

THE RELATIONSHIP BETWEEN MATHEMATICAL BELIEFS AND MATHEMATICS ANXIETY AMONG PRE SERVICE ELEMENTARY SCHOOL TEACHERS IN EAST BORNEO, INDONESIA

Suci Yuniarti
School of Education and
Social Development
Universiti Malaysia Sabah

Mohd. Zaki Ishak
School of Education and
Social Development
Universiti Malaysia Sabah

Vincent Pang
Centre for the Promotion of
Knowledge and Language Learning
Universiti Malaysia Sabah

Abstract

The study investigates the relationship between mathematical beliefs and mathematics anxiety among pre service elementary school teachers in East Borneo, Indonesia. The sample of this study is 374 pre service elementary school teachers from the elementary school teacher education departments in public universities in East Borneo. The data obtained from the questionnaire used in the study are analyzed via SPSS 21.0. The findings show that there is no significant relationship between beliefs about the nature of mathematics and mathematics anxiety and between beliefs about mathematics teaching and mathematics anxiety. However, findings indicate that there is relationship between beliefs about mathematics learning and mathematics anxiety. Furthermore, there is a negative significant relationship between mathematical beliefs and mathematics anxiety among pre service elementary school teachers when combining the dimensions of mathematical beliefs. In other words, a higher mathematical beliefs is associated with lower mathematics anxiety.

Keywords: mathematical beliefs, mathematics anxiety, pre service elementary school teachers.

1. Introduction

The development of information and communication technologies today is based on mathematics development in the field of number theory, algebra, analysis, statistic and discrete mathematics. Mathematics is one of the fundamental skills that an individual of modern societies require in sustaining their daily life (Vitasari *et al.*, 2011), in today's increasingly data and technological oriented society (Ashcraft, 2002). The early mastery of mathematics is needed to master and create the future technologies. Mathematics is taught to all students from elementary school to equip students with the skills of logical, analytical, systematic, critical, and creative thinking. These competences are required so that learners can have the ability to acquire, manage, and utilize information to survive in the ever-changing circumstances and competitive life.

In Indonesian education system mathematics is a compulsory subject for elementary and secondary school. Based on the National Curriculum, mathematics is learned to give students the skills to understand mathematics concepts and the relationship between them; to use the logic of mathematics pattern and characteristics; to solve mathematics problem and interpret its solution; to communicate their thinking and opinion using mathematics representations; and to appreciate the use of mathematics in life. Students should be able to think mathematically, use it in their lives to empower themselves both personally and as citizens, and appreciate its role in history, culture and the contemporary world (Ernest, 2001).

Mathematics also becomes one of compulsory subjects for national examination and test for entering public universities. Students face national examination when they are in grade six, grade nine and grade twelve. However, there is a difference in mathematics tests for grade twelve and test for entering public universities. The test items differed based on the majors chosen by student: science or social science majors. It means that mathematics is one of requirements to continue their education to higher level. However, the result of national examination always showed that mathematics was the lowest-scoring subject (Ministry of Education and Culture, 2012).

Sutame and Harpinto (2012) argue that one of the causes of low achievement is mathematics anxiety. The previous research found that mathematics anxiety related to achievement (Ma, 1999; Zakaria and Nordin, 2008). Supardi and Leonard (2010) argue that there is a negative direct effect of anxiety on mathematics achievement. However, mathematics anxiety is found in the teachers who are mathematically anxious, and teach in ways that develop mathematics anxiety in their own students (Gresham, 2007; Maloney and Beilock, 2012). It appears that teachers play a key role in improving student outcomes (World Bank, 2010).

The teacher-related reasons that contribute to the low quality of student outcomes are an ineffective learning process, with a heavy focus on theory and rote learning, and a high proportion of under-qualified teachers without proper incentives to focus on student achievement (UNESCO-IBE, 2011). It remains a challenge for teacher preparation program to prepare the better teachers in the future as pre service teacher training program is one of programs which can enhance teachers' professionalism (Kusumah and Marsigit, 2010).

When pre service elementary school teachers are in their secondary education, most of them enrolled in science and social science majors' programs. Oropesa (1993, cited in Baloglu and Kocak, 2006) argues that most of social science majors' students who enrolled in mathematics courses are under-prepared. They also try to avoid mathematics subjects because of the difficulties to understand. It is a sad fact that, more than any other school subject, mathematics has the power to arouse feelings of anxiety, fear and helplessness (Goulding, 1997).

Most of pre service teachers believe that mathematics as difficult and boring subject (Jamiah, 2012). If a teacher believes that mathematics is difficult and boring, it is obvious to imagine how they represent mathematics in front of their future students. Timmerman (2004) suggests that pre service elementary teachers' beliefs directly influence their future teaching practice. Pre service mathematics teachers should have positive beliefs toward mathematics so they will be able to represent mathematics as an interesting and challenging subject, applicable in many areas and can be learned by everyone; and not as a difficult subject which is abstract and only for high cognitively able students (Widjajanti, 2010). Again, this becomes a challenge for teachers' preparation program to develop positive beliefs toward mathematics among pre service elementary school teachers.

Mathematical beliefs play an important role in enhancing the quality and effectiveness of the teaching and learning of mathematics (Adnan, 2012). Raymond (1997) notes that past school experiences, early family experiences and the teacher education program have greatest effect on developing pre service teachers' mathematical beliefs. All teachers possess beliefs about their profession, their students, how learning takes place and the subject areas they teach, and their practices should flow from these beliefs (Capraro, 2005). Thus, they transfer their own attitudes and beliefs to their students (Kalder and Lesik, 2011). As a result of their past experiences, pre service teachers come to their education courses with deeply rooted anxieties and attitudes about mathematics (Nisbet, 1991; Bryant, 2009).

Mathematics anxiety is a sophisticated and multi-dimensional phenomenon (Bekdemir, 2010) in students from elementary through university level, including pre service teacher education. Research related to elementary pre service teachers' mathematics anxieties has consistently shown that elementary pre service teachers have higher levels of mathematics anxiety than the general college population, which has prompted concern in the mathematics education community for decades (Brown *et al.*, 2011). Pre service teachers' mathematics anxiety is caused by the teachers, their behaviour or teaching approach in their past (Bekdemir, 2010). Most of the teachers teach mathematics using their own experience based on the lesson they attended in elementary school, junior high school or senior high school (Kusumah and Marsigit, 2010). Individually they interpret their own experience and it is brought to the mathematics classroom with prejudice and bias that exists (Adnan and Zakaria, 2010).

Hembree (1990) suggests that high levels of mathematics anxiety experienced by teachers may be perpetuated in their classrooms and it leads to the transmission of anxiety and a fear of mathematics to their students. In other words, it can establish a cycle of mathematics anxiety between teachers and students. This impact should be of major concern to colleges/universities (Johnson and vanderSandt, 2011). They argue that special care should be taken to determine the level of mathematics anxiety among pre service teachers early in pre service education. By knowing the level of mathematics anxiety among pre service elementary school teachers, mathematics anxiety can be reduced and the quality of pre service elementary school teacher can be improved.

Anxiety towards mathematics is one affective factor that “has probably received more attention than any other area that lies within the affective domain” (Mcleod, 1992). However, a great deal of research about mathematics anxiety has been accumulated in the western context (Bekdemir, 2010). It would appear that more studies are needed by considering the different contexts.

The relationship between mathematical beliefs and mathematics anxiety has been investigated by previous studies (Cox, 2011; Haciomeroglu, 2013; Usop *et al.*, 2013; Walsh, 2008). However study about relationship between mathematical beliefs has not yet investigated in Indonesian context. In addition, studies on pre service elementary school teachers in Indonesia are still limited. There also inconsistency in the result of the studies about relationship of mathematics anxiety and mathematical beliefs (Usop *et al.*, 2013; Haciomeroglu, 2013). Although there is relationship between mathematical beliefs and mathematics anxiety, their study showed different directions of correlation.

The present study investigates the relationship between mathematical beliefs and mathematics anxiety focusing on pre service elementary school teachers in East Borneo, Indonesia. Mathematical beliefs refer to personal judgements about mathematics formulated from experience in mathematics, including beliefs about the nature of mathematics, mathematics learning and mathematics teaching (Raymond, 1997) while mathematics anxiety refers to a feeling of panic, embarrassment, flurry, avoidance, failing and fear, and the general lack of comfort that someone might experience when required to perform mathematically, which are physically visible and which prevent solution, learning and success about mathematics (Bekdemir, 2010; Wood, 1988).

2. Methodology

The present study uses non-experimental quantitative research using cross-sectional survey. A total of 374 respondents are chosen using stratified random sampling. The sample of this study is pre service elementary school teachers who are currently pursuing a four-year program in Elementary School Teacher Education and have not taught yet in the actual elementary school. All respondents are Indonesian pre service elementary school teachers and they enrolled in full time study in public universities in East Borneo, Indonesia.

The study employs questionnaires to obtain the data about mathematical beliefs that consist of three dimensions i.e. beliefs about the nature of mathematics, beliefs about mathematics teaching and beliefs about mathematics learning and mathematics anxiety. The demographic variables included in this study are gender and year of study. The questionnaire used in this study consists of three sections. Section A presents sixteen items with five point Likert-scales to investigate pre service elementary school teachers’ mathematical beliefs. The items were adopted from Mathematical Beliefs Questionnaire (MBQ, Zakaria and Musiran, 2010). Section B presents twenty seven items with five point Likert-scales to investigate the level of mathematics anxiety among pre service elementary school teachers. The items were adopted from the Revised-Mathematics Anxiety Survey (R-MANX, Bursal and Paznokas, 2006). The last section of the questionnaire consists of five items to obtain the information about gender, age, ethnicity, year of study and secondary school major.

The questionnaires were administered by one of the researcher directly with respondents with the facilitation of a lecturer in each university. Before the administration of main questionnaires, the researcher asked the respondents to complete the consent form. The completed consent forms were collected first, then, the main questionnaires were administered. The researcher waited in the classroom while the respondents were completing the questionnaire. The completed questionnaires were then collected at the site.

The data was then analysed using Statistical Package for Social Sciences (SPSS) version 21.0. Descriptive statistics and Pearson’s product moment coefficient of correlation were engaged.

3. Findings

3.1 Respondents’ Profile

Most of respondents were female pre service elementary school teachers (82.1%). Their ages range from 17 up to 26 years old however most of the respondents were 20 up to 23 years old (57.5%). They enrolled in the first (23.3%), second (17.4%), third (29.4%) and fourth years (29.9%). A proportion of 43.6% of the respondents were Javanese followed by Bugis (11.5%), Dayak (8.8%), Kutai (7%) and others ethnicities (17.4%). Although elementary school teacher education is under social science major, there were pre service elementary school teachers who come from

science (39%), language (3.2%) and others majors (19%). The others majors were from vocational schools with different subjects.

Table 4.1: Respondents' Profile

Demographic variables	Frequency	Percentage (%)
Gender		
Male	67	17.9
Female	307	82.1
Year of Study		
First	87	23.3
Second	65	17.4
Third	110	29.4
Fourth	112	29.9
Ethnicity		
Java	163	43.6
Banjar	44	11.8
Bugis	43	11.5
Dayak	33	8.8
Kutai	26	7.0
Others	65	17.4
Age		
17 – 19	152	40.6
20 – 23	215	57.5
> 23	7	1.9
Secondary School Major		
Science	146	39
Social science	145	38.8
Language	12	3.2
Others	71	19

3.2 The relationship between mathematical beliefs and mathematics anxiety

Pearson's product moment coefficient of correlation is used to determine the relationship between mathematical beliefs and mathematics anxiety. This study found out that there was no significant relationship between beliefs about the nature of mathematics and mathematics anxiety ($r=-0.059$, $p>0.05$). The relationship between beliefs about mathematics teaching and mathematics anxiety were found not significant ($r=-0.088$, $p>0.05$). However beliefs about mathematics learning and mathematics anxiety correlated significantly ($r=-0.117$, $p<0.05$). Furthermore, there was a small negative significant relationship between mathematical beliefs and mathematics anxiety among pre service elementary school teachers in East Borneo when combining the dimensions of mathematical beliefs ($r=-0.143$, $p<0.05$). It means that higher mathematical beliefs indicating lower mathematics anxiety. The result of Pearson's product moment coefficient of correlation can be seen in Table 3.1

Table 3.1: Result of Pearson's Product Moment Coefficient of Correlation

Correlation	r	Sig. (2-tailed)
Beliefs about the nature of mathematics and mathematics anxiety	-0.059	0.253
Beliefs about mathematics teaching and mathematics anxiety	-0.088	0.088
Beliefs about mathematics learning and mathematics anxiety	-0.117*	0.024
Mathematical beliefs and mathematics anxiety	-0.143*	0.005

4. Discussion

This study finds that there is a negative significant relationship between mathematical beliefs and mathematics anxiety among pre service elementary school teachers in East Borneo. It means that higher mathematical beliefs associated with low mathematics anxiety. This finding supports Walsh (2006) and Cox (2011) studies. Their study

revealed that higher levels of mathematics anxiety correlated significantly with beliefs about mathematics in a small, inverse relationship.

In addition, there is significant relationship between beliefs about mathematics learning and mathematics anxiety. It means that if pre service elementary school teachers have positive beliefs toward mathematics learning then they have lower mathematics anxiety. However, two dimensions of mathematical beliefs, beliefs about the nature of mathematics and beliefs about mathematics teaching are not related with mathematics anxiety. Jackson (2008) argued that it is not the nature of mathematics that is problematic, but the learning of the subject. She further suggested that the learning of mathematics is the most potential causes of mathematics anxiety.

Although the strength of the relationship between mathematical beliefs and mathematics anxiety in this study were considered small, this relationship should be acknowledged. This finding supported Haciomeroglu *et al.* (2013) study. Their study revealed that there is a small negative relationship between mathematical beliefs and mathematics anxiety among pre service teachers. However, this finding did not support Usop *et al.* (2013) study. Their study found out that there is a positive significant relationship between mathematics beliefs and mathematics anxiety. The different samples may cause these different results.

5. Conclusion

The study revealed that there is a negative correlation between beliefs about mathematics learning and mathematics anxiety and between mathematical beliefs and mathematics anxiety. In other words, higher beliefs about mathematics learning and mathematical beliefs is associated with lower mathematics anxiety. Therefore, pre service elementary school teachers should develop positive mathematical beliefs in order to reduce their mathematics anxiety. It is suggested that educators assist pre service elementary school teachers to develop positive mathematical beliefs in their class during the teaching and learning activities. Since this study focuses on mathematical beliefs and mathematics anxiety among pre service elementary school teachers, future research in this area may be undertaken to study mathematical beliefs and mathematics anxiety among in service elementary school teachers and pre service and in service secondary school teachers.

6. References

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7. Biography

Suci Yuniarti is a master's degree research student in the School of Education and Social Development, Universiti Malaysia Sabah. She is set to graduate in 2014 and hopes to continue her study to PhD level in mathematics education.

Dr. Mohd. Zaki Ishak is currently attached in the School of Education and Social Development, Universiti Malaysia Sabah. He is a Deputy Dean (Research & Innovation). He teaches Physics Teaching Methods, Physics, the History and Philosophy of Science Education, Education for Sustainable Development, and Research Methods. His primarily research interest has been in the training of secondary school pre service physics teachers, in particular within "didaktik tradition" (teaching and learning), but also span several disciplines from teacher training to the sustainability education.

Vincent Pang is a professor of education and the Dean of Centre for the Promotion of Knowledge and Language Learning, Universiti Malaysia Sabah. He is also an editor of the Malaysian Journal of Learning and Instruction, and an Associate Research Fellow of the National Higher Education Research Institute (IPPTN). He has undertaken numerous research and consultation projects for UNESCO, UNICEF, and other international, federal and state agencies.