COMMON ERRORS MADE BY GRADE 7 STUDENTS IN SOLVING WORD PROBLEMS

An action research
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Finally, we offer all our efforts to Him who provided us with the heart of service. We offer this all for the greater Glory of God!

AMDG!

ABSTRACT

This study aimed to identify the common errors made by the grade 7 students of the Ateneo de Davao University in solving word problems involving linear equation in one variable, and to determine whether or not the errors committed were related to gender and the primary schools attended.

Using the descriptive method of research, the researchers gathered the population of errors made so as to identify the distribution of said errors and to determine whether any commonality, if any, exists among them. The study also investigated whether there are different patterns in the errors committed, i.e. so as to be related to gender and primary schools attended.

The distribution of errors is found to be related to reading comprehension and test anxiety. No error type was considered common among the moderating variables. However, an interesting trend was observed in the distribution of errors when analyzed according to the primary schools attended. The study found that there was no significant relationship in the distribution of errors - neither by gender nor the primary schools attended. The results of this study may hopefully be utilized in designing future activities and instruction materials for remediation days and during Learning Enhancement Assistance Program (LEAP) classes.

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INTRODUCTION

Background of the Study

In the past years, the number of failing marks among Grade-7 students of the Ateneo de Davao University - High School (AdDU-HS) evidently increased in the third quarter of the school year - which usually covers word problem lessons in Algebra. As observed, around 40% of the students per class usually failed during this quarter, 50% or more experienced decreased proficiency, and less than 10% showed an improved performance. Understandably, the teachers, administrators and parents had expressed concerns on the matter. Unfortunately, no study had yet been conducted to identify the root cause of the apparent difficulties among students.

One of the main concerns of the grade 7 Mathematics teachers is to ensure that understanding the key concepts of Elementary Algebra is acquired by the students. Error analysis can prove to be a useful tool in this process as, according to Labinowicz, "a child's errors are actually natural steps to understanding" (quoted in Brooks, 1993, page 83). Perhaps this development of understanding through error-making is more common in the study of mathematics (and the sciences) than in other school subjects. Mathematical errors can provide valuable insights to understand how students perceive the world and its representations. This was explicated by Hiebert, J. and Carpenter, T., (1992), i.e. that "students must understand the conflict(s) between their principles and misconceptions, which may be mutually exclusive, to make the newly acquired principle meaningful to them." The findings of Fajemidagba (1986), Salman (1997), Steve (2002) and Salman (2004) affirmed that students do commit errors in problem solving in Mathematics and have also identified certain types of errors committed in specific topics/concepts in Mathematics. According to Salman (2004), solving word problems involving linear equations in mathematics require specific steps that should be followed such as identifying the key words and their meanings, determining the unknowns and formulating the algebraic equations equivalent to the word expression. The ability to correctly obtain the algebraic equation through the translation of the word expression is a strong determinant in obtaining the correct values for the unknowns. Word problem solving requires special skills that students need to acquire through training and retraining programs, seminars and workshops.

Further, Tonogbanua (1980) stressed that a significant number of students entering the tertiary level have difficulties in dealing with quadratic equations, linear equation and verbal problem. More than 30 years have passed since then but the same problem exists. She also emphasized the salient role of the basic education department in addressing the errors committed by the students.

To resolve the aforementioned issues, this action research was conducted among the students of AdDU - HS particularly the grade 7 Mathematics students. The study investigated and analyzed the common errors of students in solving word problems. This will thus serve as the initial step in addressing the recurring problem over the years and serve as the baseline data for teachers in designing and providing the necessary interventions for the students. The purpose of this inquiry is to identify and classify by relative frequencies of the most common errors made by the grade 7 students as they solve word problems involving linear equations using one variable. A deeper analysis on the possible mechanisms for these errors may help facilitate the design and development of remediation strategies in the classroom.

Objectives of the Study

The objectives of the study are as follows: First, the study aims to identify the common errors made by the grade 7 students in solving word problems. Second, it aims to determine whether such errors are related to gender and the primary schools attended.

Statement of the Problem

The study sought to answer the following questions:

1. What is the demographic profile of the erred responses cross-classified by gender and the primary schools attended?
2. What are the frequencies of errors in the said responses?
3. Is there a significant relationship, if any, between the errors made cross-classified by gender and the primary schools attended?

Theoretical Framework

This study was anchored on the theoretical framework of Haghverdi, M., and Kazemipour, N. (2014) based on Kinfong's and Holtan's study which analyzed the errors of the respondents on Zhu's observation (2007) that there are differences among male and female students in committing mistakes in solving Mathematical problems. The data is further examined using Jacobs, et.al.

(2007) theory that highlighted the important role of elementary education in forming prerequisite algebraic reasoning to prepare students for Algebra.

Hypothesis of the Study

The null hypotheses of this study were tested at 0.05 level of significance:

Ho1: There is no significant relationship in the types of errors committed by the respondents when cross-classified *by gender.*

Ho2: There is no significant relationship in the types of errors committed by the respondents when cross-classified *by the primary schools attended.*

Definition of Terms

Word Problems – This is a Mathematical exercise presented in the form of a hypothetical situation that requires an equation to be solved. (Clement, 1982) In this study, this refers to the five word problems which were covered during the 3rd quarter of school year 2013-2014 that can be solved using linear equations in one variable.

Common Errors – This is a well-defined error(s) where more than 50% of the frequency of errors can be identified. (Tonogbanua, 1980) In this action research, this is the error type which contains more than half of the erred responses within that group. The erred responses in solving word problems have been categorized as *Translation error, Clerical error*, Computational *error* and *Other errors.*

Translation error - This type of error is the inability to represent mathematical sentences with algebraic expressions or equations. (Salman, 2002; Haghverdi and Kazemipour, 2014) In this study, this refers to the respondents' inability to use letters to stand for the unknowns in a word problem and set up an

Algebraic statement to represent word phrases or sentences.

Computational error - This type of error is the failure of the student to perform mathematical operations, process-oriented skills, and numerical computations in line with other mathematical concepts. (Haghverdi and Kazemipour, 2014) In this study, this refers to errors in performing mechanical operations with real numbers, simplifying algebraic expressions and appropriate use of properties (of equality) to isolate a variable. This error is considered to have been committed if students correctly performed translation from english phrases to algebraic expressions.

Clerical errors - This type of error occurs when a student incorrectly copies, edits, translates, manipulates, or even visualizes a number (i.e. signs, numbers, addend, subtrahend, multiplier, divisor or exponent) or a phrase in the process of solving a word problem regardless of ending up with a wrong or correct answer. (Salman, 2002; Haghverdi and Kazemipour, 2014) In this study this is determined in a solution as failure to copy any symbol or detail in the mathematical statement from one step of the solution to another. This error is committed if the clerical error has not influenced errors to computation or translation.

Other errors - Also, errors in the solution of the students which cannot be categorized as clerical error, operational error or translation error will be classified as other errors. (Salman, 2002) In the conduct of this study, respondents whose answer sheets have blank entry fields, vague responses, or incomprehensible writing were classified as "Other errors."

Significance of the Study

The findings of this investigation would be beneficial to both new and tenured Math teachers, the students and to the school for the following reasons:

Firstly, identifying the common errors made by grade 7 students could assist teachers in understanding the progress of the students' initial thought processes and common pitfalls in solving word problems involving linear equations with one variable. Secondly, analyzing the relationships in the errors committed by gender will guide mentors in providing appropriate remediation activities and differentiated instruction strategies. Thirdly, understanding the errors that transferees and non-transferees (graduates of the AdDU - HS) commit would help AdDU-HS educators and curriculum designers identify underlying factors and help shape the K-12, grade 7 math, curriculum in developing the students' Mathematical skills. Lastly, having categorized the common errors committed by these students in solving word problems, Mathematics teachers may be provided with literature on the nature of errors and their manifestations on a paper-and-pen test.

Scope and Limitations

The study focused on the frequencies of the errors on a word problem test given to the students. Aside from time constraints and the data treatment coverage it is limited to the analysis of the frequencies of errors in terms of gender and primary schools attended. Also, the study was undertaken through the cooperation and participation of the grade 7 students of AdDU - HS. It is limited to those students undergoing the K to 12 curriculum, particularly in grade

7 of school year 2013-2014. Further, while the results of this study will be used to improve instruction, it will not involve the collection and identification of the appropriate teaching strategies and methodologies. The administration of the research instrument was conducted immediately after the 3rd Quarter of the School Year 2013-2014 and prior to the start of the 4th quarter to avoid contamination of the concepts being tested in this action research. (Salman, 2004)

Chapter 2

REVIEW OF RELATED LITERATURE

In mathematics education, solving word problems is considered as the best tool to help students apply their understanding in mathematics. The National Council of Teachers of Mathematics (NCTM) recommended in 1980 in its "Agenda for Action" that the focus of mathematics education should be problem-solving. Most word problems in math deal with applying concepts in real world situations. With these, students apply what they have learned in mathematics problem solving towards solving their daily problems. (Gerofsky, 1999) Word problems aid in showing where mathematics can be utilized; how to use it in real life situations; and present mathematics as a language of our civilization.

Unfortunately, most students commit mistakes in applying the skills set necessary to solve word problems. More students in different academic grades are struggling in solving word problems as evidenced by the results in various research studies. The latter revealed that while most students can successfully use calculation algorithms, they fail to use the same algorithm when it comes to solving word problems (MAYER; HEGARTY, 1996). Such inabilities may be due to the demands of such problems in mathematical computations together with other necessary knowledge, including linguistic knowledge, and the prerequisite skills (CUMMINS et al., 1988). Also, Gerofsky (1999) explained that these errors are due to misconceptions i.e. that although errors differ from one student to another, common patterns of misconception and errors may be categorized. Li

(2006) noted, in his study on the cognitive analysis of students' errors and misconceptions in variables, equations, and functions, that certain types of errors related to students' misconceptions occurred frequently and repeatedly after one year of additional instruction. He added that this may provide an opportunity to address specific misconceptions and plan a systematic approach to intervene.

Kinfong's and Holtan's framework supported the analysis of the errors, and Mayes's theory was implemented to understand the necessary knowledge for solving math word problems. The result of their study revealed that the reasons why students commit errors in solving arithmetic word problems was the lack of linguistic, semantic, structural and communicational knowledge. The higher error rate was that of miscalculation in solving algebra word problems. Based on the results, the highest deficiency was mainly related to the lack of semantic, structural (operational) and communicational knowledge. Their study defined semantic knowledge as knowledge on the comprehension of the problem text. This knowledge meant that data and math expression were seen as pure words but their meanings are formed through semantic knowledge. In other words, their knowledge on translating word text to mathematical sentences helps them to understand the objective of the problem and to give meaning to it (Cummins, 1988). Secondly, the structural knowledge was defined as the knowledge that relates to schemes, meaning structures and the entire mathematical concept which exist in the mind (Rumelhart and Norman, 1985). The knowledge structures help students to classify problems in order to find the appropriate solution. Thus, the students will be able to select a proper method or pattern, and/or appropriate procedure to solve a word problem (Fischbein, 1999). Lastly, communicational knowledge was defined as a kind of knowledge which connects the representation of the problem to mathematical concepts and structures. With this knowledge, the student is able to select the appropriate structure from the mathematical concepts in order to find the relevant solution to the problem.

Majid Haghverdi, Ahmad Shahvarani Semnani and Mohammad Seifi (2012) discussed the relationship between the different kinds of students' errors and the knowledge required to solve Mathematical word problems using Kinfong's and Holtan's framework. They revealed that the most common errors in solving algebra word problems was "not setting up the correct equation" which is defined as translation error in this research. In addition, their findings have pointed out that the lack of comprehension or semantic knowledge caused the higher rate of error to students. The reason was partly due to some students reading the problem not for comprehension but for extracting some key numbers and operations from its text. In fact, most of them did not understand the problem's content and goals. Such results coincided with the findings of Clements (1980) that the high rate of student errors in solving grade 7 word problems was due to their lack of comprehension, translation and processing skills, as well as their negligence. The error related to "not setting up the correct equation" is highly associated with lack of semantic and structural knowledge.

Koedinger (2008) further indicated that a detailed cognitive model of coding errors has been developed. He added that the Early Algebra Problem

Solving (EAPS) theory highlights comprehension processes as a cornerstone in solving word problems. He explained that the theory allows errors to be accurately modeled. The frequency of errors is used in its model to illustrate how a problem solver interacts with external representations to construct internal quantitative structures. Its proponents believed that errors are committed due to poor comprehension skills. This implies that a problem-solver can comprehend a word problem, but might have a difficult time comprehending the equation(s) behind it. He emphasized that EAPS, being a cognitive model as well as a pedagogical domain theory, can be used to explain the failures and successes of a student on certain word problems than its equivalent equations.

Computational Errors

On the other hand, Payne et. al. (1990) noted that errors may also be generated from flawed application of rules or from careless execution of mechanical processes. With the former being purely cognitive in nature, the latter is rooted on the student's ability to retain information. He also emphasized the importance of achieving a "cognitive diagnosis" of a learner's error towards meaningful individualized discussion. A central claim in the various literature reviewed is that many errors may be explained by the student's mental representation and application of a faulty procedure, called either a "bug" or a "mal-rule". The validity of such a claim relies on two characteristics of mal-rules: individually and as a set where they explain a considerable proportion of the observed errors, and they can be generated by some plausible cognitive theory. He identified certain errors as "arithmetic slips". In relation to Salman's syntactic error, "arithmetic slips" occur when the flawed manipulation involved the calculation of a simple and explicitly written-down arithmetic expression. Kinfong and Holtan (1976) explained how the lack of knowledge in the involved algorithm in solving a problem will result to miscalculations.

Clerical Errors

More comprehensively, Haghverdi, Semnani and Seifi (2012) categorized the errors as either *clerical* or computational error by underlining their differences. They argued that the students' failure to answer a word problem may not always be due to the lack of basic arithmetic skills. In some cases, carelessness in copying what is given in the problem and inability to pay attention to important details (i.e. numbers, signs, even exponents, etc...) may mislead students from taking note of the problem, i.e. from simple translation of word phrases to algebraic expression, to appropriately responding to a word problem using properties of Algebra or rules in mechanical computations.

In contrast, Manalo (1992) highlighted that clerical errors are entirely different from cognitive deficiencies like dyscalculia or dyslexia. He added that motivation and a student's value-system may influence how a student responds to problems. Moreover, Salman (2004) considered clerical errors as a slip. He explained the difference between misconceptions or computational errors and clerical errors, wherein the former is cognitive in nature while the latter is a result of carelessness.

Translation Error

Haghverdi, Semnani and Seifi (2012), citing Clement (1982) explained that understanding correct translations enable students to determine appropriate operations and is the prerequisite to problem solving (such as "the sum of 3 consecutive integers") which can be represented by the expression $x + (x + 2) + (x + 4)$.This is supported by Radford (2000) focusing on teaching algebra and contemporary mathematics curricula. He argued that this is just one of the several forms of translation by pointing out that translation may also be as simple as defining a variable or associating a situation to a model. Radford (2000) stressed that Mathematics in education is an avenue to acquire the skills and understandings of its real life use relevant to the context of the learners. This 'transitional language' approach, as any pedagogical approach for teaching algebra, relies on specific conceptions about what signs represent and the way in which the meaning of signs is elaborated by the students.

Chapter 3

METHODOLOGY

This chapter provides an overview of the methodology used in the study, specifically, the research design, population sampling, data collection and data analysis.

Research Design

The researchers used the descriptive and relational method to identify the common errors of the respondents in solving word problems. This method will help us find the frequency of errors being committed by the respondents. (Fraenkel et. al., 1993)

Research Subject

The study utilized the universal sampling technique to gather data needed to determine the frequency of error types among erred responses. Tonogbanua (1980) emphasized that the subject of this inquiry may be identified by determining the total *Student Samples Committing Errors (SSCE)* and not the actual population of the respondents. In effect, the proponents of the study administered the research tool on the 452 grade 7 students of AdDU - HS enrolled in school year 2013-2014 and present during the day of the administration of the research tool. This population consisted of 48.7% males and 51.3% females. A significant majority 74.3% attended the Ateneo de Davao University - Grade School (AdDU-GS) and 25.7% were transferees. After the respondents answered the five-item research tool, a total of 2,260 responses were collected. It is worth-noting that among the total responses, 721 (32%) showed no error at all and 1,539 (68%) responses exhibited at least one of the error types. Table 1 shows a summary of the correct and wrong responses.

Table 1: The Students' Erred Responses

Type of Responses	Frequency	Percentage
Responses with Errors	1539	68%
Responses without Errors	721	32%
Total Responses	2260	100%

Research Instrument

The instrument used in the study was a five-item word problem questionnaire *(see: appendix A)* that may be solved using one variable, with an information sheet relative to the respondents' section, gender and the Primary Schools Attended. Each word problem prompts the respondents to use a variable in representing the unknown and describing what it represents. It requires them to write an equation which would relate the unknown quantities in the problem. Lastly, it suggests to the respondents the appropriate use of properties of algebra to isolate the variable and solve the problem.

From the general topic "solving linear equations with one variable", the sub-topics were chosen based on math 7 curriculum's scope and sequence for the quarter. In consideration of the students' contexts, the scope and sequence were duly checked by the grade 7 Math teachers during their Professional

Learning Community (PLC) discussion. Consequently, to ensure alignment, the grade level's decision was presented to and was approved by the subject-area coordinator for Mathematics, Ms. Anper J. Ramos. In the aforementioned curriculum, only number problems, consecutive Integers problem, age problems, uniform motion and geometry problems were chosen to be extensively discussed. Other applications of linear equation involving one variable like mixture problems that were not introduced extensively, or considered to be "nice-to-know" topics, in the third quarter are excluded in drafting the research instrument.

After the determination of the focus contents, the proponents of the study lifted at random from the sample questions and problem set of the textbook, "E-math: elementary algebra" by Oronce and Mendoza (2010). These problems had already been answered by the students through seatwork, board-work, quiz and exam questions. Variations from these problems were ensured by changing only either the subject, situation or the values used in each of the particular problem. This was done to protect the validity of the research instrument.

The summary of the word problem types, the specific questions and their corresponding item number is presented in the table below.

Table II: Types of Word Problem and its Question

Type of Word Problem	Question (*Source: Oronce, O. and Mendoza, M. (2010). E-math: elementary algebra. Manila: Rex printing company, inc.)*	Item Number
NUMBER PROBLEMS	The sum of two numbers is 23. If one of the numbers is 5 more than the other number, what are the numbers?	1
CONSECUTIVE INTEGERS PROBLEMS	The sum of three consecutive even numbers is 102. Find the largest of the three.	2
AGE PROBLEMS	Frank is 6 years older than Macy. Three years ago, Macy was 14 years less than twice the age of Frank. What are their present ages?	3
UNIFORM MOTION PROBLEMS	From the same parking lot, two vehicles travel on opposite direction. One vehicle travels at an average speed of 40 kph towards Toril. If the other vehicle travels at an average speed of 30 kph towards Buhangin, how long will they have travelled 240 kilometers?	4
GEOMETRY PROBLEMS	Jose is planning to fence his rectangular backyard. He has 26 meters of chicken wire to build the perimeter fence. What should the dimensions be, if the length of the fence is to be 3 meters longer than its width?	5

Data Gathering Procedure

The steps the researchers observed in order to conduct the study were as follows:

Pre-administration:

PLC and Consultation with grade 7 math teachers

Inquiry and consultation (of the instrument's content), and PLC at Eden (on FGD)

Letters and approval to administer the research tool from the Mathematics coordinator and from the vice-principal for Academics.

During administration:

Orientation with proctors

Orientation with respondents

Post-Administration PLC:

Preliminary Assessments: Identifying the population of the study
Orientation for checkers coding observations, tallying and taking samples
Further readings and consultation with Grade 7 Math faculty
Discussion of the research findings

Once the data had been collected, the proponents identified and tallied the frequencies of the erred responses as identified in the literature provided by the study of Haghverdi et. al (2012). The determination of the common error had been based on the frequency counts. Error types with more than half the total erred responses had been labeled as Common errors. Also within a group, erred responses, belonging to a certain classification, which comprised more than half the total samples for that error type was also considered common errors. (Tonogbanua, 1980)

Table III: The Frequency of Errors and its Corresponding Descriptions

Frequency of errors (%)	Description
81% - 100%	Most Frequent
61% - 80%	More Frequent
41% - 60%	Moderately Frequent
21% - 40%	Less Frequent
1% - 20%	Least Frequent
0%	No occurrence

Having identified the common errors, the frequencies were then statistically treated to juxtaposed errors according to gender and the primary schools attended. To ensure that all errors were organized as mutually exclusive and exhaustive variables, the researchers further classified the indicators into the following: *Translation error, Computation error, Clerical error, Translation and Computation error, Computation and Clerical error, Translation and Clerical error, Translation, computation and clerical error, and Other errors.*

Statistical Treatment of Data

The data from the accomplished questionnaires were computed and analyzed using the following statistical test:

Chi-Square. This tool was used to check whether there exists a significant relationship between the frequency of errors in terms of gender and the primary schools attended.

Chapter 4

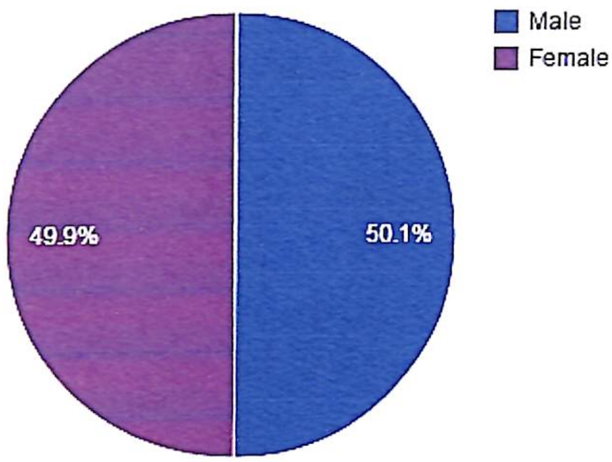
PRESENTATION AND ANALYSIS OF FINDINGS

This chapter presents the findings, analysis, and interpretation of the data gathered. The tables presented in this chapter summarizes the demographic profile of erred responses, the frequency of errors across error type cross-classified by gender and the primary schools attended and the chi square test results.

The Demographic Profile of the Erred Responses According to Gender and the Primary Schools Attended

Study results revealed that among the 1,539 erred responses, 771 (50.1%) were from male respondents while 768 (49.9%) were made by females.

Figure 1-A: The Demographic Profile of the Responses According to Gender



The number of errors committed by males is worth underlining considering that the males comprised 48.7% of the total respondents vis-a-vis the females(51.3%).

On the other hand, 73.4% of this population attended the AdDU-GS and 26.6% are transferees. It is thus worth-noting that approximately three out of ten students received their primary education at the Ateneo de Davao. Table II presents the summary of the profile of the erred responses among the grade 7 students.

Figure 1-B: The Demographic Profile of the Erred According to Primary Schools Attended

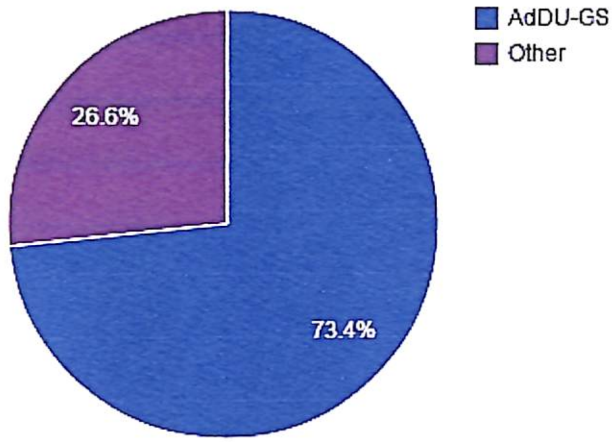


Table IV: The Demographic Profile of the Erred Responses According to Gender and the Primary Schools Attended

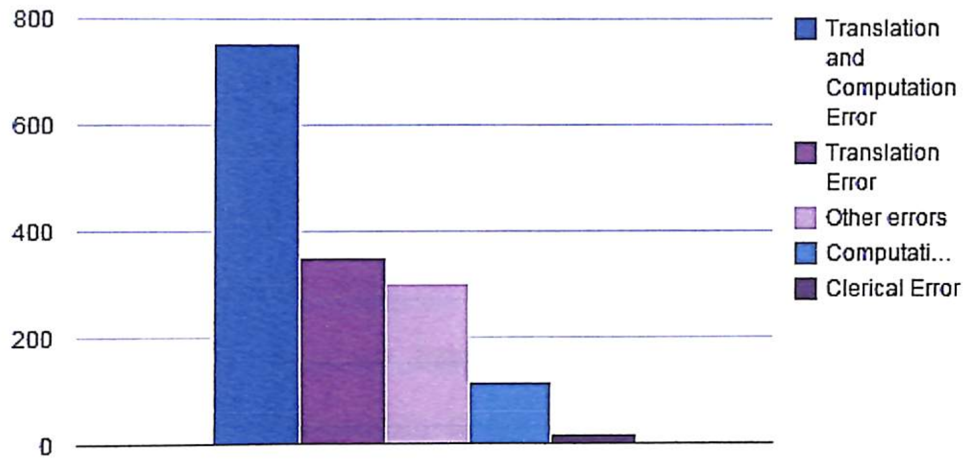
Variables		Frequency	Percentage
Gender	Male	771	50.1
	Female	768	49.9
	Total	1539	100
Primary School Attended	AdDU-GS	1129	73.4
	Other	410	26.6
	Total	1539	100

The Frequency of Errors in the Responses

Among the erred responses, the lowest number of counts was on clerical error. It is the least frequent with 17 or 1.1%. This means that respondents were cautious in copying symbols from one step to another in their solution.

Moreover, this error type was followed by computational error which only contributed 115 or 7.5% of all erred responses. Overall, the results suggested that the grade 7 students were adequately prepared with computational skills and likewise displayed caution in taking note of values.

Figure 2: The Frequency of Errors in the Responses



Ranked 3 is classified as "Other errors." In actual number of counts, it garnered 303 or 19.7% which are described as incomprehensible, vague responses or "skipped" problems. Based on the post-administration PLC conducted among the Grade 7 math faculty, it was mentioned that, in more than one instance, some students inquired before the test was given whether the it was going to be graded or not. Deci et. al. (1992) explained that there can be several factors affecting the non-responsiveness of students. These factors included self-regulation and metacognition, which he found to be influenced by a more complex set of variables. Berger (2009) further explained that some students may have viewed the test to be irrelevant and of no value. Both authorities thus further explained why almost two out of every ten student tend to leave the items blank.

Furthermore, 351 (22.8%) of the errors classified were related to the difficulty in representing unknowns and setting up algebraic equations but still produced the correct response. It was also observed that some responses containing errors in translation did not show any computational attempts. The proponents observed that errors in computation are not necessarily due to flaws in translation. Some respondents showed correct computations in spite of erroneous translations. *Figure 3* shows a student's difficulty in translating the phrase "6 more than the age of Macy." The student seems to be confused with how to represent their present ages and their ages 3 years ago. Johnson (2006) suggested that students sometimes skip items due to test anxiety. He also added that low reading proficiency contributes to increased anxiety levels.

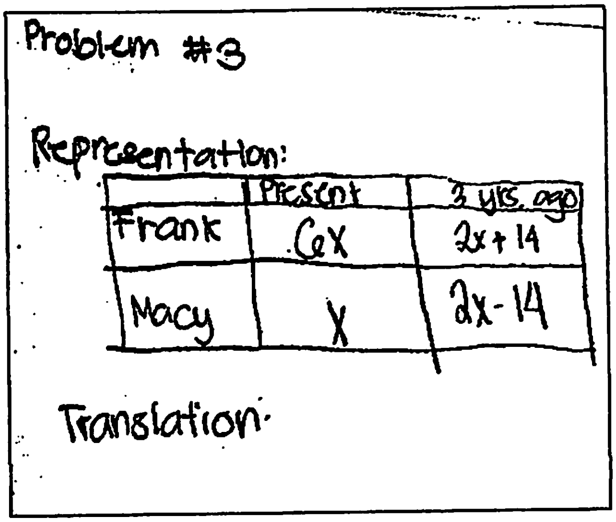


Figure 3: Translation Error

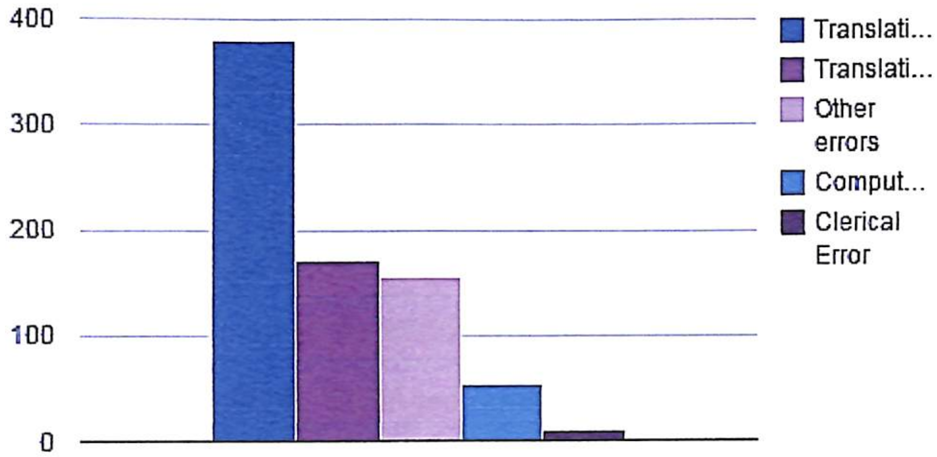
Moreover, the researchers were not able to observe erred responses that can be categorized as *"both computational and clerical"*, *"both translation and clerical"*, and *"Translation, computational and clerical"* in nature. The table below presents the summary of the aforementioned results

Table V: The Frequency of Errors in the Responses

Types of Errors	**Frequency**	**%**	**Rank**
Translation Error	351	22.80%	2
Computational Error	115	7.50%	4
Clerical Error	17	1.10%	5
Translation and Computation Error	753	48.90%	1
Other errors	303	19.70%	3
Total	1539	100%	

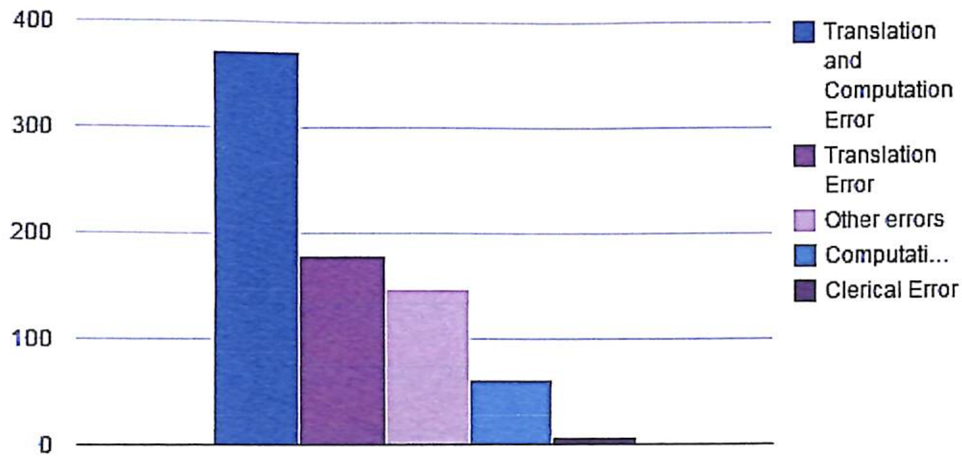
The Relationship Between the Errors in the Responses According To Gender

Figure 4-A: The Errors Committed by Male Respondents



The errors observed in the responses of grade 7 students are translation, computational, clerical, translation and computation, and other errors. Using chi-square to test the hypothesis that there is no significant relationship in the errors committed by males and females, at 0.05 confidence level, the tabular value identified was 9.488. Moreover, the computed Pearson chi-square value is 1.637 *(see: Appendix D)*. With the former value being lesser than the latter value, the data accepts the null hypothesis that there is no significant relationship in the distribution of errors among male and female grade 7 students.

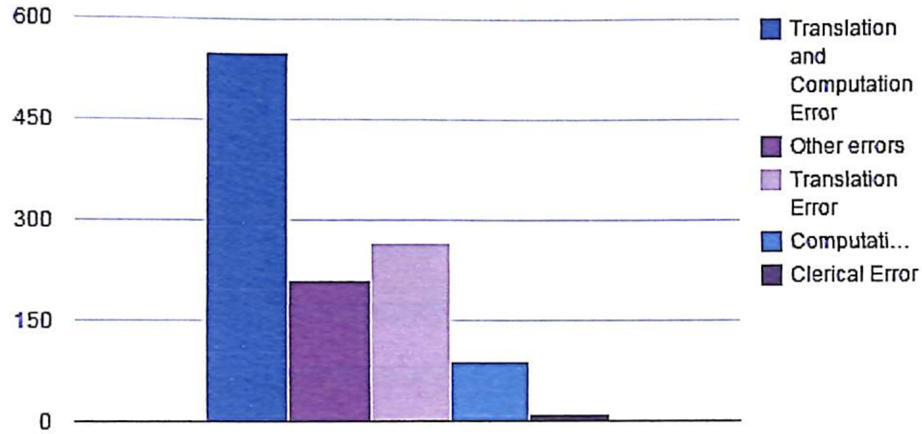
Figure 4-B: The Errors Committed by Female Respondents



Thus, the results do not agree with Zhu's (2007) findings that differences in errors made in solving Mathematical problems existed between the genders. On the other hand, the findings agree with Halpern's psycho-biosocial model, as cited by Zhu (2007), that acknowledges the complex and interactive framework in understanding patterns in solving mathematical problems.

The Relationship Between the Errors in the Responses According to the Primary Schools Attended

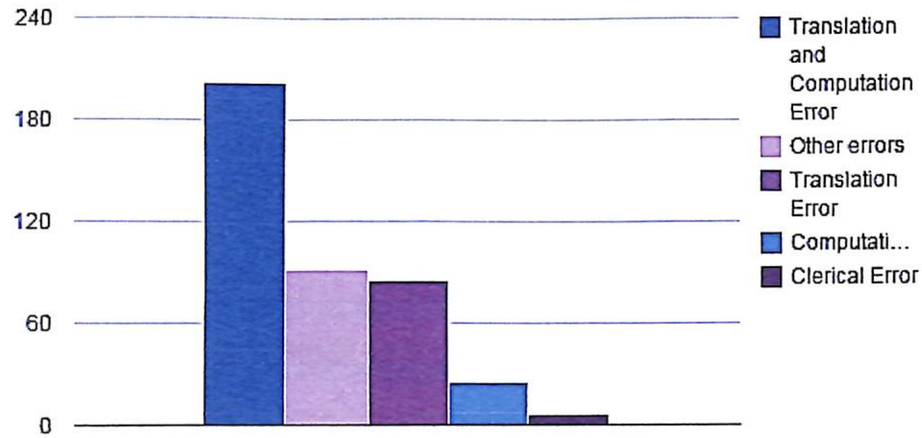
Figure 5-A: The Errors Committed by Respondents from AdDU-GS



Observing a similar pattern in the responses of grade 7 students, chi-square also tested the hypothesis that there is no significant relationship in the errors committed by Ateneo de Davao grade school graduates and transferees. The data was treated at 0.05 confidence level, with the same tabular value 9.488. The tabular value of 5.282 suggests that there is also no significant relationship in the distribution of errors between grade 7 students from the AdDU - GS and the transferees. *(see: Appendix E)*

It is worth-noting that the data collected in this study is limited to struggles and failures, and not competence and achievements. Conversely, ranking the distribution of errors between these groups revealed two different patterns in the distribution of errors. Data shows that 22.4% of the erred responses from the transferees are classified as "Other Errors," i.e. mainly due to "blanks" and "skipped" items. this is against the 18.7% of the responses from the AdDU-GS.

Figure 5-B: The Errors Committed by Non AdDU-GS Respondents



It was also mentioned in one of the PLC sessions that AdDU-GS students are observed to be more confident in trying to answer the problem. Kieran (2004) suggested that an attempt to answer a problem is better than moving to the next. In her study, she found that students' conceptual difficulties lead to desirable results and understanding. She further added that success in Algebra necessitates competence in the following mathematical thinking abilities: generalization, abstraction, analytic thinking, dynamic thinking, modeling, and organization.

Chapter 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter presents the summary of the study, the conclusions made, and the corresponding recommendations.

Summary

This study aimed to identify the common errors made by the grade 7 students in solving word problems involving linear equation in one variable, and to determine whether or not the gender of the students and the primary schools they attended affected the type of errors committed. The study utilized the descriptive research method. The survey instrument was drafted and approved within the context of the grade 7 students, their textbook, the DepEd curriculum for Mathematics 7 and the vertical articulation of the AdDU Mathematics curriculum. The research tool was administered using universal sampling methods. The population is the total of the erred responses of the respondents, was assessed and tallied according to classification of errors based on the literature. The data was then treated at 0.05 level, using Chi-square for the test of significant relationship among nominal data to determine the significant relationship among the erred responses between gender and the primary schools attended.

The results revealed that nearly half of the erred responses were classified as "Translation and Computation Errors". Respondents were unable to use letters to stand for the unknowns in a word problem and set up an Algebraic statement to represent word phrases or sentences; and perform mechanical operations with real numbers, simplifying algebraic expressions and the appropriate use of properties (of equality) to isolate a variable.

Moreover, while no error was considered common, both genders shared similar patterns in the frequencies of each error type. On the other hand, it was observed that the pattern in the distribution of the frequencies of errors committed was different between students coming the AdDU-GS and those who are transferees. It showed that the AdDU-GS graduate's had some difficulty with translation while transferees from other schools somehow skipped some items instead of trying to answer them. Furthermore, the study recorded no significant relationship among the erred responses of the respondents when cross-classified by gender and the primary schools attended.

Conclusions

Based on the foregoing findings, the following conclusions are thus made:

The study found that no error type was common to the erred responses. It was also found that based on frequencies, most of the erred responses were due to comprehension and translation of the text to algebraic language. The top three most frequent errors were: "Translation and Computation error" "Translation Error" and "Other Errors".

Finally, the data showed that there is no significant relationship in the frequency of errors when analyzed according to gender and the primary schools attended.

Recommendations

Based on the foregoing conclusions, the following recommendations are presented:

Firstly, it is recommended that incoming grade 7 student's comprehension skills initially be assessed prior to taking lessons involving word problems to detect and address misconceptions.

Second, more activities that catalyze comprehension and confidence in solving word problems are recommended, i.e. book reading, subject-related graphic organizers, and the use of interactive notebooks as suggested by Glenberg, Willford, Gibson, Goldberg and Zhu (2012) to improve performance in Algebra.

Third, the researchers recommend that a related study be conducted to identify the motivation, perception and biases of the grade 7 students in solving word problems in Algebra, particularly, students under the K-12 curriculum.

Lastly, an action-research is suggested that would try to understand how the students regard mathematics education in the light of the new implementation of K-12, particularly, KPUP assessment, the Base 0 grading system and the current assessment schemes.

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Appendix A: The Research Instrument

SOLVING WORD PROBLEMS using LINEAR EQUATIONS with ONE VARIABLE

This test will measure the concepts and misconceptions your batch have acquired in the whole quarter. Answer it with all honesty. Also, please keep whatever you have experienced in this test to yourself.

Information Sheet

Name: ______________________________ Gender: [ ] Male [ ] Female

Section: ______________________________

Age: ____________________

Last School Attended (Grade School):

[ ] Ateneo de Davao Grade School

Others: ____

General Instructions

- ✓ *Relax!* ☺
- ✓ Read the problem/situation CAREFULLY.
- ✓ Write your Readable answers inside the boxes provided.
- ✓ Write all of the parts of your solution. Do not skip a step, especially, on the mechanical solution.
- ✓ Do not write unnecessary marks on the paper (i.e. Drawings not related to solving).
- ✓ You have 5 to 10 minutes to answer each item.
- ✓ You have to answer all of the five problems.
- ✓ Take time to review your work.

PROBLEM #1: NUMBER PROBLEMS

The sum of two numbers is 23. If one of the numbers is 5 more than the other number, what are the numbers?

Representation: Use a variable to represent the unknown and describe what it represents.

Translation: Write an equation which would relate the unknown quantities in the problem.

Mechanical solution: Use the properties of algebra to isolate the variable.

Answer

Do not Write anything beyond this line

- ❑ Clerical Error
- ❑ Translational Error
- ❑ Computational Error
- ❑ Other Errors

Note:________________________________

PROBLEM #2: CONSECUTIVE INTEGERS PROBLEMS

The sum of three consecutive even numbers is 102. Find the largest of the three.

Representation: Use a variable to represent the unknown and describe what it represents.

Translation: Write an equation which would relate the unknown quantities in the problem.

Mechanical solution: Use the properties of algebra to isolate the variable.

Answer

______________________Do not Write anything beyond this line______________________

- ❑ Clerical Error
- ❑ Translational Error
- ❑ Computational Error
- ❑ Other Errors

  Note:____________________________

Appendix A (continuation): The Research Instrument

PROBLEM #3: AGE PROBLEMS

Frank is 6 years older than Macy. Three years ago, Macy was 14 years less than twice the age of Frank. What are their present ages?

Representation: Use a variable to represent the unknown and describe what it represents.

Translation: Write an equation which would relate the unknown quantities in the problem.

Mechanical solution: Use the properties of algebra to isolate the variable.

Answer

______________________*Do not Write anything beyond this line*______________________

- ❑ Clerical Error
- ❑ Translational Error
- ❑ Computational Error
- ❑ Other Errors

  Note:______________________________

Appendix A (continuation): The Research Instrument

PROBLEM #4: UNIFORM MOTION PROBLEMS

From the same parking lot, two vehicles travel on opposite direction., one vehicle travels at an average speed of 40 kph towards Toril. If the other vehicle travels at an average speed of 30 kph towards Buhangin, how long will they have travelled 240 kilometers?

Representation: Use a variable to represent the unknown and describe what it represents.

Translation: Write an equation which would relate the unknown quantities in the problem.

Mechanical solution: Use the properties of algebra to isolate the variable.

Answer

Do not Write anything beyond this line

- ❑ Clerical Error
- ❑ Translational Error
- ❑ Computational Error
- ❑ Other Errors

  Note:____________________________

PROBLEM #5: GEOMETRY PROBLEMS

Jose is planning to fence his rectangular backyard. He has 26 meters of chicken wire to build the perimeter fence. What should the dimensions be, if the length of the fence is to be 3 meters longer than its width?

Representation: Use a variable to represent the unknown and describe what it represents.

Translation: Write an equation which would relate the unknown quantities in the problem.

Mechanical solution: Use the properties of algebra to isolate the variable.

Answer

_____________________*Do not Write anything beyond this line*_____________________

- ❑ Clerical Error
- ❑ Translational Error
- ❑ Computational Error
- ❑ Other Errors

  Note:________________________________

Appendix B:

The Frequency of Errors in the Responses According to Gender

Errors	Male	Rank	Female	Rank	Total	Rank
Translation Error (Count)	172		179		351	2
% within Responses with errors	49.00%		**51.00%		100.00%	
% within Sex of the respondents	22.30%	2	23.30%	2	22.80%	
Computational Error (Count)	53		62		115	4
% within Responses with errors	46.10%		**53.90%		100.00%	
% within Sex of the respondents	6.90%	4	8.10%	4	7.50%	
Clerical Error (Count)	10		7		17	
% within Responses with errors	**58.80%		41.20%		100.00%	
% within Sex of the respondents	1.30%	5	0.90%	5	1.10%	5
Translation ERROR and Computation Error (Count)	381	1	372	1	753	1
% within Responses with errors	**50.60%		49.40%		100.00%	
% within Sex of the respondents	49.40%		48.40%		48.90%	
Other errors (Count)	155		148		303	
% within Responses with errors	**51.20%		48.80%		100.00%	
% within Sex of the respondents	20.10%	3	19.30%	3	19.70%	3
Total (Count)	771		768		1539	
% within Responses with errors	**50.10%		49.90%		100.00%	
% within Sex of the respondents	100.00%		100.00%		100.00%	

Appendix C:

The Frequency of Errors in the Responses According to the Primary Schools Attended

Type of Error	AdDU-GS	Rank	Other	Rank	Total	Rank
Translation Error (Count)	266	2	85	3	351	2
% within Responses with errors	**75.80%		24.20%		100.00 %	
% within the Primary Schools Attended	23.60%		20.70%		22.80%	
Computational Error (Count)	90	4	25	4	115	4
% within Responses with errors	**78.30%		21.70%		100.00 %	
% within the Primary Schools Attended	8.00%		6.10%		7.50%	
Clerical Error (Count)	11	5	6	5	17	5
% within Responses with errors	**64.70%		35.30%		100.00 %	
% within the Primary Schools Attended	1.00%		1.50%		1.10%	
Translation and Computation Error (Count)	551	1	202	1	753	1
% within Responses with errors	**73.20%		26.80%		100.00 %	
% within the Primary Schools Attended	48.80%		49.30%		48.90%	
Other errors (Count)	211	3	92	2	303	3
% within Responses with errors	**69.60%		30.40%		100.00 %	
% within the Primary Schools Attended	18.70%		22.40%		19.70%	
Total (Count)	1129		410		1539	
% within Responses with errors	**73.40%		26.60%		100.00 %	
% within the Primary Schools Attended	100.00%		100.00%		100.00 %	

Appendix D:

The Relationship Between the Errors in the Responses According To Gender

Statistical Tests	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.637a	4	0.802
Likelihood Ratio	1.64	4	0.802
Linear-by-Linear Association	0.485	1	0.486
N of Valid Cases	1539		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 8.48.

Appendix E:

The Relationship Between the Errors in the Responses According to the Primary Schools Attended.

Statistical tests	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5.282a	4	0.26
Likelihood Ratio	5.269	4	0.261
Linear-by-Linear Association	3.903	1	0.048

N of Valid Cases 1539

a. 1 cells (10.0%) have expected count less than 5. The minimum expected count is 4.53.