.

Table 2 Correlations between Mathematical Anxiety and Mathematics Literacy

		Mathematics Literacy	Mathematical Anxiety
Mathematics literacy	Pearson Correlation	1	0.047
	Sig. (2-tailed)		.656
	N	94	94
Mathematical Anxiety	Pearson Correlation	0.047	1
	Sig. (2-tailed)	0.656	
	N	94	94

Table 2 shows that there is no significant relationship between mathematical anxiety and mathematics literacy. This indicates that less knowledge in solving mathematics literacy won't lead to anxiety in mathematics.

Table 3 Correlations between Mathematical Anxiety
Mathematical Anxiety and Mathematics Test Self-efficacy

		Mathematics test self-efficacy	Mathematical Anxiety
Mathematics test self-efficacy	Pearson Correlation	1	0.191**
	Sig. (2-tailed)		.041
	N	94	94
Mathematical Anxiety	Pearson Correlation	0.191**	1
	Sig. (2-tailed)	0.041	
	N	94	94

Table 3 shows that there is significant and positive relationship between mathematical anxiety and mathematics self-efficacy. This indicates that when the students taking the mathematics test, it will cause mathematical anxiety among students.

Table 4 Correlations between Mathematical Anxiety and Learning Environment

		Learning Environment	Mathematical Anxiety
Learning environment	Pearson Correlation	1	0.023
	Sig. (2-tailed)		.828
	N	94	94
Mathematical Anxiety	Pearson Correlation	0.023	1
	Sig. (2-tailed)	0.828	
	N	94	94

Table 4 confirms that there is no significant relationship between mathematical anxiety and learning environment. This indicates that the performance of students during mathematics class won't lead anxiety in mathematics.

Table 5 Correlations between Mathematical Anxiety and Mathematics Application Concept

		Application	Mathematical Anxiety
Mathematics application concept	Pearson Correlation	1	0.204**
	Sig. (2-tailed)		.049
	N	94	94
Mathematical Anxiety	Pearson Correlation	0.204**	1
	Sig. (2-tailed)	0.049	
	N	94	94

Result in table 5 shows that there is significant and positive relationship between mathematical anxiety and the mathematics application concept which related to the prior knowledge since the Pearson correlation is equal to 0.204 ($p < 0.05$). This indicates that when students confuse about the application of mathematics that they learn, it will also lead to mathematical anxiety.

Table 6 The Significant of Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2.614	0.334			
Mathematics Self-efficacy	0.237	0.109	0.235	2.192	0.033**
Mathematics Application Concept	0.291	0.136	0.298	2.143	0.035**

The results of multiple regressions (refer to Table 6) showed that mathematics test self-efficacy and the application of mathematics has been absorbed into the regression equation of $y=2.614+0.231X_1+0.291X_2$ where y is variable of mathematical anxiety, X_1 is mathematics test self-efficacy and X_2 is the factor of mathematics application concept which related to prior knowledge. It is because the t-value of these two independent variables are equal to 2.192 and 2.143 ($p<0.05$). Another two factors which is learning environment and mathematics literacy are not entered into the equation are due to both of the t-value are not significant ($p>0.05$). The regression equation conveys that mathematical anxiety of students increase as the students have negative hope or expectation on the test or examination. High anxious of students on the application of mathematics concept which found to be positively affected to mathematical anxiety.

4.2 Discussion

According to the results mention in earlier parts, mathematical anxiety can be influence by mathematics test self-efficacy. It is reported by others research that erase test anxiety during taking mathematic test or examination will reduce the level of mathematical anxiety. Schwarzer and Jerusalem (1992) claimed that when students feel tension during the test, they hard to recall back the solving skills that they learned before. Consequently, the interference could lead the poor achievement in their exam paper result.

The results of study also showed that level of realize on usefulness of the mathematics application concept which related to the prior knowledge in the future also contributed to mathematical anxiety in students. Although the correlation is not so high but significantly correlated. Thus the party who are direct or indirectly involve should take some steps in dealing with this factor so mathematical anxiety can be controlled. This finding is similar with the study of Satake and Philip (1995).

The result also reveals that test anxiety and level of understanding the application concept in the future only contribute 25.3% of the variance of mathematical anxiety. This shows that there are many others factors that could be the predictors of anxiety of students in mathematics. These numbers of factors directly cause the student unwilling to put effort in mathematics subject. Thus, future research should consider others potential factors in predicting mathematical anxiety such as time management or self-efficacy of students.

5. Conclusion and Recommendation

Base on the results, this study revealed that mathematics test self-efficacy and unrealized the mathematics application concept which related to the prior knowledge are the factors that address mathematical anxiety. The study also reveals that there is a positive weak relationship

between mathematics test self-efficacy and the mathematics literacy with mathematical anxiety in both groups of students. This means numbers of exam tests will lead to increase in the level of mathematical anxiety among the students. Students who have limited understanding about the application of mathematics tend to perform high mathematical anxiety during the learning stage. This finding also shows that there is no significance difference in the mathematical anxiety between males and females. The questionnaire is well developed and reliable to explore the mathematical anxiety among business studies students at NEUC in Kajang. To get the better results in future, it is recommended to cover more students and they should be from various levels which come from different departments or faculties. Furthermore, the future study should consider embarking in others different potential factors of mathematical anxiety such as language in mathematics teaching, perceived parental influence, time management and curriculum.

University College is the institution targets to produce and supply large number of human capital to fulfill where Malaysia job market needs. As a core subject, mathematics plays an important role in many aspects, including as the major instrument for the application of science and technology. However, mathematics frequently view as a difficult subject by many students and try to avoid when they are learning. To overcome this, educators can implement reduction skill to reduce the level of mathematical anxiety. It is important to ensure students understand how mathematics can be applied in their future living. The educators can help in building this connection to motivate students. Once students perceive the hints of the application, it will control the mathematical anxiety level of students. Furthermore, awareness about the importance of aptitude mathematic will also motivate students in the learning process of this subject and transform these concepts of knowledge into their future career. Woodard (2004) also propose teaching students using the right and flexible tools base on student's capability. The alternative tools were not only come from the formal examination base but test can be in other forms such as informer assessments, group discussion as well as in the forms of gaming (Tang, 1990). Marzita (2002) suggested that games base techniques will allow students to complete the test activity, gather the ideas with their peers, and this will be more acceptable and feel more comfortable for the students.

References

- Abiam, P.O & Odok, J. K. (2006). Factors in students' achievement in different branches of secondary school mathematics. *Journal of Education and Technology 1*(1), 161-168.
- Abubakar, R.B (2010). Qualitative and functional mathematics education, does age and gender affect academic performance? Proceedings of 47th Annual National Conference of mathematics association of Nigeria (MAN) held at Nassarawa state Polytechnic, Lafia.

- Acharya, B. R. (2017). Factors Affecting Difficulties in Learning Mathematics by Mathematics Learners. *International Journal of Elementary Education*, 6(2), 8-15.
- Amy, D., Kayleigh, F., Denes, S. & Ann.D. (2012). Gender differences in mathematics anxiety and the relation to mathematics performance while controlling for test anxiety. *Behavioral and Brain Functions* 8(1).
- Arem, C.A. (2003). *Conquering Math Anxiety: a Self-Help Workbook*, California: Brooks/Cole Thomson Learning.
- Arem, C. (2009). *Conquering Math Anxiety* (3rd ed.). Belmont: Cengage Learning.
- Arnup, J., Murrihy, V., Roodenburg, J. & McLean, L. (2013). Cognitive style and gender differences in children's mathematics achievement. *Educational Studies*, 39(3), 355-368.
- Ashcraft, M. H. (2002). Math Anxiety: Personal, educational, and cognitive consequences. *Current Directions in Psychological Science*, 11, 181-185.
- Baya'a, N.F. (1990). Mathematics anxiety, mathematics achievement, gender, and socio - economic status among Arab secondary students in Israel. *International Journal of Mathematical Education in Science and Technology*, 21(2), 319-324.
- Bayaga, A. & Wadesango.N. (2014). Analysis of Students' Attitudes on Mathematics Achievement-Factor Structure Approach. *International Journal of Educational Sciences*, (6), 45-50.
- Buelow, M., & Barnhart, W. R. (2015). The influence of math anxiety, math performance, worry, and test anxiety on the iowa gambling task and balloon analogue risk task. *Assessment*, 24(1), 1-11.
- Bieg M, Goetz T, Wolter I, Hall, N. (2015). Gender Stereotype Endorsement Differentially Predicts Girls' and Boys' Trait-State Discrepancy in Math Anxiety. *Front Psychol*, 6.
- Carey E, Hill F, Devine A and Szűcs D (2016). The Chicken or the Egg? The Direction of the Relationship between Mathematics Anxiety and Mathematics Performance. *Front. Psychol.* 6.
- Debaz, T. (1994). Meta-analysis of the relationship between students' characteristics and achievements and attitudes towards science. Columbus, OH:ERIC clearing house for science, mathematics and environmental education (ERIC Document).
- Devine, A, Fawcett, K. Szűcs, D. & Dowker, A. (2012). Gender differences in mathematics anxiety and the relation to mathematics performance while controlling for test anxiety. *Behavioral and Brain Functions*, 8.
- Dowker A, Sarkar A, Looi CY (2016). Mathematics anxiety: What have we learned in 60 years? *Front Psychol*, 7.
- Effandi Zakaria, Normalizam Mohd Zain, Nur Amalina Ahmad and Ayu Erlina (2012). Mathematics Anxiety and Achievement among Secondary School Students. *American Journal of Applied Sciences*, 9 (11), 1828-1832.
- Ellenita G. Manalaysay (2019). Gender Differences, Mathematics Anxiety, and First-Year College Students' Mathematical Achievement. *International Journal Of Scientific & Technology Research*, 8, (6).
- Epstein, D., Elwood, J., Hey, V. And Maw, J. (1998). *Falling boys? Issues in gender and achievement*. Buckingham: Open University Press In.
- Firmender, J. M., Gavin, M. K., & McCoach, D. B. (2014). Examining the relationship between teachers' instructional practices and students' mathematics achievement. *Journal of Advanced Academics*, 25(3), 214-236.

- Francesca Hill; Irene C. Mammarella b, Amy Devine, Sara Caviola; Maria Chiara Passolunghi ; Dénes Szűcs (2016). Maths anxiety in primary and secondary school students: Gender differences, developmental changes and anxiety specificity. *Learning and Individual Differences*, 48, 45–53.
- Gierl, M. J., & Bisanz, J. (1995). Anxieties and attitude related to mathematics in grade 3 and 6. *Journal of Experimental Education*, 63(2), 139-159.
- Habibollah, N., Abdullahi, R., Arizan, H.T., Sharir, J. And Kurma, V. (2009). Creativity, age and gender in predictors of academic achievement among undergraduate students. *Journal of American Sciences* 5(5), 101-111.
- Hamid, M. H. S., Shahrill, M., Matzin, R., Mahalle, S., & Mundia, L. (2013). Barriers to mathematics achievement in Brunei secondary school students: Insights into the roles of mathematics anxiety, self-esteem, proactive coping, and test stress. *International Education Studies*, 6(11), 1–14.
- Haralson, K. (2002). Math Anxiety: Myth or Monster? Presentation at National Council of Teachers of Mathematics Central Regional Conference. Paducah, KY.
- Haynes, A. F., Mullins, A. G., & Stein, B. S. (2004). Differential models for mathematical anxiety in male and female college students. *Sociological Spectrum*, 24(3), 295-318.
- Hedges, L. and Newell, A. (1999). Changes in Black-white gap in achievement scores. *Sociology of Education*, 72(2), 149-182.
- Hellum-Alexander, A. (2010). *Effective Teaching Strategies for Alleviating Math Anxiety and Increasing Self-Efficacy in Secondary Students*. Master dissertation, Evergreen State College, Olympia, WA.
- Hembree, R. (1990). The nature, effects and relief of mathematics anxiety. *J. Res. Math. Educ.* 21, 33–46.
- Ho, H., Senturk, D., Lam, A. G., Zimmer, J. M., Hong, S., Okamoto, Y., Chiu, S., Nakazawa, Y., & Peng, C. (2000). The affective and cognitive dimensions of math anxiety: A cross national study. *Journal for Research in Mathematics Education*, 31(3), 362–379.
- Julie, W. and Glenda, A. (2012). Maths anxiety: The fear factor in the mathematics classroom. *New Zealand Journal of Teachers' Work*, 9(1), 6-15.
- Khatoon, T. and S. Mahmood, 2010. Mathematics anxiety among secondary school students in India and its relationship to achievement in mathematics. *Eur. J. Soc. Sci.*, 16, 75-86.
- Lyons, M. and Beilock, S. (2012). Mathematics Anxiety: Separating the Math from the Anxiety. *Cerebral Cortex*, 22(9), 2102–2110.
- Lee, J.Y. (2009). Universals and specifics of math self-concept, math self-efficacy, and math anxiety across 41 PISA 2003 participating countries, 19(3), 355-365.
- Merritt, W. P. (2011). *Exploring math anxiety as it relates to math achievement, gender, and race* (Doctoral dissertation). Retrieved from ProQuest Dissertations & Theses Global.
- Ma, X., and Xu, J. (2004). The causal ordering of mathematics anxiety and mathematics achievement: a longitudinal panel analysis. *J. Adolesc.* 27, 165–179.
- Mackenzie, S. Can we make maths count at HE? *Journal of Further and Higher Education*, 26(2), 159-169.
- Maloney, E. A., Ansari, D., and Fugelsang, J. A. (2011). The effect of mathematics anxiety on the processing of numerical magnitude. *Q. J. Exp. Psychol.* 64, 10–16.
- Maloney, E. A., Risko, E. F., Ansari, D., and Fugelsang, J. (2010). Mathematics anxiety affects counting but not subitizing during visual enumeration. *Cognition* 114, 293–297.
- Maryam Kargara,, Rohani Ahmad Tarmiziab, Sahar Bayat (2010). Relationship between Mathematical Thinking, Mathematics Anxiety and Mathematics Attitudes among University Students. International Conference on Mathematics Education Research. *Procedia Social and Behavioral Sciences*, 8, 537-542.

- Marzita,P. (2002). *Factors Associated with Mathematics Anxiety*. Tanjong Malim: Penerbitan Universiti Pendidikan Sultan Idris.
- Marzita, P. (2002). *Qualitative research approach towards factors associated with mathematics anxiety*. Sultan Idris Education Education University, Malaysia.
- Meece, J. L., Wigfield, A., and Eccles, J. S. (1990). Predictors of math anxiety and its influence on young adolescents' course enrolment intentions and performance in mathematics. *J. Educ. Psychol.* 82, 60-70.
- Ozgur, B. (2014). Trait Anxiety Levels of University Students Studying at Sports Departments. *Educational Research and Reviews*, 9(20), 1021-1024.
- Ramirez, Gerardo & Chang, Hyesang & A Maloney, Erin & Levine, Susan & L Beilock, Sian (2015). Factors affecting mathematics literacy of students based on pisa 2012: a cross-cultural examination. *Journal of Experimental Child Psychology*, 141. 83-100.
- Ridner,A., et.al. (2015). Symptoms and Causes of Anxiety. Retrieved October 2015 from http://manthan.dreadinghelp.org/articles/symptoms_andcauses_of_mat_anxiety
- Sanna,S., & Mohammad , E. (2018). The Impact of Teacher' Practices and Content of Mathematics on Student' Anxiety in Secondary and Intermediate Classes. *Journal of Depression and Anxiety*, 7(4).
- Satake, E., & Amato, P. P. (1995). Mathematics anxiety and achievement among Japanese elementary school students. *Educational and Psychological Measurement*, 55, 10001007.
- Secada, W. G. (2001, May). Teaching mathematics to dual-language students. Paper presented at the conference, Education of language minorities: The teaching of language and mathematics at Aristotle University of Thessaloniki, Greece.
- Scarpello, G. (2007). Helping Students Get Pass Math Anxiety. *Connecting Education and Careers*, 82(6), 34-35.
- Schwarzer, R., & Jerusalem, M. 1992. Advances in Anxiety Theory: A Cognitive Process Approach. In K. A. Hagtvet & T. B. Johnsen (Eds.), *Advance in test anxiety research*. The Netherlands: Swets & Zeitlinger.
- SitiHamad Mohamed & Rohani Ahmad Tarmizi, (2010). Anxiety in Mathematics Learning Among Secondary School Learners: A Comparative Study between Tanzania and Malaysia. *Procedia - Social and Behavioral Sciences*. 8. 498-504.
- Skouras, A. S. (2015). Factors associated with middle-school mathematics achievement in Greece: the case of algebra. *International Journal of Mathematical Education in Science and Technology*, 45(1), 12-34.
- Smith, H., Wendy, B., & Smith, S. (2014). Coping with math anxiety. Retrieved 9 Apr 2014 from Platonic Realms.
- Stoet, G., Bailey, D. H., Moore, A. M., & Geary, D. C. (2016). Countries with higher levels of gender equality show larger national sex differences in mathematics anxiety and relatively lower parental mathematics valuation for girls. *PloS one*, 11(4).
- Suinn, R. & Winston, E. (2003). The mathematics anxiety rating scale. *Psychological Reports* 92(1),167-173.
- Tang, C.Y. (1990). *Psikologi Perkembangan*. Siri Pendidikan Perguruan, Kumpulan Budiman Sdn. Bhd. Selangor.
- Tapia, M., & Marsh, G. E., II. (2004). An instrument to measure mathematics attitudes. *Academic Exchange Quarterly*, 2(8), 1621.
- Tobias, S., and Deutsch, T. (1980). Prior achievement, anxiety and instructional method. Paper Presented at 88th Annual Meeting of the America Psychological Association, Montreal, QC.

- Welch, S.A. (2008). Communication Students' Mathematics Anxiety: Implications for Research Methods Instruction. *Journal Communication Research Reports Volume 25(4)*.
- Wern, L. Y., Choo K.T. & Sook L.L. (2015). Mathematics Anxiety among Male and Female Students. World Academy of Science, Engineering and Technology. *International Journal of Psychological and Behavioral Sciences 9(8)*, 2830 – 2835.
- Wong, K.C, Lan, Y.R and HO, L.M. (2002). The effects of schooling on gender differences. *British educational research Journal, 28*, 827-843.
- Woodard, T. (2004). The Effects of Math Anxiety on PostSecondary Developmental Students as Related to Achievement, Gender, and Age. *Inquiry, 9(1)*.
- Zettle, R., & Raines, S. (2000). The Relationship of Trait and Test Anxiety with Mathematics Anxiety. *College Student Journal, 34(2)*, 246-259.