Problem Solving Readiness of the Teacher Education Students

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Abstract: *The study determined the status and relationship of students' problem solving readiness, conceptual understanding and mathematics anxiety. A 10-item teacher-made open-ended word problem and a scale were used to assessed students' problem-solving skills, conceptual understanding and mathematics anxiety. The study revealed that students have low level of problem solving readiness, weak conceptual understanding and high level of mathematics anxiety. There was no significant correlation between students' problem solving readiness and conceptual understanding. However, negative low correlations were found to be significant between students' problem solving readiness and mathematics anxiety; and between conceptual understanding and mathematics anxiety. Thus, students need an intervention that would address the weakness of their problem solving ability and improve their conceptual understanding.*

Keywords: problem solving readiness, conceptual understanding, mathematics anxiety

1. Introduction

1.1 Background

A major challenge facing students as they pursue a college degree is lack of academic preparedness for college-level mathematics as evidenced by high rates of referral to developmental mathematics and low rates of college mathematics completion (Hodara, 2013).

Bailey, Jeong, and Cho (2010) found out that 59% of incoming college students are referred to developmental mathematics as compared to 33% to developmental English. Among students who started at a 2-year college in 2003, only 40% of students completed an introductory college mathematics subject, 9% completed an advanced mathematics subject as their highest mathematics subject after six years, 21% only completed a developmental mathematics subject and 30% of no mathematics subject at all (Chen & Ho, 2012).

Students who enter college unprepared in any mathematics courses do not only hinder their mathematics success but also impact their overall well-being in college progression and completion (Baum, Ma, & Payea, 2010). Students have several reasons why they enter college not ready for any mathematics tasks. Some did not take enough mathematics, did not master the concepts and forgot the mathematics they learned in high school.

In Western Mindanao State University- Malangas Campus (WMSU-MC), College Entrance Test (CET) from 1998 to 2015 results showed that students' scores were averaging to 25% only where quantitative skills is one of the components in the result and the campus cut- off score is 40% (Tauto-an, 2015). The component under quantitative skills is mostly problem solving.

In addition, two local studies conducted by Go Silk, Somblingo & Go Silk (2012 & 2014) in the campus which tried to assess the cognitive and metacognitive skills of the students in problem solving and applying metacognitive

process. The results revealed that students' level of problem solving is still in developing, that is, second from the lowest level due to students' lack of retention, inability to apply previously learned concepts to new situations and misconceptions.

Improving the college problem solving readiness of students may contribute to decreased remediation rates and increased rates of college diligence and completion helping to improve individuals' lifetime earnings and overall welfare. It may also bolster the quality of the workforce, particularly in science and technology field, thus helping to improve the nation's economy (Fike & Fike, 2012).

In the light of the existing problems based on literature and studies, it is the desire of this paper to assess first the problem-solving readiness of the students before designing and implementing intervention to make appropriate actions to improve students' performance in problem solving. Thus, this study.

1.2 Objectives of the Study

The study primarily intended to determine the status and relationship of students' problem solving readiness, conceptual understanding and mathematics anxiety.

2. Literature Survey

Problem solving is an important component of mathematics education. The National Council of Teachers of Mathematics (NCTM, 1980) recommended that problem solving should be the focus of instruction since it encompasses skills and functions that can develop critical thinking of students which is the goal of teaching mathematics. Critical thinking needs to be cultivated among the youth because it is the important features useful in the workplace and real-life situation for global competitiveness.

Taplin (2006), said that problem solving contribute significantly to the outcomes of a mathematics education through developing students' logical thinking, provide

students with a context for learning mathematical knowledge. It enhances transfer of skills to unfamiliar situations and provides students an opportunity to construct their own ideas about mathematics and to take responsibility for their own learning. Problem solving can allow students to demonstrate their conceptual understanding on mathematical concepts. In this study problem solving readiness of the students was measured through their achievement in problem solving tasks.

Conceptual understanding involves comprehension of mathematical concepts, operations and relations necessary in solving a problem. It helps student to apply and adapt some mathematical ideas previously learned to new situations. It reflects student's ability to reason in settings involving the application of concept definitions, relations and representations. Learning with understanding is important feature of learning that help students to solve the new kinds of problems they will encounter in the future (National Assessment of Educational Progress (NAEP), 2003).

Cummings (2015) believed that if a student solves a problem and able to answers a question why they did such process, he had conceptually understood the topic. To improve student problem solving performance it needs one with a strong conceptual understanding. Good conceptual understanding could solve mathematics problem that related to real life and could make decision critically. Hajiyati (2008), believe that a person would fail to answer application questions without good conceptual understanding which is also supported by Subhan (2007) who stated that conceptual understanding is the ability to get meaning of an abstract idea until it could allow one to classify concepts.

Another factor that may cause students low performance in problem solving is mathematics anxiety. Ashcraft & Faust (1994) defined mathematics anxiety as feelings of tension, apprehension or even fear that interferes with the ordinary manipulation of number and the solving of mathematical problems. Mathematics anxiety is experienced by many people in many ways. Psychological indicator of mathematics anxiety includes low self-confidence, a negative mind set towards mathematics learning, feeling threatened, failing to reach expectation, and a temporary reduction in working memory that hinder their ability to think and analyze mathematical problems posed to them. It hinders thought processes which are needed in problem solving (Cavanagh and Sparrow, 2011). Hence, this study considered mathematics anxiety to determine if it obstructs students to solve mathematical problems.

3. Methodology

3.1 Research Design

This study used a descriptive survey research design to determine the relationship of students' problem solving readiness, conceptual understanding and mathematics anxiety.

3.2 Respondents of the Study

The respondents of this study were the second year Bachelor of Elementary Education (BEED) students of Western Mindanao State University - Malangas Campus (WMSU - MC) who were enrolled in Advanced Algebra and Trigonometry subject for the first semester of school year 2016-2017. They were composed of two sections with thirty-five students in each section. A total of seventy students were the respondents of the study through total enumeration.

3.3 Instrument and Procedure

To answer the different queries in this study, different instruments were used. A 10- item teacher made test open ended word problems was used to assess the problem solving readiness and conceptual understanding of the students. The test was composed of problems in geometry, age, motion, work and mixture problem. The test was subjected to face and content validity and tried out for reliability on students of similar ability but not the target participants. The reliability coefficient is 0.83. The test was scored using the Northwest Regional Educational Laboratory Mathematics Problem Solving Model (NRELMPSM) to ensure objectivity in the scoring of students' answers. Answers of the respondents for the conceptual understanding were scored based on the rubric adapted from the paper "Understanding by Design Framework in the Philippines" by Mc Tighe and Wiggins (1998). Another instrument used to assess the level of Mathematics Anxiety of the respondents was the Mathematics Anxiety Questionnaire (MAQ) which was adapted from May (2009). This was a fifteen item test with a reliability coefficient of 0.91.

Since this study used a quantitative descriptive survey method of research, a 10 item open ended teacher made test was administered to the respondents that lasted for three hours. The scores of the students in the problem solving were obtained from their average scores from the three raters to avoid subjectivity and for objectivity in scoring. Mathematics Anxiety Questionnaire (MAQ) was also administered to the students to be answered in fifteen minutes. The data collected were analysed using mean, standard deviation and Pearson product moment correlation.

4. Results and Discussions

The results of the analysis using mean, standard deviation and Pearson r are shown in the following tables.

Table 1: Level of Problem Solving Readiness, Conceptual Understanding and Mathematics Anxiety

Variables	Group 1			Group 2		
	$\bar{x}$	SD	Level	$\bar{x}$	SD	Level
Problem Solving Score	12.27	8.35	Low	15.3	7. 1	Low
Conceptual Understanding	1.53	2.65	Weak	2.43	2.3	Weak
Mathematics Anxiety	3.69	0.73	High	3.74	0.5	High

It can be gleaned from the table that the problem solving readiness of the students of group 1 has a mean of 12.27 while group 2 has a mean of 15.31. This means that

students' level of problem solving readiness is low. The standard deviation of the group 1 is 8.35 which is quite higher than the standard deviation of group 2 which is 7.07. This means that the scores of group 1 were more dispersed than group 2. This further means that there were scores that were high and there were also scores that were low. Based on the rubrics the solutions of the students in this level revealed that students' mathematical representations of the problem were incorrect, used the wrong information in trying to solve the problem, they did not know where to begin, the mathematical procedures used would not lead to a correct solution, there was no apparent logic to their solution and commit some errors in computation as reflected in their solutions.

It can also be observed from the table that students' conceptual understanding of group 1 has a mean of 1.53 and the group 2 has a mean of 2.43. This indicates that both groups have the same level of conceptual understanding that is weak. This level of conceptual understanding means that students barely demonstrate understanding in applying concepts effectively using and adapting what they know in new and complex situation, interpreting by making sense of data, text, and experience through images, analogies and models and offered little or no explanation of the strategies used and their answers. The standard deviation of group 1 is 2.65 and group 2 is 2.38. This means that the scores of the first group was slightly scattered than the scores of the second group.

Lastly, students' mathematics anxiety of both groups is high with a mean of 3.69 for the first group and 3.74 of the second group. This means that students were tense, nervous and worry when they took the test since they were not able to do it well. The standard deviation of the first group is higher than the second group which is 0.53. This means that students' scores in the first group were more dispersed than the second group.

To determine if there is a significant relationship exists among the variables studied, Pearson product moment correlation technique was used and the result is presented in table 2.

Table 2: Summary Results of Correlation of the Students

Problem Solving Readiness	Conceptual Understanding	Mathematics Anxiety	r	Probability value
13.79	1.98		0.120	0.322
13.79		3.72	-0.366*	0.002
	1.98	3.72	-0.334*	0.005

*Significant at 0.05

The results revealed that there is no significant relationship between students' problem solving readiness and their conceptual understanding with a negligible correlation coefficient of 0.120 and a probability value of 0.322 which is higher than alpha level of 0.05. This means that the scores of the students in the problem solving readiness and conceptual understanding were both low as evidenced in their means. This implies that if students are low in terms of their readiness towards problem solving, their conceptual understanding which is weak still does not significantly

relates to their problem solving readiness. This implies further that there are students that can solve the problem without conceptual understanding since they may solve problems using procedural knowledge through patterns and intuition.

The analysis also yielded a negatively slight correlation between students' problem solving readiness and mathematics anxiety with correlation coefficient value of -0.366. However, this correlation was found to be significant with a probability value of 0.002 which is lesser than alpha 0.05. Hence, there is a significant relationship between students' problem solving readiness and their mathematics anxiety. This means that the scores of the students in the problem solving were low but, their scores in the mathematics anxiety were high. This implies that students are highly tense and nervous in dealing with any mathematical problems because they do not understand the concepts and they cannot correctly solve the problems. This implies further that if students' level of problem solving readiness is low their mathematics anxiety is high and this inverse relationship is significant.

Table 2 also reveals that there is a negative slight correlation exists between students' conceptual understanding and mathematics anxiety with correlation coefficient value of -0.334. This correlation was found to be significant with a probability value of 0.005 which is lesser than alpha 0.05. This implies that if students are weak in conceptual understanding their anxiety towards mathematics is high.

5. Conclusions and Recommendations

Based on the analysis it can be inferred that students do not possess the skills needed for solving problems that requires higher order thinking and were not ready to engage in a problem solving tasks. Furthermore, students' anxiety towards mathematics has a direct relationship with their problem solving performance. Thus, students need an intervention that would address the weakness of their problem solving ability and improve their conceptual understanding.

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Author Profile

Carmela J. Go Silk earned her Master of Science in Teaching Mathematics at Western Mindanao State University in 2012 and earned her Doctor of Philosophy in Mathematical Sciences – Mathematics Education at the University of Science and Technology in Southern Philippines in March 2017. Presently, she is the Research and Extension Coordinator of Western Mindanao State University- Malangas Campus and at the same time teaching mathematics content and pedagogy, statistics and educational assessment in the teacher education program.