MATHEMATICAL BELIEFS AND MATHEMATICS ANXIETY AMONG PRE SERVICE ELEMENTARY SCHOOL TEACHERS IN EAST KALIMANTAN, INDONESIA

SUCI YUNIARTI

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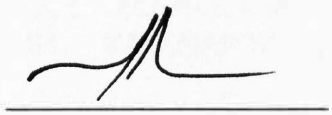

25 June 2014

Suci Yuniarti
PT20118108

CERTIFICATION

NAME	:	**SUCI YUNIARTI**
MATRIC NO.	:	**PT20118108**
TITLE	:	**MATHEMATICAL BELIEFS AND MATHEMATICS ANXIETY AMONG PRE SERVICE ELEMENTARY SCHOOL TEACHERS IN EAST KALIMANTAN, INDONESIA**
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DECLARED BY

1. SUPERVISOR

Dr. Mohd. Zaki Ishak

Signature

2. CO. SUPERVISOR

Prof. Dr. Vincent Pang

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ABSTRACT

The study investigated the differences in mathematical beliefs and mathematics anxiety according to gender and years of study, the relationship between mathematical beliefs and mathematics anxiety, and the influence of mathematical beliefs on mathematics anxiety among pre service elementary school teachers in East Kalimantan, Indonesia. This study applied quantitative approach using survey research. The questionnaires were used to gain the data. The sample of this study was 374 pre service elementary school teachers from the elementary school teacher education departments in public universities in East Kalimantan. The data obtained from the questionnaire used in the study were analyzed via SPSS 21.0. Results of descriptive statistics showed that most of pre service elementary school teachers in East Kalimantan were under the moderate category of mathematical beliefs and mathematics anxiety. However, some pre service elementary school teachers still had low mathematical beliefs and high mathematics anxiety. The findings showed that there were no significant differences in mathematical beliefs and mathematics anxiety according to gender. In addition, there was no significant difference in mathematical beliefs according to year of study however there was significant difference on mathematics anxiety according to year of study. A small negative significant correlation between mathematical beliefs and mathematics anxiety was found. The study suggested that mathematical beliefs could predict mathematics anxiety to a small extent. Implications for this study were discussed practically and theoretically.

ABSTRAK

MATHEMATICAL BELIEFS AND MATHEMATICS ANXIETY AMONG PRE SERVICE ELEMENTARY SCHOOL TEACHERS IN EAST KALIMANTAN, INDONESIA

Kajian ini mengkaji perbezaan dalam kepercayaan matematik dan kebimbangan matematik mengikut jantina dan tahun pengajian, hubungan antara kepercayaan matematik dan kebimbangan matematik, dan pengaruh kepercayaan matematik pada kebimbangan matematik antara guru-guru pelatih sekolah rendah di Kalimantan Timur, Indonesia. Kajian ini menerapkan pendekatan kuantitatif dengan menggunakan kajian survey. Soal selidik telah digunakan untuk memperolehi data. Sampel kajian ini adalah 374 guru-guru pelatih sekolah rendah dari Bahagian Pendidikan Guru Sekolah Rendah universiti awam di Kalimantan Timur. Data yang diperolehi daripada soal selidik yang digunakan dalam kajian ini dianalisis menggunakan SPSS 21.0. Keputusan statistik deskriptif menunjukkan bahawa kebanyakan guru-guru pelatih sekolah rendah di Kalimantan Timur mempunyai kepercayaan matematik dan kebimbangan matematik kategori sederhana. Walau bagaimanapun, terdapat beberapa orang guru-guru pelatih sekolah rendah yang masih mempunyai kepercayaan matematik tahap rendah dan kebimbangan matematik tahap tinggi. Dapatan kajian menunjukkan bahawa tidak ada perbezaan yang signifikan dalam kepercayaan matematik dan kebimbangan matematik mengikut jantina. Di samping itu, tidak ada perbezaan yang signifikan dalam kepercayaan matematik mengikut tahun pengajian, tetapi terdapat perbezaan yang signifikan pada kebimbangan matematik mengikut tahun pengajian. Satu hubungan negatif yang signifikan di antara kepercayaan matematik dan matematik kebimbangan diperolehi. Kajian ini menunjukkan bahawa kepercayaan matematik boleh meramalkan kebimbangan matematik pada tahap yang rendah. Implikasi kajian ini dibincangkan secara praktikal dan teori.

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LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
BPS	Badan Pusat Statistik/Statistic Centre
BSNP	Badan Standar Nasional Pendidikan
CDA	Confirmatory Data Analysis
CGI	Cognitively Guided Instruction
EDA	Exploratory Data Analysis
HDI	Human Development Index
IBE	International Bureau of Education
IPA	Ilmu Pengetahuan Alam/Science
IPS	Ilmu Pengetahuan Sosial/Social Science
MA	Madrasah Aliyah/Islamic Senior High School
MAK	Madrasah Aliyah Kejuruan/Islamic Vocational School
MBQ	Mathematical Beliefs Questionnaire
MI	Madrasah Ibtidaiyah/Islamic Elementary School
MOEC	Ministry of Education and Culture
MORA	Ministry of Religious Affairs
MTs	Madrasah Tsanawiyah/Islamic Junior High School
PDPT	Pangkalan Data Perguruan Tinggi/Higher Education Databases
PGSD	Pendidikan Guru Sekolah Dasar/Elementary School Teacher Education
PISA	Program for International Student Assessment
R-MANX	Revised-Mathematics Anxiety Survey
SD	Sekolah Dasar/Elementary School
SMA	Sekolah Menengah Atas/Senior High School
SMK	Sekolah Menengah Kejuruan/Vocational School
SMP	Sekolah Menengah Pertama/Junior High School
SNMPTN	Seleksi Nasional Masuk Perguruan Tinggi Negeri/National Test for Entering Public University
TIMSS	Trend in International Mathematics and Science Study

TPB	Theory of Planned Behavior
TRA	Theory of Reasoned Action
UKA	Uji Kompetensi Awal/Competences Examination
UN	Ujian Nasional/National Examination
UN SD/MI	Ujian Nasional SD/MI- National Examination for SD/MI
UN SMA/MA/SMK/MAK	Ujian Nasional SMA/MA/SMK/MAK – National Examination for SMA/MA/SMK/MAK
UN SMP/MTs	Ujian Nasional SMP/MTs – National Examination for SMP/MTs
UNDP	United Nation Development Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
VIF	Variance Inflation Factor

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CHAPTER 1

INTRODUCTION

1.1 Background of the Study

Indonesia is one of developing countries in South-east Asia. In terms of geographic location, Indonesia is located between Asian Continent and Australian Continent, and between Atlantic Ocean and Pacific Ocean. Indonesia has thirty three provinces spread over five main islands and four archipelagos. The main islands are Sumatra, Java, Kalimantan, Sulawesi and Papua, while the archipelagos are Riau, Bangka Belitung, Nusa Tenggara and Maluku. In 2012, population in Indonesia reached 245,138,420 citizens that consist of 123,431,380 males and 121,707,040 females (Badan Pusat Statistik (BPS), 2013).

Having high population density, the Government of Indonesia faces the challenge to provide good education for its citizens. Education is one of indicators to see the quality and development of a country. Annual report of Human Development Index (HDI) conducted by the United Nation Development Program (UNDP) placed education as one of basic dimension in measuring human development. Indonesia's HDI value for 2012 is 0.629—in the medium human development category—positioning the country at 121 out of 187 countries and territories. The value is below the average of 0.64 for countries in the medium human development group and below the average of 0.683 for countries in East Asia and the Pacific (UNDP, 2013).

As we know, 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 technology. Mathematics should be given to all students from elementary school to equip students with the skills of logical thinking, analytical, systematic, critical, and creative, as well as the ability to cooperate. These competences are required so that learners can have the ability to acquire, manage, and utilize information to survive in the ever-changing circumstances, uncertain, and competitive life.

The following discusses Indonesian education system as in section 1.1.1, mathematics education in Indonesia as in section 1.1.2 and teacher education in East Kalimantan as in section 1.1.3.

1.1.1 Indonesian Education System

In the National Education Law Number 20 of 2003, it is stated that education means conscious and well-planned effort in creating a learning environment and learning process so that learners will be able to develop their full potential for acquiring spiritual and religious strength, self-control, personality, intelligence, morals and noble character, and skills that one needs for him/herself, for the community, the nation and the state. National education means education based on *Pancasila* (State ideology, spelled out in the five basic principles of the Republic of Indonesia: belief in One God; just and civilized humanity, including tolerance to all people; unity of Indonesia; democracy led by wisdom of deliberation among representatives of the people; and social justice for all) and the 1945 Constitution, and is rooted in the religious values, national cultures of Indonesia, and one that is responsive to the needs of the ever-changing era.

Furthermore, the system of national education is overall educational component that interrelated and integrated to achieve national education goals. In general, education system in Indonesia is under the responsibility of Ministry of Education and Culture (MOEC), however, Ministry of Religious Affairs (MORA) also responsible for the religious (Islamic) schools.

There are three education types in Indonesia: formal, non formal and informal. Formal education is a structured education type and tiered consisting of elementary, secondary and tertiary education. Non formal education is the type of education outside the formal education that can be implemented in a structured and tiered. Non-formal education consists of courses institutes, training institutes, study groups, community learning centers, '*majlis taklim*', and similar educational units. Informal education is family and environment education that form of independent learning activities. In this section, it will be explained more about formal education.

Elementary education is the first level in formal education. Children who are seven until twelve years old are compulsory to attend education. It consists of Sekolah Dasar (SD/elementary school) and Madrasah Ibtidaiyah (MI/Islamic elementary school). In general, SD is under MOEC while MI is under MORA. In the end of elementary education, the children must face national examination called Ujian Nasional (UN SD/MI). The result of UN SD/MI is a requirement to pass the study and to continue to the next level of education.

The second level of formal education is secondary education. Secondary education is also compulsory for students who are thirteen until eighteen years old. There are two kinds of secondary education i.e. lower secondary and upper secondary education. Lower secondary education is addressed for student who are thirteen until fifteen years old while upper secondary education is addressed for student who are fifteen until eighteen years old.

Lower secondary education consists of Sekolah Menengah Pertama (SMP/junior high school) and Madrasah Tsanawiyah (MTs/Islamic junior high school). In general, SMP is under MOEC while MTs is under MORA. Actually, elementary and lower secondary education is basic education that compulsory for all students in Indonesia. Students will face Ujian Nasional (UN SMP/MTs) in the end of their study as requirement to continue to upper secondary education.

Upper secondary education consists of Sekolah Menengah Atas (SMA/senior high school), Madrasah Aliyah (MA/Islamic senior high school), Sekolah Menengah Kejuruan (SMK/vocational school), Madrasah Aliyah Kejuruan (MAK/Islamic vocational school), or other equivalent forms. In general, there are three majors in upper secondary education i.e. Ilmu Pengetahuan Alam (IPA/science), Ilmu Pengetahuan Sosial (IPS/social science) and Bahasa (language). The students can choose one of the majors offered that appropriate with their talents in their second year. In the end of upper secondary education, students also face national examination (UN SMA/MA/SMK/MAK).

The students can continue to tertiary education after completed their upper secondary school. Tertiary education is education after upper secondary education program that includes diploma education, bachelor, master, specialists, and doctoral degrees held by the colleges. It consists of academies, polytechnics, colleges, institutes and universities. In addition, it is organized by government and private organizations. The private and public institutions have their own tests for students who will enter to continue the study.

To enter the public university, the students who completed upper secondary school must follow the national test that called Seleksi Nasional Masuk Perguruan Tinggi Negeri (SNMPTN/ National Test for Entering Public University). Based on Government Regulation of Republic of Indonesia Number 66 Year 2010, the admissions pattern of the new degree program in tertiary education through a nationwide selection is conducted by all public colleges and universities together to be followed by prospective students from all over Indonesia. SNMPTN is the only pattern of selection that is carried out jointly by all public universities in one integrated system and held simultaneously. The levels of education in Indonesia are shown in Figure 1.1.

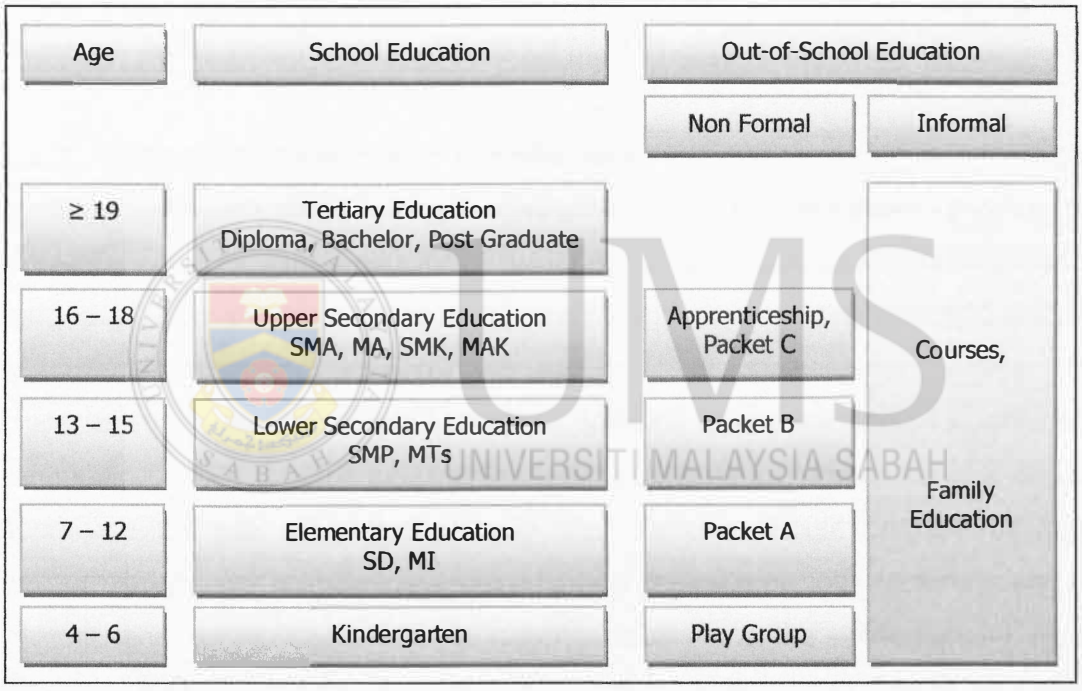

Figure 1.1 : Structure of Education System in Indonesia.
Source : Ministry of Education and Culture Republic of Indonesia

Education quality in Indonesia remains a challenge, particularly for basic education. While Indonesia has made great strides in providing universal access to basic education in recent decades, the quality of education in the country has lagged. The Indonesian educational system has not consistently produced graduates with high-quality knowledge and skills (World Bank, 2010). Based on Trend in International Mathematics and Science Study 2011 (TIMSS), Indonesia ranked thirty eight of forty two participating countries in mathematics achievement and the score is below the average of international score (500). Indonesia's position is far from its neighboring countries like Malaysia, Singapore and Thailand. In addition, mathematics achievement of Indonesian student in Program for International Student Assessment 2012 (PISA) ranked sixty forth of sixty five participating countries. Again, Indonesia's position is far from Singapore and Thailand.

1.1.2 Mathematics Education in Indonesia

In Indonesian education system mathematics is a compulsory subject for elementary and secondary education. Based on National Curriculum, mathematics is learned to give students the skills to understand mathematics concepts and its relationship between them; to use the logic of mathematics pattern and characteristics; to solve mathematics problem and interpret its solution; 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 (UN) and test for entering public universities (SNMPTN). Students face national examination when they are in grade six, grade nine and grade twelve. However, there is difference of mathematics material test for grade twelve and SNMPTN. The material differed based on the majors chosen by student, science or social science majors. It means that mathematics is one of requirements to continue their upper education. However, the result of national examination always showed that mathematics was the lowest-scoring subject (MOEC, 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 from the teachers who mathematically anxious and teach in ways that develop mathematics anxiety in their own students (Gresham, 2007b; Maloney and Beilock, 2012). It appears that teachers certainly play a key role in improving student outcomes (World Bank, 2010).

Based on Teacher Law Number 14 of 2005, teachers must be qualified minimum of bachelor degree (S1/Diploma 4). However, there are still under-qualified teachers especially in basic education (MOEC, 2013). The number of under-qualified teachers of elementary school is the biggest number between other under-qualified teachers in all level education. Based on Badan Pusat Statistik (BPS) data, it is known that 46.96% of 1,707,635 elementary school teachers are under-qualified teachers (BPS, 2012). It is a sad fact that the number of under-qualified teachers in elementary school close to number of qualified teachers.

Result of Uji Kompetensi Awal 2012 (UKA/competences examination) for teachers shows that the national average score is only 42.25 from maximum score 100. Actually, the test is purposed to map how the competences of teachers in Indonesia are. UKA is one of the requirements for teachers to follow certification teachers program. Certification teachers program is government program to select the teachers who competent in their profession. The teachers who passed the program will get the additional allowance from government. The UKA's score of each teacher is shown in Table 1.1.

Table 1.1: National Average Score of UKA 2012

No	Teacher of	Average Score
1	Kindergarten	58.57
2	Elementary School	36.86
3	Lower Secondary School	46.15
4	Upper Secondary School	51.35
5	Vocational School	50.02

Source: MOEC (2012)

According to Table 1.1, elementary school teachers' score is the lowest than other teachers. It determines how the quality of elementary school teachers in general. Regarding mathematics subject, mathematics teaching in elementary education also have weaknesses i.e. students are difficult to comprehend mathematical concepts and to construct and solve mathematical representation from a story problem; and teaching style of the teachers makes mathematics more difficult to learn and to understand (Sembiring *et al.*, 2008).

On the other hand, most teachers in Indonesia still view mathematics as an accumulation of facts, rules and skills to be used in the pursuance of some external end (Platonist view) and mathematics as a static, but unified body of knowledge, mathematics is discovered, not created (Instrumentalist view) (Podomi *et al.*, 2012). This is contrary with the curriculum of mathematics education that focuses on problem solving (MOEC, 2006). In addition, this will encourage teachers to teach only to the understanding of the procedure and not on conceptual understanding (Adnan and Zakaria, 2010).

1.1.3 Teacher Education in East Kalimantan

East Kalimantan is one of provinces in Indonesia that located in Borneo Island. It consists of ten regencies and four cities. The area of East Kalimantan is about 20,865,774 ha. Most of the area is land, approximately 95.1% from the overall area and is dominated by wavy topography. In 2012, population of East Kalimantan reached 3,840,240 inhabitants that consist of 2,021,680 males and 1,818,570 females (BPS, 2013).