ISSN 2586-4769
Journal of International Education Vol. 3, 2021

Effects of Creative Writing Activities on Students' Mathematics Anxiety

Francis O. Pantino, Ph. D.
Joy Hondrade-Pantino, Ph. D.
West Visayas State University-Main Campus, Iloilo City, Philippines

---

Abstract: *This study investigated the effects of using creative writing activities in Mathematics on students' Mathematics anxiety. Using a quasi-experimental design, the data were collected from 60 respondents from three intact classes of college freshman students from a university in Iloilo City, Philippines. Results of the study showed that significant differences were noted in the mathematics test anxiety of students who were exposed to Treatment 1 (traditional method of instruction with creative individual writing activities), Treatment 2 (traditional method of instruction with creative group writing activities), and Conventional set up (traditional method of instruction without creative writing activities). The post hoc test revealed that students exposed to Treatment 2 had significantly lower mathematics test anxiety than the Conventional group. The paired-samples t-tests showed that there was no significant decrease in the mathematics anxiety of students after exposure to Treatment 1 and the Conventional set up. However, there was a significant decrease in the mathematics anxiety of students after exposure to Treatment 2.*

Keywords**:** mathematics anxiety, creative writing, test anxiety

**The authors wish to thank DOST-SEI and WVSU-URDC for the financial support in the conduct of the study.

I. INTRODUCTION

Day after day realities and experiences strongly indicate that survival in this continuously changing world necessitates application of mathematics. Mathematics is a vital tool in everyone's existence for its usefulness in all types of human endeavors. At work and at home, while reading, relaxing, shopping, interacting with others, and making practical decisions, people are compelled to make use of mathematics, and often to employ its language and methods. The goal of mathematics education is to prepare students for these tasks, as well as to provide for further development of new mathematics knowledge (Walker and Karp, 2005).

While it is true that mathematics is an indispensable tool in every personal pursuit and in the employment arena, problems in learning and acquisition of mathematical knowledge and skills continuously occur inside the mathematics classroom. The UNESCO National Education Support Strategy (UNESS) Report in 2009 shows that the achievement rates of grade six and fourth year Filipino students in mathematics are way below the proficiency level. Results also of the Trends in International Math and Science Survey (TIMSS) reveal that the Philippines performed poorly in Mathematics. This under performance may indicate that students are struggling with some mathematics disabilities. According to Shaikh (2013) research-based math disability characteristics include: learned helplessness, passive learners, memory problems, attention problems, cognitive thinking deficits, low level of academic achievement, and mathematics anxiety.

Mathematics anxiety is a reoccurring problem for many students, and the effects of this anxiety on college students are increasing (Andrews and Brown, 2015). This mathematics disability is often mirrored in most incoming tertiary students' choice of programs or career path. They either intentionally shun programs with mathematics or that they would prefer taking up programs with the minimum number of required mathematics courses. Avoiding mathematics courses severely restricts the fields a student can study and the jobs one can find (Shaikh, 2013).

The 1989 NCTM's *Curriculum and Evaluation Standards for School Mathematics* encouraged teachers to incorporate writing into the teaching of mathematics (Quinn and Wilson, 1997). McIntosh (1991, cited in Quinn and Wilson, 1997) pointed out that a variety of writing activities-including logs, journals, expository writing, and creative writing can be used to help students learn mathematics effectively. Stix (1994, cited in Quinn and Wilson, 1997) found out that the use of pictorial journals by elementary and middle school students promotes a better understanding and retention of mathematical concepts, decreases "math anxiety," and gives students a feeling of ownership of the material.

Thus the researcher pursued this investigation to find out the effects of the use of creative writing activities on mathematics anxiety among college freshmen students. Specifically, this study sought answers to the following questions:

1. Are there differences in mathematics anxiety among students who are exposed to the traditional method of instruction with individual creative writing activities (Treatment 1), traditional method of instruction with group creative writing activities (Treatment 2), and traditional method of instruction without creative writing activities (Conventional set up)?
2. Is there a significant decrease in mathematics anxiety of students before and after exposure to:
   a. Treatment 1? b. Treatment 2? c. Conventional set up?

II. RELATED LITERATURE

Many research works have been conducted that espoused the use of writing in content areas such as Mathematics as a means to enhance the understanding and learning of the content. At the same time, many theories have been proposed to explain the root-causes of mathematics anxiety and its influence on mathematical performance. This review encompasses certain themes that have significance in understanding the variables of this study. These themes include: creative writing, use of creative writing activities in mathematics, writing as a process and a learning tool, writing in the mathematics curriculum, mathematics anxiety and mathematics achievement. Although the literature presents these themes in a variety of contexts, this investigation will primarily focus on their application to or association of writing with mathematics achievement.

What is Creative Writing?

Creativity is comprised of some qualities such as originality, extraordinariness, exceptionality, composing things in hitherto unseen ways (Ömeroğlu, 1990; Üstündağ, 2002; Yıldırım, 1998, cited in Temizkan, 2011). San (2002) and Torrance (1998) define creativity as an ability which is present in all emotional and cognitive activities and in all kinds of work and endeavor, laying the foundations of all aspects of human life and development (Temizkan, 2011). At the heart of creativity lies the ability to make new connections among hitherto unassociated items and to come up with new experiences, new and original thoughts within this novel thinking scheme (İzgören, 1999; Kale, 1994; May, 1994; Sylvan, 1997; Turla, 2004, cited in Temizkan, 2011).

Directly associated with creativity, creative writing means one's putting his or her ideas and feelings about a particular topic on paper by using his or her imagination freely (Oral, 2003, cited in Temizkan, 2011). Creative writing, although done mostly in connection with language arts, is a form of writing that can strengthen learning in mathematics (Education World, 2012). The term 'creative writing' may be defined as: having the power to create an imaginative, original literary production or composition and can be applied to a very broad spectrum of writing genres (Ramet, 2007).

Creative writing involves going beyond the ordinary without deviating from the normal values, creating ideas that are different from everyone else's ideas with the help of one's imagination, achieving originality, and writing fluently while taking pleasure in the act of composing, and going beyond the standards (Küçük, 2007, cited in Temizkan, 2011). Creative writing is characterized by originality and imagination rather than truthfulness or standardization of thoughts (Brookes & Marshall, 2004, cited in Temizkan, 2011). Creative writing requires organization, planning, and discovery of thoughts and it rejects restrained thinking. "Recreating emotional experiences freely in mind" is a fundamental philosophy of creative writing (Sharples, 1996, cited in Temizkan, 2011).

Factors motivating students to become involved in creative writing activities include a higher order of thinking, exploration and observation skills, knowledge, a regular habit of reading, innovativeness, a critical eye for things happening around, richness of emotions and experience, sufficient use of information, communication technologies, and diversity of methods (Küçük, 2007, cited in Temizkan, 2011).

Use of Creative Writing Activities in Mathematics

Ideas for integrating creative writing activities in mathematics are provided by Janzen (2000) in her article "*Integrating Writing into the Mathematics Classroom"* published by Glencoe (2000) and Education World (2012) in the article "*Incorporate Language Into Math Instruction"*. Both articles are available online.

Janzen (2002) provided ideas for mathematics writing activities including mathematics journals and creative or expressive writing activities. According to Janzen (2000) these are "the activities that are a snap to incorporate, and can kick-start writing in the teachers' mathematics class." As teachers feel more comfortable, they can try incorporating a few longer, more involved writing activities (Janzen, 2000). Teachers can use writing activities in mathematics class to diagnose learning difficulties, assess student mastery of concepts, and to enable students to express their thoughts and feelings about mathematics in reflective or creative ways. Writing also provides an interesting and varied instructional activity for the students (Janzen, 2000).

According to Education World (2012) creative writing appropriate for mathematics can include poetry, stories and skits. Poetry, because it has a meter, already has a mathematical component. Two forms of poetry, the haiku and the cinquain were discussed in the article. The Japanese-inspired haiku is a non-rhyming little wisp of language consisting of three lines, seventeen syllables, in the pattern of 5–7–5. Authentic haiku captures an image from nature, but in this case, a concept in mathematics is captured (Education World, 2012). A mathematics term can be used as a title and then it is described in the haiku, or the mathematics term is included within the haiku. The mathematics term can be used literally or metaphorically.

Writing as a Pedagogic Tool in Mathematics

Jeppsen (2005) observed that mathematics education researchers have noted several distinct characteristics of writing that seem to make it a useful tool for developing mathematical knowledge. These characteristics include the potential of writing to engage

students in mathematical learning, to structure thought, and to make the learner's thought process explicit. She explained these characteristics individually.

First, writing is thought to be a natural way to engage students directly in the processes involved in thinking and learning about mathematics. When students are asked to write about their solution process in addition to solving a problem, they are required to think about their reasoning and about the underlying mathematical concepts (Jeppsen, 2005).

Second, the structuring of abstract thought inherent in the process of writing suggests that writing can play a role in structuring students' knowledge and understanding. Vygotsky (1962) referred to writing as a "deliberate structuring of the web of meaning", and Emig (1977) emphasized that "the medium of written verbal language requires the establishment of systematic connections and relationships". This characteristic of writing is particularly appealing to mathematics educators because the precision and structure of writing appears to parallel the precision and structure of rigorous mathematics (Elsholz & Elsholz, 1989; Morgan, 1998 cited in Jeppsen, 2005).

Third, from a cognitive perspective, writing is frequently seen as a way for students to be made aware of their own thought processes and to thereby learn from and become able to control those processes (Jeppsen, 2005).

Similarly, Morgan (2001) suggested that the concreteness of written records allows students to reflect upon and revise what they have already written, and to bring together texts to be compared and discussed. In this way, when the thought process of a student is written down, it itself becomes the object of thought (Jeppsen, 2005).

Langer and Applebee's *How Writing Shapes Thinking* (1987) is an influential study on the pedagogical practice of using writing as a teaching tool. According to Langer and Applebee (cited in Reilly, 2007), writing allows students to think and reflect in a focused way on the content about which they are writing. In fact, Langer and Applebee argued that whenever students are asked to write about a particular concept, they gain a greater understanding of that concept because writing requires active thinking: "Thinking skills are taught best when related to some content, the argument goes, and writing provides a particularly welcome context for thinking deeply about such content" (Langer & Applebee, 1987, p. 1). Langer and Applebee also argued that writing can be an invaluable means for evaluating student understanding: Writing "can be used to diagnose students' needs and it can reflect students' ability to apply what they know" (p. 57) (Reilly, 2007).

Challenges with Writing in Mathematics

One of the difficulties of examining student writing for evidence of mathematical learning and reflection is the unavoidable question of whether the writing itself is actually aiding the understanding, or whether the writing is merely a reflection of understanding that students arrive at through other means. This issue is addressed directly by Cooley (2002), who states that, "It is not clear, nor could it ever be absolutely clear, if the questions asked of the students or the thinking they do in order to write a response are the catalysts or if the writing assignment is a conduit by which they can demonstrate that the process has occurred".

A second difficulty is that the evidence of student learning is not entirely consistent. Journal entries or written responses that seem to reflect students' thinking processes and increased understanding are used to show that writing can impact mathematical learning, but in general only a small portion of the students who are engaged in writing actually do demonstrate this type of learning process (Jeppsen, 2005).

Furthermore, the belief that writing can promote learning, as well as proposed theories on precisely how such learning might occur, seem intuitive and speak to our experiences as writers and as learners (Jeppsen, 2005). Hill (1994) pointed out that, even lacking an

empirical foundation, the use of writing as a learning tool "is a commonsense notion, not just in the writing community, but in the larger educational community" (Jeppsen, 2005, p. 20)

Writing in the Mathematics Curriculum

Reilly (2007) emphasized the role of communication in the mathematics classroom that in the National Council of Teachers of Mathematics (NCTM) *Curriculum and Evaluation Standards for School Mathematics* (1989) and *Principles and Standards for School Mathematics* (2000) communication is addressed as a standard.

> Communication is an essential part of mathematics and mathematics education. It is a way of sharing ideas and clarifying understanding. Through communication, ideas become objects of reflection, refinement, discussion, and amendment. The communication process also helps build meaning and permanence for ideas and makes them public. (NCTM, 2000, p. 60).

Thus bringing writing into the mathematics classroom is one way to achieve NCTM's goal of teaching students effective communication (Reilly, 2007). NCTM (2000) suggests that students write explanations about how they solved a problem, solutions to exercises as if they were writing a textbook, essays about what it means to prove something, or reports describing the significant contributions of well-known mathematicians (Urquhart, 2009).

Strategies for Incorporating Writing in the Mathematics Instruction

Burns (2004) recommended some classroom strategies for teachers who want to incorporate writing into their math instruction:

1. Establish the purpose for writing in math class. Making sure students understand the two basic reasons that writing is an important part of math: to support their learning and to help the teacher assess their progress.
2. Establish yourself (teacher) as the audience. Letting students know that their writing will help the teacher teach them better by providing valuable insights into their understandings, misconceptions, and confusions.
3. Ask students to include details and to explain their thinking as thoroughly as possible. Encouraging them to use words, numbers, and, if they like, pictures to provide as much information as possible.
4. Have students discuss their ideas before writing. Providing opportunities to students to talk about their thinking to help them formulate ideas that they will then try to explain in writing.
5. Post useful mathematics vocabulary. Maintaining a class chart showing pertinent mathematics vocabulary that comes up in class discussions.
6. Write a prompt on the board to get students started on a writing assignment.
7. Give individual assistance as needed. Providing additional reinforcement for some students who may have difficulty starting with the writing task.

Writing may provide clues as to why a student is unable to complete an assignment by oneself. Teachers can assign writing tasks that may reveal attitudes, anxieties and beliefs about mathematics that might be interfering with a student's learning. Through such an assignment, the student can express to the teacher, in a private and direct way, concerns about learning the material (Dodd, 1992). A quick and caring response to these concerns may increase the motivation of the student and strengthen the student-teacher relationship. Dodd maintains that this may be of particular importance in disciplines such as mathematics, where there tends to be a large amount of student anxiety.

According to Bryan (1996), in a writing course, cooperative writing groups are very effective because students establish a supportive, comfortable environment, are more actively engaged in the content of the course; and experience greater gains in mastering course

content. Writing groups encourage students to take increased responsibility for their learning (David, 1985, cited in Bryan, 1996), give students confidence in the value of their own words and ideas (Bruffee, 1994, cited in Bryan, 1996), provide a less threatening environment (Elbow, 1981; Gere, 1987, cited in Bryan, 1996) and give students an opportunity to rehearse changes on their own writing by participating in discussion of others' writing (Bruffee, 1980; Coleman, 1987, cited in Bryan, 1996).

Mathematics Anxiety and Mathematics Achievement

Tobias (1989) suggested that "getting students to write about their feelings and misconceptions would relieve their anxiety and unlearn models and techniques that were no longer useful to them" (p. 50). LeGere (1991, cited in Menon, 1992) too, concurred that writing does seem to diminish stress and anxiety about getting the "correct" answer, and allows risk-taking. Morrow and Schifter (1988, cited in Menon, 1992) had this to say about the "anxiety-reducing" role of writing in mathematics:

> Turning to a more familiar and often more comfortable mode, such as writing, can provide a sense of security to a math-anxious student. Alternating among various modes of discourse (writing, talking, drawing, and symbolic representation) builds bridges between formal mathematics knowledge embedded in students' everyday experiences; insistence that mathematically valid thought is restricted to rule-governed manipulation of strings of symbols keeps the mathematics insulated from their personal knowledge (p.380).

Mathematics anxiety has been the object of attention of several researchers when studying students' dilemma in Mathematics. Ashcraft defined mathematics anxiety as a "feeling of tension, apprehension or fear that interferes with math performance" Facun, Mati, & Bautista (2014, p.195). Byrd (1982) opined that mathematics anxiety is a fear state while D'Ailly and Bergering (1992), Trujillo and Hadfield (1999), and Levine (1995) argued that mathematics anxiety is a feeling of stress and fear of apprehension which hinders mathematical problem solving and calculation in both regular and academic life (cited in Ajogeje, Borisade, Aladesaye, & Ayodele, (2013, p.16). Buckley and Ribordy described mathematics anxiety as "an inconceivable dread of mathematics that can interfere with manipulating numbers and solving mathematical problems within a variety of everyday life and academic situations" (Smith, 2004, p.4).

Students' mathematics anxiety may occur due to their belief of incapability to do math, if they have bad or negative attitude towards mathematics, if they experience an intensifying fear of answering a teacher's questions incorrectly, if they have never experienced success in their mathematics classes and if students are in the freshman year of college (Smith 2004). Furthermore, students may have the tendency to compare their grades to their peers' more and worry more about how their peers will react to them if they give a wrong answer in mathematics class (Smith, 2004).

Jackson and Leffingwell (1999) identified causes of mathematics anxiety as occurring throughout a student's formal education. Although the experiences are spread over several years, the nature of the experiences indicates that mathematics anxiety is directly related to the interactions of students within the classroom (Smith, 2004). Jackson and Leffingwell (1999) identified some of the causes of math anxious feelings. These include difficulty of material, hostile instructor behavior, gender bias, perception of instructors as insensitive and uncaring, and communication and language barriers (Allen, 2001).

According to Smith (2004), mathematics anxiety is caused by poor test grades, inability (or unwillingness) to complete difficult assignments, negative predisposition of parents, and even the mathematics teacher. Orton and Frobisher (1996) declared that the abstract nature of mathematics could be a cause of anxiety (cited in Jackson, 2008, p.36) Furner and Duffy (2002) asserted that teachers and parents that are afraid of mathematics pass that on to their students and children (cited in Smith, 2004, p. 7). Usop, Sam, Sabri, and Wah (2009) found

out that that the teacher has the greatest influence in the development of undergraduate students' anxiety and teaching strategies such as individual and competitive activities also contributed to the existence of mathematics anxiety among their respondents.

According to Williams (1988), mathematics anxiety has its roots in teaching and teachers and has been tied to poor academic performance of students, as well as to the effectiveness of elementary teachers (cited in Woods, 2006).

Yenilmez, Girginer, and Uzun (2007, cited in Usop et al., 2009) asserted that mathematics anxiety can occur in all levels of education from primary school to higher education, and once established, can persist in life, interfering with everyday activities involving numeracy and further learning of mathematics.

Mathematics anxiety in particular of college students had been widely studied in the past decades. Revak (1996) cited the works of Dreger and Aiken (1957) who reported that one-third of college students enrolled in basic mathematics classes suffered from number anxiety while Adams and Holcomb (1986), Betz (1978), and Richardson and Suinn (1972) found out that up to half of all college students are intensely anxious about mathematics at one time or another. Zakaria and Nordin (2008) reported that almost one-third of the matriculation students they studied had high level of mathematics anxiety.

Usop et al. (2009) found out that mathematics anxiety existed among undergraduate students and Helal and Hamza (2011) investigated mathematics anxiety across undergraduate majors. Among pre-service teacher education students Ballado (2014) found out that majority of them had moderate to high anxiety levels and Facun, et al. (2014) reported that the Psychological/Emotional Domain of mathematics anxiety has the greatest effect on the achievement of BSED students in mathematics. Vitasari, Herawan, Wahab, Othman, and Sinnadurai (2010) pointed out that female engineering students were more anxious than their male counterparts while Kargar, Tarmizi, and Bayat (2010) added that female university students have higher anxiety level than the male group and the investigation of Ajogbeje et al. (2013) further supports that female college students have higher mathematics anxiety level than male students. In an investigation carried out with vocational college students, Rameli, Kosnin, Said, Tajuddin, Karim, and Van (2014) found out that a high percentage of their respondents experienced a relatively high level of mathematics anxiety.

Research has shown that mathematics achievement in students is influenced by psychological factors such as mathematics anxiety (Zakaria, Zain, Ahmad & Erlina, 2012). In the mathematical context, it appears that many students who are weak in mathematics worry while attempting to use mathematics skills to solve problems (Mohamed &Tarmizi, 2010; Arem, 2003; Rahim, 2002; Tobias, 1995, cited in Zakaria et al., 2012). The findings of Marsh and Tapia (2002) indicate that students with low levels of math anxiety feel more excited, more confident and highly motivated to learn mathematics when compared to students who have high anxiety levels (Zakaria et al., 2012). Coleman (1991) and D'Ailly and Bergering (1992) established that there is a direct relationship between level of mathematics anxiety and math avoidance. Pourmoslemi, Erfrani and Firoozfar (2013) cited that the relationship between mathematics anxiety and mathematics achievement was investigated by Ma and Xu (2004) and students with higher level of mathematics anxiety perform at a lower level of mathematics achievement (Tocci & Engelhard, 1991).

Jackson (2008) reported the works of Kogelman & Warren (1978) on the influence of mathematics anxiety on mathematical performance by affecting memory and Tobias (1978) by creating nervousness and an inability to concentrate. According to Sherman and Wither (2003), a five-year study conducted on students from the age of 6 to the age of 10 revealed that the level of mathematics anxiety in students is strongly related to student achievement (Zakaria et al., 2012). Zakaria et al. (2012) found out that mathematics anxiety is one factor that affects student achievement. Hembree's (1990, cited in Pourmoslemi, Erfrani &

Firoozfar, 2013) meta-analysis reported an average correlation of -.34 between mathematics anxiety and mathematics achievement.

A recent work on meta-analytic review on the relationship between mathematics anxiety and mathematics achievement, Ma (1999, cited in Pourmoslemi, Erfrani & Firoozfar, 2013) found that the common population correlation for this relationship is -.27. This magnitude was associated with a prediction that "measures (or treatments) that resulted in the movement of a typical student in the group of high mathematics anxiety in the group of low mathematics anxiety would be associated with improvement of the typical student's level of mathematics achievement from the 50th to the 71st percentile" (Pourmoslemi, Erfrani & Firoozfar, 2013). Also a negative correlation between mathematics anxiety and mathematics achievement was reported by (Ashcraft, 2002; Ashcraft & Kirk, 2001; Bandalos, Yates, & Thorndike-Christ, 1995; Cates & Rhymer, 2003; Miller & Bichsel, 2004, cited in Pourmoslemi, Erfrani & Firoozfar, 2013).

Sheffield and Hunt (2006) supported the notion that mathematics anxiety has a direct impact on mathematics tasks (Helal, Hamza & Hagstrom, 2011). Daneshamooz, Alamolhodaei and Darvishan (2012) found a significant negative correlation between mathematics anxiety and mathematical performance while Zakaria and Nordin (2008) and Ojogbeje et al. (2013) found out that a significantly low negative correlation coefficient existed between mathematics anxiety and mathematics achievement. This means that college students with high mathematics anxiety scored significantly low in mathematics achievement and those with low mathematics anxiety scored significantly higher than college students with moderate or high mathematics anxiety. This is supported by studies by Elenchothy (2007, cited in Zakaria et al., 2012), which showed an inverse relationship between mathematics anxiety and student achievement. This inverse relationship means that students with high mathematics anxiety will realize low achievement in mathematics. The results conform to the findings of Khatoon and Mahmood (2010); Yuksel-Sahin (2008); and Satake and Amato (1995) (Zakaria et al., 2012).The investigation of Facun et al. (2014) revealed that there is a significant relationship between mathematical achievement and the psychological domain of mathematics anxiety. Student's feelings have a great impact on their performance in mathematics. Fear hinders a person to think logically which grounds him to a low performance (Facun et al., 2014). Ballado (2014) found out that there was a significant negative relationship between anxiety level and mathematics achievement.

Using the Abbreviated Mathematics Anxiety Scale (A-MARS) developed by Alexander and Martray (1989). Valle-Tourangeau, Sirota, and Villejoubert (2013) found out that mathematics anxiety negatively affects performance in simple arithmetic tasks. They observed that mathematics anxiety was significantly correlated with mental arithmetic performance in the static condition while in the interactive condition, mathematics anxiety and working memory did not significantly correlate with performance- as mathematics anxiety increased, the participants made fewer errors in the
interactive than in the static condition.

Ajogbeje et al. (2013) who also adapted the abbreviated version of Mathematics Anxiety Rating Scale developed by Alexander and Martray (1989) reported that college students with high mathematics anxiety scored significantly low in mathematics achievement and those with low mathematics anxiety scored significantly higher than college students with high mathematics anxiety. Rameli et al. (2014) found out that mathematics anxiety was a significant predictor of mathematics achievement.

Revak (1996) reported that the interaction between mathematics anxiety and distributed practice homework cannot explain a significant proportion of variance in Pre-calculus achievement. Josiah & Adejoke (2014) argued that the level of anxiety does not affect the achievement of college students in Algebra.

III. METHODOLOGY

Research Design

The three-group pretest-posttest quasi-experimental design was employed in this study.

$$\begin{array}{llll} G_1 & O_1 & X_1 & O_1' \\ G_2 & O_1 & X_2 & O_1' \\ G_3 & O_1 & X_3 & O_1' \end{array}$$

where:

G_1: traditional instruction with Individual Creative Writing Activities

G_2: traditional instruction with Group Creative Writing Activities

G_3: traditional instruction without Creative Writing Activities or Conventional group

X_1: exposure to traditional instruction with Individual Creative Writing Activities

X_2: exposure to traditional instruction with Group Creative Writing Activities

X_3: exposure to traditional instruction without Creative Writing Activities or Conventional group

O_1: Pretest of the Abbreviated Mathematics Anxiety Rating Scale (A-MARS) for the three classes

O_1': Posttest of the A-MARS for the three classes

The Sample

The participants of this study involved sixty students from three intact classes of freshmen students in the College of Nursing enrolled in MATH 102 - College Algebra offered at a university in Iloilo City, Philippines.

The participants were from the same college, same year level, 16-17 age bracket, and obtained a score of 100 or better in the College Admission Test. The required minimum score of 100 (out of 250) in the CAT is set by the College of Nursing. Nine of the participants were male and fifty-one were female.

To establish the degree of equivalence among the groups, the researcher administered the Abbreviated Mathematics Anxiety Rating Scale (A-MARS) (pre-test) before the treatment period. The participants of the study may not be comparable at the start of the study and this can influence their scores in the Abbreviated Mathematics Anxiety Rating Scale (A-MARS) (post-test). After the implementation of the treatments, twenty students from each treatment group were randomly selected as participants. The treatments were administered to the entire class. However, only the data collected from the twenty participants who were randomly selected from each of the treatment groups and the conventional group were utilized for statistical analysis and interpretation. This was done because the class and the participants themselves were not informed that the teacher is conducting research to maintain the natural setting of the classroom.

To justify the utilization of the data of the twenty randomly selected participants, preliminary tests were conducted to check whether the data could meet the assumption for the statistical test. In particular, paired-samples t-test assumes normality and if the distributions of the pre-test and post-test data on the A-MARS are normal the use of the data of the twenty respondents is justified.

The results of the normality tests showed that the pre-test and post-test data on the Abbreviated Mathematics Anxiety Rating Scale were normally distributed. Thus the use of the data of the twenty respondents on this instrument is justified.

The Instruments

***Abbreviated Mathematics Anxiety Rating Scale (A-MARS*)**. This is a 25-item questionnaire developed by Alexander and Martray (1989) adopted in the study. The instrument had reliability coefficient of 0.96 on Factor I (Math Test Anxiety), 0.86 on Factor II (Numerical Test Anxiety and 0.84 on Factor III (Math Course Anxiety). Cronbach's alpha was used to test the reliability of this instrument and an alpha of 0.797 was obtained. Pallant (2015) emphasized that the ideal Cronbach alpha coefficient of a scale should be above .7. Thus the instrument is considered to be reliable with the sample.

In the A-MARS administered to the students, items 1 to 13 and 16 to 17 belong to the mathematics test anxiety component, items 18 to 22 belong to the numerical anxiety component, and items 14 to 15 and items 23 to 25 belong to the mathematics course anxiety.

The following scale was used to interpret the means obtained in Mathematics Anxiety.

Scale	Description
3.01 – 4.00	High
2.01 – 3.00	Moderate
1.00 – 2.00	Low

The instrument was administered before and after the implementation of the treatments.

Career Research Report. This is a five-part instrument used by the students to accomplish the research activity about careers that require the use of mathematics. This instrument which can be accessed online was developed by Hurley (no date) and adopted in the study.

Creative Writing Activities

The types of creative writing activities done by the students included *Vocabulary Paragraphs, Numbers Stories, Poems, Advice Columns,* and *Research Activity,* which was limited only to *Careers That Require the Use of Mathematics*. The choice for these creative writing activities took support from the articles of Janzen (2000) and Education World (2012).

Criteria Scale

To score each creative writing activity including the students' research activity, a set of criteria was developed. Each creative writing output was rated by the teacher in each criterion from 1 to 4 with 1 as the lowest and 4 as the highest. The criteria were presented to the chairperson of the English Department of the University for suggestions and comments to improve its validity. The scoring was patterned from the writing rubrics used by the faculty members of the English Department in their respective classes. Students' written outputs were given comments and returned to them.

Data Collection Procedure

Prior to the treatment period, the A-MARS was administered to the three classes to collect the pre-test data. The A-MARS was administered at the start of the class and took about 10 to 15 minutes of the class period. Right after the administration of the A-MARS, the teacher started to discuss the first topic of the course which was about *Sets*.

After the discussion of all the subtopics on *Sets* the first creative writing activity, the Vocabulary Paragraph, was given. Since it was the first creative writing activity, the teacher gave some sample vocabulary paragraphs and discussed these with the students. The teacher addressed some questions that were raised by the students after which he gave the first set of Mathematics vocabulary taken from the subtopics on *Sets*. The time allotted for the activity was 20 minutes but was later extended to 30 minutes for students who experienced creative writing activities in mathematics for the first time.

This approach was followed all throughout the duration of the treatment period for the rest of the creative writing activities except for the career research report which was done outside the class hours.

A colleague of the researcher was requested to randomly observe the classes to assure quality of implementation of the creative writing activities. She was requested to be present during the period of the class when the students would write a creative writing activity. She observed the students in the two treatment groups on three occasions. The researcher informed her when the discussion of the topic was about to be concluded and that the next activity would be the creative writing.

At the end of the treatment period, the Abbreviated Mathematics Anxiety Rating Scale (A-MARS) was administered by the teacher to the three groups to collect the post-test data.

Data Analysis Procedure

All data gathered were reported in the aggregate form to protect anonymity. Means and standard deviations were employed as descriptive statistics. Analysis of Covariance (ANCOVA) and paired-samples t-test, set at .05 alpha levels were used as inferential statistics. All statistical computations were processed through the use of IBM SPSS Statistics 20.0.

Statistics from the A-MARS pre-test and post-test scores were examined using Analysis of Covariance (ANCOVA) to determine significant differences in attitude towards writing in mathematics of students exposed to Treatment 1, Treatment 2, and Conventional set up. The pre-test scores from the instrument (A-MARS) were treated as the covariate since the researchers assumed that the three groups were not comparable at the start of the treatment period. Preliminary checks were likewise conducted to ensure there was no violation of the assumptions of normality, linearity, homogeneity of variances, homogeneity of regression slopes, and reliable measurement of the covariate.

Paired-samples t-tests were conducted to determine whether there was a significant decrease in mathematics anxiety of students exposed to Treatment 1, Treatment 2, and the pure traditional teaching format (Conventional set up) before and after the implementation of the intervention.

IV. RESULTS AND DISCUSSION

Effects of Creative Writing on Mathematics Anxiety

The Abbreviated Mathematics Anxiety Rating Scale (A-MARS) was administered to the three classes before and after the implementation of the intervention to collect the pre-test and post-test data, respectively. In the pre-test, the Abbreviated Mathematics Anxiety Rating Scale (A-MARS) mean scores of the students in Treatment 1 range from 1.32 to 3.32. Before the introduction of the treatment, 3 or 15% of the students had high level of mathematics anxiety, majority (15 or 75%) had moderate level of anxiety, and 2 or 10% had low level of mathematics anxiety. In the post-test, the mean scores of students range from 1.70 to 3.30. After the implementation of the treatment, 2 or 10 % of the students had high level of

mathematics anxiety, majority (15 or 75%) had moderate level of anxiety, and 3 or 15% had low level of mathematics anxiety.

In Treatment 2, the A-MARS pre-test mean scores range from 1.40 to 2.72 which indicates that students had low to moderate levels of mathematics anxiety before the introduction of the intervention. In the post-test, the mean scores of students range from 1.40 to 2.92 which indicates that students had low to moderate levels of mathematics anxiety after the intervention. After the implementation of the treatment, 10 or 50 % of the students had moderate level of anxiety, and the other 10 or 50% had low level of mathematics anxiety.

In the Conventional group, the A-MARS pre-test mean scores of students range from 1.52 to 3.56. Before the start of the study, 1 or 5% of the students had high level of mathematics anxiety, 12 or 60% had moderate level of mathematics anxiety, and 7 or 35% had low level of mathematics anxiety. In the post-test, the mean scores of students range from 1.12 to 3.00. After the period of the study, none obtained high level of mathematics anxiety, 14 or 70% had moderate level of mathematics anxiety, and 6 or 30% had low level of mathematics anxiety.

A one-way between-groups analysis of covariance was performed to find out the effects of the interventions on the participants' mathematics anxiety (test anxiety). Participants' mean scores on the pre-intervention administration of the Abbreviated Mathematics Anxiety Rating Scale (A-MARS) (test anxiety) were used as the covariate in this analysis. Preliminary checks were likewise conducted to ensure there was no violation of the assumptions of normality, linearity, homogeneity of variances, homogeneity of regression slopes, and reliable measurement of the covariate. After adjusting for pre-intervention scores, it was found out that there was a significant difference on post-intervention scores on the Abbreviated Mathematics Anxiety Rating Scale (A-MARS) (test anxiety) [$F(2,56)=3.53$, $p=.036$, partial eta squared=.11] among students who were exposed to Treatment 1, Treatment 2, and Conventional set up.

The results also revealed that there was a strong relationship between the pre-intervention and post-intervention scores on the Abbreviated Mathematics Anxiety Rating Scale (test anxiety), as indicated by a partial eta squared value of 0.35. This also means that the covariate, mathematics anxiety (test anxiety) pre-test is significantly related to the mathematics anxiety (test anxiety) post-test, $F(1, 56)=30.34$, $p=.000$. This goes to show that an increase in the mathematics anxiety (test anxiety) of students before the intervention would likely have a corresponding increase in their mathematics anxiety (test anxiety) after the intervention. The ANCOVA results are presented in Table 1.

Table 1
ANCOVA Results and Descriptive Statistics for Mathematics Anxiety (Test Anxiety) by Method of Instruction and A-MARS Pre-test

Method of Instruction	Mathematics Anxiety (Test Anxiety)			
	Observed Mean	Adjusted Mean	SD	N
Treatment 1	2.61	2.50	.62	20
Treatment 2	2.18	2.20	.50	20
Conventional Group	2.49	2.57	.59	20
Source	SS	df	MS	F
A-MARS Pre-test	6.66	1	6.66	30.34*

Method of Instruction	1.55	2	.77	3.53*
Error	10.31	56	.18	

Note: R^2=.41, Adj. R^2=.38, adjustments based on A-MARS (Test Anxiety) Pre-test mean=2.58. Homogeneity of regression tested and not significant: F=1.38, p>.05.
***p<.05**

Legend:

Treatment 1- traditional method of instruction with individual creative writing
Treatment 2- traditional method of instruction with group creative writing
Conventional Group- traditional method of instruction without creative writing

Since the main effect for the method of instruction is statistically significant, the Bonferroni test was used to interpret it. The group with the lowest mean was composed of respondents who undertook group creative writing activities the effect is interpreted based on this category. The Bonferroni pairwise comparison of the difference between Treatment 1and Conventional group (0.37) was statistically significant (p=0.047), but the Bonferroni pairwise comparison of the difference between Treatment 2 and Treatment 1 (0.30) was not statistically significant (p=0.148). Based on the mean mathematics anxiety (test anxiety) adjusted by A-MARS (test anxiety) pre-test mean scores, respondents who did group creative writing activities in class had significantly lower mathematics anxiety (test anxiety) (M=2.20, SE=0.11) compared with the respondents who did not do any creative writing activities in class (M=2.73, SE=0.07).

Likewise, based on the mean mathematics anxiety (test anxiety) adjusted by A-MARS (test anxiety) pre-test mean scores, respondents who did group creative writing activities had lower mathematics anxiety (test anxiety) (M=2.20, SE=0.11) compared to the respondents who did creative writing activities individually (M=2.50, SE=0.11), but the Bonferroni pairwise comparison of the difference (.30) was not significant (p=0.15). The results of the post hoc analysis are presented in Table 2.

Table 2
Multiple Comparisons and Mean Differences in Mathematics Anxiety (Test Anxiety) by Method of Instruction Controlling for A-MARS (Test Anxiety) Pre-test

Comparison	Mean Difference	s.e.	Bonferroni Adjusted 95% CI
Treatment 1 vs. Treatment 2	-.30	.150	-.069, .671
Treatment 1 vs. Conventional Group	-.07	.150	-.444, .306
Treatment 2 vs. Conventional Group	.37*	.149	-.737, -.003

Note: Comparisons based upon ANCOVA adjusted means controlling for A-MARS (Test Anxiety) Pre-test mean of 2.58.

***p<.05**, where p-values are adjusted using the Bonferroni method.

Legend:

Treatment 1- traditional method of instruction with individual creative writing
Treatment 2- traditional method of instruction with group creative writing
Conventional Group- traditional method of instruction without creative writing

This result agrees with Steele and Arth (1998) who argued that students who are anxious about sharing their mathematical thinking with the entire class may have success working in cooperative groups. In small groups, students who are anxious are more likely to participate and share their thinking during discussions. Working in cooperative groups of three or four also reduces anxiety because students do not have the sole responsibility of finding the answer or completing the activity (Steele and Arth, 1998).

Mathematics Anxiety of Students Before and After Exposure to the Treatments

Paired-samples t-tests were conducted to evaluate the impact of the intervention on students' scores on the Abbreviated Mathematics Anxiety Rating Scale (A-MARS). On Treatment 1, there was no significant increase in A-MARS scores before (*M*=2.48, *SD*=0.50) and after [*M*=2.64, *SD=0.*42; *t*(-1.30), *p*=0.210] the exposure to creative individual writing activities. The eta squared statistic (0.08) indicated a moderate effect size. This result agrees with Stewart (1993, cited in Jurdak and Zein, 1998) who reported no significant change in the anxiety level of students as a result of including writing activities in mathematics.

On Treatment 2, there was a statistically significant decrease in A-MARS scores before (*M*=2.31, *SD*=0.34) and after [*M*=2.01, *SD=0.*50; *t*(2.41), *p*=0.026] the intervention. The eta squared statistic (0.23) indicated a large effect size. This finding supports the work of Tobias (1989, cited in Menon, 1992) who suggested that "getting students to write about their feelings and misconceptions would relieve their anxiety and unlearn models and techniques that were no longer useful to them" (p. 50). LeGere (1991, cited in Menon, 1992) concurred that writing does seem to diminish stress and anxiety about getting the "correct" answer and allows risk-taking and Morrow and Schifter (1988, cited in Menon, 1992) who had this to say about the "anxiety-reducing" role of writing in mathematics:

> Turning to a more familiar and often more comfortable mode, such as writing, can provide a sense of security to a math-anxious student. Alternating among various modes of discourse (writing, talking, drawing, and symbolic representation) builds bridges between formal mathematics knowledge embedded in students' everyday experiences; insistence that mathematically valid thought is restricted to rule-governed manipulation of strings of symbols keeps the mathematics insulated from their personal knowledge (p.380).

This investigation agrees with Steele and Arth (1998) who argued that students who are anxious about sharing their mathematical thinking with the entire class may have success working in cooperative groups. In small groups, students who are anxious are more likely to participate and share their thinking during discussions. Working in cooperative groups of three or four also reduces anxiety because students do not have sole responsibility for finding the answer or completing the activity (Steele and Arth, 1998).

On the Conventional set up, there was no significant increase in A-MARS scores before (*M*=2.21, *SD*=0.48) and after [*M*=2.24, *SD=0.*53; *t*(-.389), *p*=0.702] the duration of the study. The eta squared statistic (0.01) indicated a small effect size.

Findings from the three paired-samples t-tests are summarized in Table 3.

Table 3
Descriptive Statistics and Paired-samples t-test Results for the three Methods of Instruction (Mathematics Anxiety)

Method of Instruction	Pre-test		Post-test		n	95% CI for Mean Difference	*p*	t	df
	M	SD	M	SD					

Treatment 1	2.48	.50	2.64	.42	20	-0.42, .10	.21	-1.30	19
Treatment 2	2.31	.34	2.01	.50	20	0.04, 0.56	.03	2.41*	19
Conventional Group	2.21	.48	2.24	.53	20	-0.23, 0.16	.70	-.39	19

*p<.05

Legend:

Treatment 1- traditional method of instruction with individual creative writing
Treatment 2- traditional method of instruction with group creative writing
Conventional Group- traditional method of instruction without creative writing

V. CONCLUSION AND RECOMMENDATION

Conclusions

In view of the above results, the researchers conclude that creative writing activities may be considered as a medium for students' discussions about their own feelings concerning mathematics especially about taking exams. Creative writing activities when done in small groups could significantly reduce students' mathematics anxiety (test anxiety) as established in this investigation. Furthermore, mathematics anxiety of students, as revealed in the present study, cannot be influenced by exposure to the traditional method of instruction with individual creative writing activities and to the pure traditional teaching format.

Recommendations

Teachers need to allot more time in doing the creative writing activities such as the vocabulary paragraphs, numbers stories, poems, and advice columns for these have the benefit to reduce mathematics anxiety (test anxiety) of students when done in small groups. Invariably, students benefit from the interdependence and interaction that occur in cooperative learning groups. Since the anxiety level of students who worked on the creative writing activities individually increased, the teacher should allow the students to discuss their ideas before writing. This is to provide them the opportunity to talk about their thinking to help them to formulate ideas that they will then try to explain in writing. Future researchers may investigate the influence of other types of writing activities on mathematics anxiety such as traditional stories and fairy tales where a mathematics problem is inserted as part of the story, parodies of song lyrics where math words and concepts replace some of the words, haiku, and cinquain.

References

Adams, N.A. and Holcomb, W.R. (1986). Analysis of the Relationship Between Anxiety about Mathematics and Performance. *Sage Journals*. Article Information.Volume: 59 issue: 2, page(s): 943-948. https://doi.org/10.2466/pr0.1986.59.2.943

Ajogbeje, O. J., Borisade, F. T., Aladesaye, C. A., & Ayodele, O. B. (2013). Effects of Gender, Mathematics Anxiety and Achievement Motivation on College Students' Achievement in Mathematics. *International Journal of Education & Literacy Studies,*Vol. 1, No. 1

Allen, David S. (2001). *Mathematics Experience: Contributing Factors to the Math Anxiety and Avoidance Behaviors of Female Elementary School Pre-Service Teachers.*Dissertation Texas Tech University.

Alexander L., Martray, C. (1989). The development of an abbreviated version of the mathematics anxiety rating scale. Measurement and evaluation in counseling and development. 22:143-150.

Andrews, A., & Brown, J. (2015). The Effects of Math Anxiety. *Education, 135*(3), 362-370. Retrieved from: http://search.proquest.com/docview/1717289017?accountid=145417

Ashcraft, M. H. (2002). Math anxiety: Personal, educational, and cognitive consequences. Current Direction in Psychological Science, 181-185.

Ashcraft, M. and Kirk E. (2001). The Relationships Among Working Memory, Math Anxiety, and Performance. *Journal of Educational Psychology* Vol. 130 No. 2.

Ballado, Ronato. S. (2014). Mathematics Anxiety and Academic Achievement of Junior Pre-Service Teacher Education Students. *The 2014 WEI International Academic Conference Proceedings* (224-229). Bali, Indonesia:The West Indies Institute.Web. 30 Jan. 2015

Bandalos,D.L. and Thorndic, C.L. (1995). Effects of Math Self-Concept Perceived Self Efficacy and Attribution for Failure and Success on Test Anxiety. *Journal of Educational Psychology*, 87, 4, pp. 611-623

Bryan, L. (1996). Cooperative Writing Groups in Community College. *Journal of Adolescent & Adult Literacy, 40*(3), 188-193. Retrieved from: http://www.jstor.org/stable/40012128

Burns, M. (2004). Writing in math. Educational Leadership, 62, 30-33

Byrd, P. (1982). A Descriptive Study of Mathematics Anxiety: Its Nature and Antecedents. Unpublished doctoral dissertation, Indiana University, Bloomington.

Cates, G. L., & Rhymer, K. N. (2003). Examining the relationship between mathematics anxiety and mathematics performance: An instructional hierarchy perspective. *Journal of Behavioral Education*, 12(1), 23-34.

Coleman, B.L. (1991). A Study of The Prevalence And Intensity of Maths Anxiety in College Students and Preservice Teachers at a Large Southern University, Doctoral dissertation. University of Tennessee.

Cooley, L. (2002). Writing in Calculus and Reflective Abstraction. *Journal of Mathematical Behavior* 21(3) (2002): 255-282.

Daneshamooz, S., Alamolhodaei, H,. Darvishian. S. (2012). Experimental Research About Effect of Mathematics Anxiety, Working Memory Capacity on Students' Mathematical Performance with Three Different Types of Learning Methods. *Journal of Science and Technology*, v2, n4, p313-321.

D'ailly, H. and Bergering, A. (1992). Mathematics Anxiety and Mathematics Avoidance Behavior: A validation study of two MARS factor-derived subscales Educational and Psychological Measurement, 52, pp. 369-377

Dodd, A. W. (1992). Insights from a math phobic. MathematicsTeacher, 85 (4), 296-298.

Elsholz, R. & Elsholz, E. (1989). The Writing Process: A Model for Problem Solving. *Journal of Mathematical Behavior*, 8, 161-166.

Emig, J. (1977). Writing as a Mode of Learning. College Composition and Communication, 28(2), 122-128. doi:10.2307/356095

Facun, R. D., Nancy I. Mati, & Ninez Bautista (2014). Math Anxieties: A Basis for an Enhanced Mathematics Instruction Program. *Journal of Teaching and Education* 03(03) :195–206

Helal, A., Eid Abo Hamza, E.A. and Hagstrom, F. (2011). Math Anxiety in College Students Across Majors. *International Journal of Arts and Sciences* 4, 11: 211-221. International Journal.org.

Jackson, C.D. and Leffingwell, R. J. (1999).The Role of Instructors in Creating Math Anxiety in Students from Kindergarten through College. *Mathematics Teacher*, 92(7), 583-587.

Jackson, E. (2002). Mathematics Anxiety in Student Teachers. *Practitioner Research in Higher Education* 2(1). Retrieved from: http://194.81.189.19/ojs/index.php/prhe/article/viewFile/20/20

Janzen, H. (2000). Integrating writing into the mathematics curriculum. New York. Retrieved from http://www.glencoe.com/sec/teachingtoday/subject/int_writing_math.phtml

Jeppsen, A. (2005). An Examination of the Role of Writing in Mathematics. Masters' Thesis, Bringham Young University. Retrieved from: http://contentdm.lib.byu.edu/ETD/image/etd940.pdf.

Josiah, O. and Adejoke, E. O. (2014). Effect of Gender, Age and Mathematics Anxiety on College Students' Achievement in Algebra. *American Journal of Educational Research* 2(7) :474-476.

Kargar, M., Tarmizi, R. A., and Bayat, S. (2010). Relationship Between Mathematical Thinking, Mathematics Anxiety and Mathematics Attitudes among University Students. *Procedia Social and Behavioral Sciences* 8: 537-542.

Khatoon, T. & Mahmood, S. (2010). Mathematics Anxiety Among Secondary School Students in India and its Relationship to Achievement in Mathematics. *European Journal of Social Sciences*,16 (1), 75-86.

Langer, J.A. and Applebee, AN (1987). How Writing Shapes Thinking: A Study of Teaching and Learning. NCTE Research Report No. 22.

Levine, G. (1995). Closing the gender gap: Focus on mathematics anxiety. Contemporary Education ,67(1),42-45

Ma, X., & Xu, J. (2004). The Causal Ordering of Mathematics Anxiety and Mathematics Achievement: A Longitudinal Panel Analysis. *Journal of Adolescence*, 27 (2), 165−180

Marsh, G.E. and M. Tapia (2002). Feeling good about mathematics: Are there sex differences? Proceedings of the Annual Meeting of the Mid-South Educational Research Association, Nov. 6-8,2002. Chattanooga, TN, pp: 1-12.

Menon, R. (1992). Writing to Learn Mathematics: Student Journals and Student-Constructed Questions. The University of British Columbia. Retrieved from: https://open.library.ubc.ca/cIRcle/collections/ubctheses/831/items/1.0086383

Miller, H., & Bichsel, J. (2004). Anxiety, working memory, gender, and math performance. Personality and Individual Differences, 37(3), 591-606.

Pallant, J. (2005). SPSS Survival Manual: A step by step guide to data analysis using SPSS for Windows (Version 12). Allen and Unwin, Australia.

Pourmoslemi, A., Erfani N., and Firoozfar, I. (2013) [Electronic version]. Mathematics Anxiety, Mathematics Performance and Gender Differences among Undergraduate Students. *International Journal of Scientific and Research Public*ation. Retrieved from: http://www.ijsrp.org/research-paper-0713/ijsrp-p1911.pdf

Quinn, R. J., & Wilson, M. M. (1997). Writing in the mathematics classroom: Teacher beliefs and practices. *The Clearing House, 71(*1), 14-20. Retrieved from http://search.proquest.com/docview/196848368?accountid=145417

Rameli, M. R. M., Kosnin, A., Said, H., Tajuddin, N., Karim, N.A. & Van, N.T. (2014) Correlational Analyses Between Mathematics Anxiety and Mathematics Achievement Among Vocational College Students. *Jurnal Teknologi.* 69:6:117-120.

Ramet A., (2007), Creative Writing, United Kingdom, How to books Ltd.

Ramirez, G., Gunderson, E. A., Levine, S. C., & Beilock, S. L. (2013). Math anxiety, working memory, and math achievement in early elementary school. *Journal of Cognition and Development, 14*(2), 187. Retrieved from: http://search.proquest.com/docview/1350609779?accountid=145417

Reilly, E. (2007). Writing to Learn Mathematics: A Mixed Method Study. Dissertation Indiana University of Pennsylvania. Retrieved from: dspace.lib.iup.edu:8080/dspace/bitstream/2069/61/1/Edel+Reilly.pdf

Revak, M. A. (1996). The Effect of Distributed Practice Homework on Precalculus Achievement at a Military Academy.Dissertation Florida Institute of Technology, Retrieved from: http://www.dtic.mil/getdoc/pdf?Location=U2&doc=GetTRDoc.pdf&AD=ADA309099

Richardson, F.C. and Suinn, R.M. (1971).The Mathematics Anxiety Rating Scale: Psychometric Data. *Journal of Counseling Psychology,* 19 (6), pp. 551-554

Satake, E & Amato, P. P. (1995). Mathematics anxiety and achievement among Japanese Elementary School Students. *Educational and Psychological Measurement,* 55, Issue 6.1000-1007.

Shaikh, S. N. (2013). Mathematics Anxiety Factors and Their Influence on Performance in Mathematics in Selected International Schools in Bangkok. *Journal of Education and Vocational Research, 4* (3), 77-85. Retrieved from: http://www.ifrnd.org/Research%20Papers/V41.pdf

Sherman, B., & Wither, D. (2003). Mathematics Anxiety and Mathematics Achievement. *Mathematics Education Research Journal*, 15, 138-150. doi:10.1007/BF03217375

Sheffield, D. & Hunt, T. (2006) How does anxiety influence methods performance and what can we do about it? MSOR Connections, 6 (4) 19-23.

Smith, M.R. (2004). Math Anxiety: Causes, Effects, and Preventative Measures. Thesis Liberty University. Retrieved from: http://digitalcommons.liberty.edu/cgi/viewcontent.cgi?article=1263&context=honors

Steele, D. F. and Arth, A. A. (1998). Lowering Anxiety in the Math Curriculum. *The Education Digest,63*(7)18-23. ProQuest Research Library.

Temizkan, M. (2011). The Effect of Creative Writing Activities on the Story Writing Skill. *Kuram Ve Uygulamada Egitim Bilimleri, 11*, 933-939.

Tobias, S. 1989. In Paul Connolly and Teresa Vilardi (Eds.), Writing to learn mathematics and science. New York: Teachers College Press.

Tocci, C. M., & Engelhard Jr., G. (1991). Achievement, Parental Support, and Gender Differences in Attitudes Toward Mathematics. *Journal of Educational Research*, 84, 280–286

Trujillo, K. M., & Hadfield, O. D. (1999). Tracing the Roots of Mathematics Anxiety Through In-depth Interviews with Pre-service Elementary Teachers. *College Student Journal* 33(2), 219-232.

Urquhart, Vicki. (2009). Using Writing in Mathematics to Deepen Student Learning. Retrieved from: http://files.eric.ed.gov/fulltext/ED544239.pdf.

Usop, K. H., Hj, H., Sabri, N. A., Kian , H., & Wah, T. K. (2009). Factors Causing Mathematics Anxiety Among Undergraduate Students. Retrieved from: http://www.recsam.edu.my/cosmed/cosmed09/AbstractsFullPapers2009/ Abstract/Mathematics%20Parallel%20PDF/Full%20Paper/M11.pdf

Vallée-Tourangeau, F., Miroslav Sirota, & Gaëlle Villejoubert. (2013) Reducing the Impact of Math Anxiety on Mental Arithmetic: The Importance of Distributed Cognition. Proceedings of the 35th Annual Conference of the Cognitive Science Society (3615-3620). Austin, TX: Cognitive Science Society.

Vitasari, P., Wahab, M.N.A., Othman, A., Herawan, T., and Sinnadurai, S.K. (2010). The Relationship Between Study Anxiety and Academic Performance Among Engineering Students. *Procedia-Social and Behavioral Sciences*. Vol. 8, pp. 490-497

Vygotsky, L.S. (1962). Thought and language (E.Hanfmann & G. Vakar, Trans.). Cambridge, MA: Massachusetts Institute of Technology.

Walker, E. N. & Karp, A. P. (2005). Encyclopedia of Education and Human Development, Volume One. Retrieved from: http://www.scribd.com/doc/55531835/29/MATHEMATICS-EDUCATION

Woods, D. (2006) Coping with Math Anxiety: A workshop for Students. Unpublished Handout. Austin Community College.

Yuksel- $sahin, F. (2008). Mathematics Anxiety Among 4th and 5th Grade Turkish Elementary School Students, *International Electronic Journal of Mathematics Education*, 3 (3), 179-192.

Zakaria, E. and Nordin, N.M. (2008). The Effects of Mathematics Anxiety on Matriculation Students as Related to Motivation and Achievement. *Eurasia Journal of Mathematics, Science and Technology Education* 4(1) :27-30.

Zakaria, E., Zain, N.M., Ahmad, N.A., & Erlina, A. (2012). Mathematics Anxiety and Achievement Among Secondary School Students. *American Journal of Applied Sciences, 9*, 1828-1832.

Education World.(2012). *Incorporate language into math instruction*. Retrieved from: http://www.educationworld.com/a_lesson/incorporate-language-into-math-instruction.shtml

National Council of Teachers of Mathematics (1989). Curriculum and Evaluation Standards for School Mathematics. Reston, VA: TheCouncil of Teachers of Mathematics.

UNESCO National Education Support Strategy (UNESS) (2009). *Educational Challenges, Priorities and Strategies.* Retrieved from: http://www.unesconatcom.ph/docs/education/uness_report.pdf

Date Submitted: August 11, 2021
Date of Review Completion: September 14, 2021
Date of Publication: October 31, 2021

About the Authors

Francis O. Pantino is an Associate Professor at West Visayas State University-Main Campus, Iloilo City, Philippines. He was the Chairperson of the Department of Mathematics and the Coordinator of the Senior High School Department before his current designation as the Associate Director for Instruction of the same university. He earned his degrees, Bachelor of Secondary Education (BSED) major in Mathematics (Cum Laude) from Capiz State University-Burias, Campus, Philippines; Master of Science in Teaching (MST) major in Mathematics from Ateneo de Manila University, Philippines; and Doctor of Philosophy in Education major in Mathematics Education from University of the Philippines Open University (UPOU), Philippines. He serves in technical review committees for research, instructional materials, and accreditation in WVSU. He teaches major and general education Mathematics courses both in the undergraduate and graduate programs. His research interests include Mathematics education, curriculum, instruction.

Joy Hondrade-Pantino has a Ph.D.in English, major in Language at the University of San Jose Recoletos, Cebu City, Philippines. She is an Assistant Professor 3 of the Department of Foreign Languages and Literary Studies (DEFLLS) of the College of Arts and Sciences of West Visayas State University, Iloilo City, Philippines. Her academic interests include language studies particularly on Therapeutic Discourse, Conversation Analysis, Critical and Political Discourse.