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Attitude and Error Patterns in Problem Solving

Alberto R. SIA, JR
Isabela State University – Philippines

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Abstract

The students' accomplishment and satisfaction of Mathematics depend on how well they have gained the mastery of the use of certain problem solving as well as having developed a positive attitude towards problem solving as a mathematical mental discipline. This study focused on the attitude and error patterns in problem solving among second year college students of Isabela State University. The descriptive research design was used in the study and the attitudinnaire towards problem solving together a 20 item problem set were the principal data gathering tools used to elicit the needed information from 70 student participants. The stratified random sampling method with proportional allocation was used after determining the sample size through the Slovins formula. Analysis of students' incorrect responses revealed that here is a consistent error pattern in all problems. The students have difficulty doing problem solving due to their negative attitude towards problem solving. Truly a student's attitude or his attitudinal disposition towards a subject greatly influences his performance in the error pattern. The proposed enhancement plan which is an output of the study maybe implemented by the teachers on problem solving among students

Keywords; *Attitude towards problem solving, Error patterns in problem solving, Frequency and Percentage, Research Design.*

I. INTRODUCTION

Solving word problems are commonly used as practice exercises and illustrations in the teaching . Spite its prevalent use, many students have difficulty in problem solving, based on the complexity and the varied nature of the mathematical problems or exercises. Achievement in solving word problems is dependent on the students' attention of language and framework, their ability to clarify vocabulary in mathematical terms, and their actual mathematical knowledge and competency.

Misunderstanding of the problem and the situations surrounding it may lead to mistakes or wrong assumptions. At times, the wrong use of mathematical approaches to problem solving may also further contribute to students' inability to deal with math problems. The Florida Department of Education, Bureau of Exceptional Education and Student Services (2010) cited Polya's four-step approach to problem solving: (1) understanding the problem, (2) devising a plan or strategy to solve the problem, (3) implementing the plan, and (4) reflecting on the problem solution. Some possible strategies to problem solving include: guess and check, make an organized list, eliminate possibilities, use symmetry, consider special cases, use direct reasoning, solve an equation, look for a pattern, draw a picture, solve a simpler problem, use a model, work backward, use a formula, be ingenious, and consider extremes.

Analyzing problems and correctly applying these concepts present much difficulty to a high percentage of people. In a study conducted by Tambychik and Subahan (2010), students were reported to have difficulties in Mathematics problem solving.

Error pattern analysis is an assessment approach that allows one to determine whether students are

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making consistent mistakes when performing basic computations. By pinpointing the pattern of individual student's errors, the teacher can then directly teach the correct procedure for solving the problem. While there are common errors that students with learning problems make, students may demonstrate error patterns that are individual specific.

Error pattern analysis provides an effective and efficient method for pinpointing specific problems students are having with computation. By determining that students are consistently using inaccurate procedures for solving computation problems, teachers can then provide specific instructions and monitoring to assist the students to use an effective procedure for solving specific types of computations. Additionally, teachers may discover through error pattern analysis whether a student does not have an accurate working knowledge of a major mathematical concept. In other words, specific types of error patterns can cue the teacher that a student not only uses an ineffective procedure to compute a problem. More oftentimes than not, error pattern analysis is much more than a diagnostic tool for determining a student's procedural effectiveness; often, it provides the teacher a window for determining that a student lacks basic conceptual understanding. Students who possess difficulty learning Mathematics typically lack important conceptual knowledge. This situation is due to various student learning characteristics as well as instructional factors including: a student's slow rate of processing information relative to instructional pace, lack of sufficient opportunities to respond (practice), lack of specific feedback regarding misunderstanding or non-understanding, anxiety and negative attitude towards Mathematics, and visual as well as auditory processing difficulties.

The researcher believes that to be a good problem solver, one needs to start with the right attitude. A Mathematics problem that one encounters may sound difficult but with a right positive attitude, the difficulty may be overcome and successfully be dealt with. Furthermore, students normally encounter errors in problem solving not because the problems they sought to solve are difficult but may be attributed to either their math anxiety or their negative attitude towards problem solving. The researcher deemed it necessary and important to conduct this research to uncover his students' problem solving skills, their difficulties as revealed by their error patterns and as well to assess his students' attitude towards problem solving with the end in view of proposing a program or a plan to either sustain students' uncovered strengths or enhance revealed weaknesses in problem solving.

II. CONCEPTUAL FRAMEWORK

A framework to think about processes involved in Mathematics, as introduced by Polya (1973), includes the following four stages: (1) understanding the problem, (2) devising a plan, (3) carrying out the plan, and (4) looking back. Review of literature reveals that in the process of solving problems, students exhibit weaknesses and misconceptions in some steps of problem solving. Likewise, beliefs and attitudes – and their interplay with cognition are fundamental prerequisite factors to problem solving. It is, therefore, important to empower students with a positive attitude and equally important is to see where they are coming from. Research findings point out that students‟ attitude towards Mathematics has a significant effect on their performance, achievement and proficiency in Mathematics.

III. STATEMENT OF THE PROBLEM

This study aimed to investigate the attitude and error patterns in problem solving among second year college students of Isabela State University.

Specifically, it sought to answer the following questions:

1. What are the error patterns of the research participants in problem solving per program in terms of the following:

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1.1 understanding the problem,

1.2 devising a plan or strategy to solve the problem,

1.3 implementing the plan, and

1.4 reflecting on the problem solution?

4. Is there a significant difference in the error patterns in problem solving of the participants when they are grouped according to program?

IV. METHODOLOGY

Research Design

The descriptive method of research was used since the study involves a description of the research participants' in the error patterns in their solutions, and their attitude towards solving problems.

Research Participants

The participants of the study consisted of second year students from the different programs of the Isabela State University Cabagan Campus who finished College Algebra during the School Year 2015-2016. The following table shows the number of participants in each program.

Table 1

Frequency and Percentage Distribution of the Participants per Program

Program	Frequency	Percentage
BS Biology	9	12.86
BS Criminology	7	10.00
BS Computer Engineering	16	22.86
BS Computer Science	22	31.42
BS Information Technology	16	22.86
Total	70	100.00

Sampling Technique

There are different degree programs at Isabela State University Cabagan Campus from which the sample of second year students was drawn. Stratified random sampling was employed using proportional allocation from each course, the total sample of which is based on the Slovins' formula with N = 70 and margin of error of 0.05.

Instrumentation

The study used the following data- gathering instruments:

Attitudinaire. This questionnaire consisted of twenty (20) items and was used to elicit the participants' attitude towards problem solving. To determine their degree of agreement or disagreement to each of the items or statements, the participants were made to choose from among four choices: Strongly Agree, Agree, Disagree and Strongly Disagree. The attitude inventory was based from the book of Hopkins and Stanley (1983). This book includes attitude statements towards Mathematics but was revised by the researcher so much so that the resulting instrument is directed towards students' attitude towards solving problems, using four-point Likert scales instead of five just like in Stanley and Hopkins (1983). The revised attitudinnaire consisted of 10 positively stated (item numbers 3, 4, 5, 9, 10, 12, 13, 16, 18 and 20) and 10 negatively stated items 1, 2, 6, 7, 8, 11, 14, 15, 17 and 19).

Attitude. It refers to the students weighted mean rating on the twenty-item attidinnaire which describe either a very favorable, favorable, fairly favorable. Unfavorable and very favorable.

Error Pattern.Error patterns in problem solving in this study involves errors committed by the participant.

Data-Gathering Procedure

Immediately, after administering the attitudinnaire, the problem solving test was administered. The

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researcher himself personally administered the data-gathering instruments to the participants.

To determine the participants' error patterns, the researcher noted the area in Polya's problem solving processes where each student had committed the most number of errors, like if a student had committed seven (7) times errors along understanding the problem, five (5) times in devising a problem solving plan or strategy and two (2) times in implementing the chosen strategy then the student's error pattern lies in understanding the problem.

After data collection was done, the needed data were collated and analyzed electronically using statistical software (Statistical Package and Services Solutions - SPSS Version 17) to ensure the precision of data treatment and analysis.

Data Analysis

To describe the data of the study, frequency, percentage, and the weighted mean were used.

Frequency and Percentage. These were used to describe the profile of the participants based on their degree program as well as in describing the problem solving strategies utilized by the participants and the error patterns obtained from their test.

Weighted Mean. This was utilized to describe the participants' attitude towards problem solving. The attitude of the students towards problem solving was described using the following arbitrary intervals and descriptions:

Mean Range	**Qualitative Description**	
3.25 – 4.00	Very Favorable	Positive Attitude
2.50 – 3.24	Favorable	
1.75 – 2.49	Unfavorable	Negative Attitude
1.00 – 1.74	Very Unfavorable	

The attitude ratings of the participants were based on the scale from 4 to 1, for positive statements and 1 to 4 for negative statements presented as:

Response	Positive Statement	Negative Statement
Strongly Agree	4	1
Agree	3	2
Disagree	2	3
Strongly Disagree	1	4

Chi-Square Test. The Chi-Square Test was utilized to test for significant differences in the error patterns and attitude of the participants when they are grouped according to program.

Summary of Findings

Based on the data obtained and analyzed, the following summarizes the salient findings of this study:

I. Error Patterns of Student Participants in Problem Solving Grouped According to Program

At most eight (8) of the BS Biology student participants have committed errors along understanding the problem in nineteen (19) out of twenty (20) items and at most three (3) of these participants have committed errors along devising the correct plan and strategy in seventeen (17) out of the twenty (20) problem items. In addition, the BS Biology students had committed errors along "implementing the chosen plan or strategy " in fourteen (14) items while only one (1) had committed error along "reflecting on the solution".

At most six (6) of the seven (7) BS Criminology student participants have committed errors along devising the plan or strategy in eigtheen (18) out of twenty (20) items. Their errors include their being unable to understand the problem and their inability to identify what is/are given as well as their inability to identify what is/are asked for in the problem. At most five (5) of the BS Criminology student-participants have erred in identifying the appropriate problem solving strategy to use in

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solving the problem and at most three (3) participants were unable to carry out/solve correctly the problem using the chosen strategy.

At most ten (10) of the BS Computer Engineering student participants have committed errors in 7 items along understanding the problem which includes identifying what is/are given in the problem as well as being able to identify what is/are asked for in the problem while at most fourteen (14) have errors along devising the correct plan and strategy in seventeen (17) problems and at most ten (10) BS Computer Engineering student participants have erred in terms of implementing the plan in sixteen (16) items and at most three (3) erred on reflecting on the solution in one (1) item.

At most eight (8) of the BS Computer Science student participants have committed errors in terms of understanding the problem in sixteen (16) problems while at most fifteen (15) of the students have erred in devising the plan or strategy in eigtheen (18) of the twenty (20) problem items. Furthermore, at most eight (8) students have committed errors along implementing their chosen strategy or plan.

At most eight (8) of the BSIT student participants have committed errors in problem solving in terms of understanding the problem while at most fifteen (15) committed errors with respect to devising the plan or strategy. Furthermore, at most eight (8) of the BSIT student participants had errors along implementing the plan.

II Test for Significant Difference in the Error Patterns of Student Participants in Problem Solving when Grouped According to Academic Program

There is a significant difference in the error patterns of the student participants when they are grouped according to program.

III Attitude of Student Participants in Problem Solving

Majority of the participants have negative attitude towards problem solving. This kind of attitude is generally the same across the five (5) academic programs that include the BS Biology, BS Criminology, BS in Computer Engineering, BS Computer Science and BS Information Technology. Among the participants who possess positive attitude toward problem solving, most of them come from the BS Computer Science program.

IV Test for Significant Difference in the Attitude of the Student Participants in Problem Solving when Grouped According to Academic Program

There is no significant difference in the attitude of the participants towards problem solving when they are grouped according to their academic program. Generally, participants manifest a negative attitude towards problem solving regardless of their course or program.

V. CONCLUSION

In the light of the findings obtained, the following conclusions are reached:

The students have difficulty doing problem solving due to their inability and inadequate knowledge to use appropriate strategies and their negative attitude towards problem solving. Truly a student's attitude or his attitudinal disposition towards a subject greatly influences his performance in the subject. The poor performance of students in problem solving is characterized by their inability to understand the problem as well as their inability to utilize appropriate problem solving strategies.

The learning of Mathematics through problem solving has long been perceived as difficult and problematic but when students are regularly exposed to the diffferent problem solving strategies in their Mathematics classes, they will gradually be trained to become good problem solvers and critical thinkers. The students may not be faulted for being poor in problem solving as they might not have had adequate exposure and training in problem solving

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in their lower years of their education, thus the responsibility to train students to become problem solvers must be viewed as a collaborative and concerted effort of all Mathematics teachers regardless of their students' level and program.

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