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Development and Validation of Mathematics Achievement Test in a Public School

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DEVELOPMENT AND VALIDATION OF MATHEMATICS ACHIEVEMENT TEST IN A PUBLIC SCHOOL

A Seminar Paper Submitted to the Faculty of
College of Graduate Studies and
Teacher Education Research
Philippine Normal University
Taft Avenue, Manila

In Partial Fulfillment of the
Requirements for the Degree
Master of Arts in
Teaching Mathematics

by
Charmie R. Clataro
March 2016



APPROVAL SHEET

This Seminar Paper entitled **"DEVELOPMENT AND VALIDATION OF MATHEMATICS ACHIEVEMENT TEST IN A PUBLIC SCHOOL"** prepared and submitted by **CHARMIE R. CLATARO-SILAO**, in partial fulfillment for the degree Master of Arts in Teaching Mathematics is hereby recommended for approval.

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Above all to the almighty God for His bountiful blessings and guidance that made this study possible.

DEDICATION

The author humbly dedicate this piece of work to

Our Almighty God;

Her husband ,Jojo

And her daughter, Yani

Who inspired and gave unceasing support

And

Unconditional love,

Exceptional time and extensive understanding.

ABSTRACT

RESEARCHER: Charmie R. Clataro

TITLE : Development and Validation of Fourth Year
Mathematics Achievement Test in a Public School

KEY CONCEPTS: Mathematics Achievement Test

DEGREE : Master of Arts In Teaching

SPECIALIZATION : Mathematics

ADVISER: Wilmer G. Marquez, M.A.

This study aimed to develop and validate fourth year mathematics achievement test in a public school. Specifically , it intend to specify the competencies, and content areas of Mathematics IV in order to succeed ;make a table of specifications for the skills , competencies , and content areas; construct test items that will measure the math aptitude and attitude of fourth year students; try out and item analyze the test to determine the difficulty and discriminate on indices of each item;establish evidences of validity and reliability of the instrument ; and prepare a manual for administering the test, scoring and interpreting the results. This study made use of the descriptive–developmental design. Two hundred (200) students from Rizal district were the respondents.

The first one hundred participants were from fourth year. The second try out had been given to the fourth year students of three secondary schools; The final try out is intended for the establishment of test validity and reliability was administered to the remaining two sections. To realize the objectives of this research study, the standard procedure in instrument development and validation was followed, namely: Phase I --- Planning Stage, Phase II --- Item Writing Stage, Phase III --- Try out Stage, Phase IV --- Evaluation Stage. Multiple choice was selected as the item format of the test. The item writer constructed 75 items of the test. Item analysis was also undertaken every after the first two try outs using the U-L Method. The item analysis resulted in the reduction of items from 69 items in the first draft to 60 items in the final draft.

The results revealed that the reliability coefficients obtained using the split – half method through the Pearson r and corrected by Spearman Brown formula both which imply that the test has internal consistency. The instrument was found valid. First, the concurrent validity was established by correlating the scores of the first part to the scores in the open ended questions which yielded 0.76. Second the scores of the examinees was correlated with their score in 2013 -2014 National Achievement Test, 0.88 was the obtained coefficient of correlation. Both were found to be significant.

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CHAPTER I

The Problem and its Background

Introduction

The quest to improve student achievement is a never ending struggle of every school administrator. Numerous strategies and approaches had been tried but still student performance is far from the desired level. Educators continually look for ways to make learning more meaningful and for learners to get the most out of the time they are in school.

Educators and parents have been flanked by the problem of students' low achievement in school. Many students who encounter achievement problems in school frequently warrant the concerned scrutiny of teachers and parents alike.

The Department of Education aims to lead young Filipinos in the discovery of their own potential through the academe provided for every Filipino enabling them to create their own destiny to the global community. To achieve this vision, DepEd reaches out responsive efforts for the students' educational and worthwhile needs. One way is to determine the student's capacity of learning. There comes, National Achievement Test. In the Philippines, the National Achievement Test (NAT) is a Philippine made standardized test designed to determine pupils/students' achievement level, strengths and weaknesses in five key curricular subject areas at the end of the school year. The NAT was developed to measure what pupils/students in Grade Three, Grade Six and

Fourth Year know and can do in five subject areas: Science, Mathematics, English, Filipino, and HeKaSi (Heograpiya, Kasaysayan at Sibika) in elementary, plus Araling Panlipunan in secondary level. Specifically, the test aims to provide empirical information on the achievement level of pupils/students in Grade Three, Grade Six and Second Year to serve as guide for policymakers, administrators, curriculum planners, supervisors, principals and teachers in their respective courses of action; identify and analyze variations on achievement levels across the years by region, division, school and other variables; and, determine the rate of improvement in basic education with respect to individual schools within certain time frames(Cuevas,2012). Achievement tests may also be used by private schools and elite institutions as admissions benchmarks, and sometimes appear in the workplace, too — particularly when it comes to determining whether certain employees have what it takes to assume greater responsibilities or to transition to different leadership areas (Tatum, 2003-2015). Due to the changes indicated in the enclosure of DepEd Order No. 28, s. 2011 and DepEd Memorandum No. 266, s. 2011, instead of the sophomore,our seniors shall take the National Achievement Test in the absence of the National Career Assessment Exam which will be administered now for the juniors. Ratings obtained from NAT for Grade VI and Fourth Year also serves as a tool to measure the school's competency and effectiveness as well as the students' aptitude and mastery towards the basic learning areas (Cuevas, 2012).

Background of the Study

The Department of Education (Dep Ed) has set the conduct of the 2012-2013 National Achievement Test (NAT) to March this year for selected levels of elementary and high school students in public and private schools nationwide.

Fourth Year high school students from all over the Philippines take NAT as part of their curricular requirements, including the high schools in Rizal in the Division of Occidental Mindoro. There are three public secondary education institutions in the area which uses the prescribed 2010 secondary education curriculum by the Department of Education. These schools are: Magsikap National Vocational High School, Rizal National High School-Manoot Annex and Aguas National High School.

Derived from 2012 National Achievement Test results, a sizeable number of schools were categorized in the High Performing Schools (HPS) with an MPS of 86% and above and the Low Performing School with an MPS of 34% and below. Benchmarking on the best practices can be generated from the High Performing School, which may form part of the intervention package to be designed and provided to improve the performance of Low Performing School (LPS).

Maximizing these identified strategies needs the concerted efforts of the concerned individuals at school and division levels.

Rizal National High School is an institution of competitive, productive and God fearing literates where competent and committed teachers, administrator

and stakeholders work cooperatively with integrity and respect. For the past five years, Rizal National High School has the following mean percentage scores in the area of mathematics:

School Year	Mean Percentage Scores (MPS) in Mathematics
2007-2008	57.29 (average)
2008-2009	43.05 (average)
2009-2010	27.29 (low)
2010-2011	50.03 (average)
2011-2012	46.46 (average)

Because of these observations, the researcher firmly believed that there is an urgent need to devise an instrument that can objectively and consistently measure the mathematical aptitude of fourth year students of the school. It is for the reason that the researcher was inspired to develop and validate an achievement test for fourth year students.

Conceptual Framework

The relationship between attitude towards mathematics and the ability in the subject is dynamic and interactive. In that, the individuals with low ability in mathematics are likely to have more negative attitudes towards the subjects and those with negative attitudes are less inclined to make the effort to improve their mathematical abilities (Husen & Postlethwaite, 1985).

The teacher's proficiency and competency are the most valuable element of instruction. Effective instruction in mathematics can only be realized when the teacher is proficient and competent in mathematics content and in methods of teaching mathematics. In any level of education, achievement and performance of learners are greatly attributed to the teacher's competency in the subject. Good teachers produce good students. There is really no substitute for knowledge of what is being taught (Asuncion, 1981).

To this effect, it must be emphasized that the first and fundamental requisite in the preparation of competent teachers is through the mastery of skills about the subject. A teacher needs to master her/his subject matter so she/ he can teach with authority. Teaching in the rest of all the profession requires some unique skills to be truly professionally competent (Cruz,1996).

Our attitude towards mathematics affects how well or how often we do it, and how much enjoyment we derive from it. Many students have a negative attitude toward mathematics that can be described as "math anxiety" or "math

avoidance“. Math anxiety is a state of such tension or fear that the learning process in mathematics is blocked or interrupted. Math avoidance usually occurs because this fear or tension causes a person to react negatively to mathematical situations and therefore avoid them as much as possible. The math anxious or avoidant individual has difficulty doing well in mathematics. But this difficulty is not related to ability, but rather is related to the attitudes that are held about mathematics. Researchers found that one of the traits of mathematical problem solver is having a low level of anxiety. If we feel that we have this fear of mathematics, it is important to recognize that we can change the attitudes that can cause fear and prevent mathematical incompetency (El-Araj, 2013).

Tests have several functions. They may be predictive diagnostic or evaluative. Predictive test assesses a student's potential for learning. Administratively, test facilitates quality control, classification, placement and selection (Flores, 1980). Similarly, Zulueta (1992) claims that the effectiveness of teaching–learning experiences can be evaluated by the use of the test and other systematic evidence-gathering procedures. The topics, principles and concepts to be learned can be evaluated using the multiple choice type of test. The devised item should evaluate a meaningful understanding of the topics, principles and concepts learned. According to Thorndike and Hagen (1977), “the multiple choice is the most flexible and the most effective means of measuring information, vocabulary, understanding, application of principle, or ability to interpret data.”

The researcher, as a faculty member of Rizal National High School, decided to develop mathematics achievement test for fourth year students who are expected to be well versed in mathematics IV competencies. These competencies are referred to as the skills and concepts reflected in the different topics of mathematics IV. With the use of the BEC curriculum syllabus, teachers' manual and textbook the researcher prepared the table of specifications for the math achievement test, the developed test was tried out and validated – the result is the validated mathematics achievement test. This conceptual framework is the basis for the development and validation of an achievement test in mathematics.

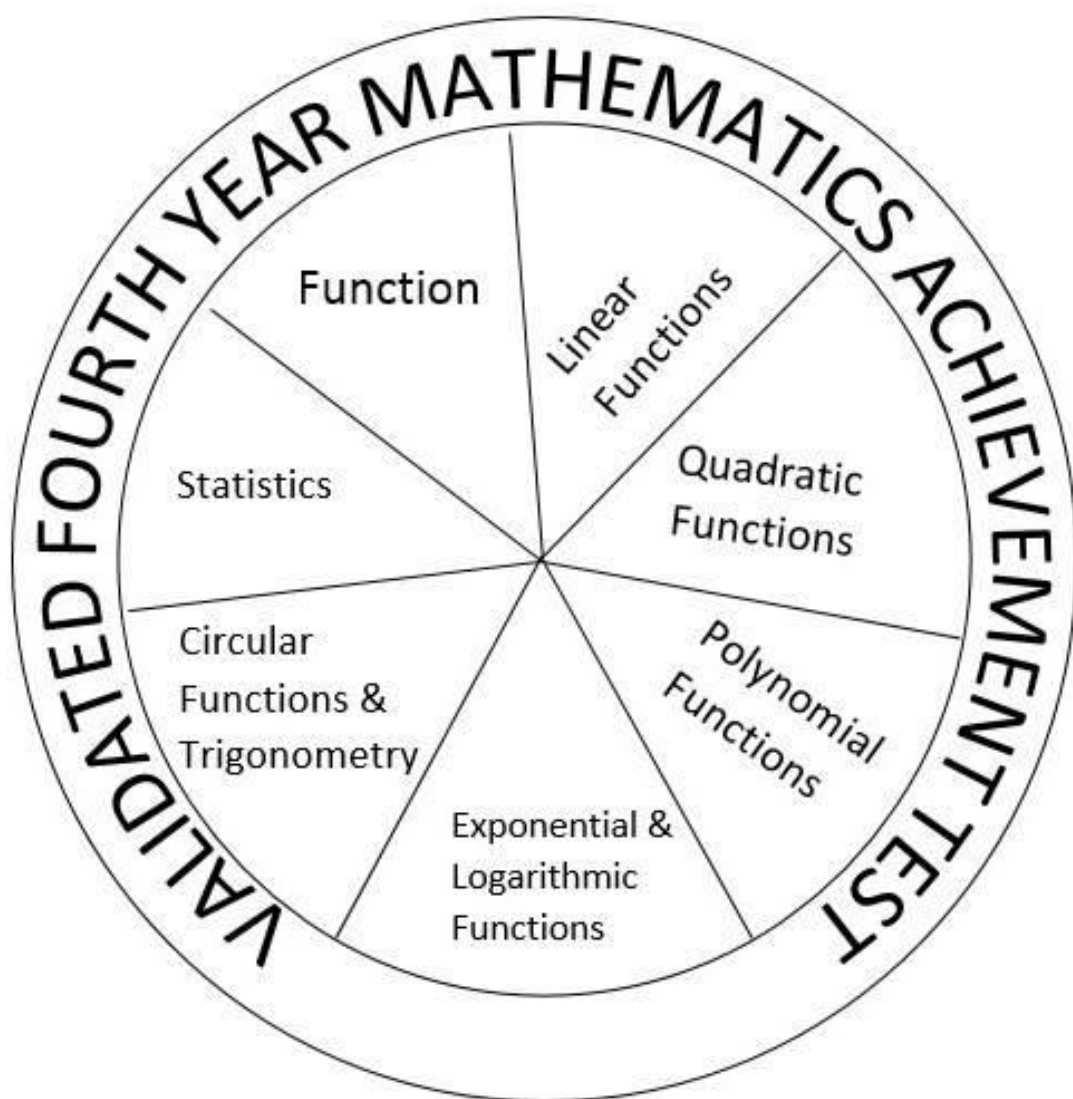


Figure 1 Conceptual Framework of the Validated achievement test in Mathematics for fourth year students.

Secondary students is expected to be well –versed in fourth year mathematics competencies. These competencies are referred to as the skills and concepts the student should acquired. The following are the competencies intended for secondary students as reflected in the mathematics book.

Chapter 1: Functions

- Determine whether a given set of ordered pair and graph represents a function or a mere relation.

Chapter 2: Linear Functions

- Determine the value of $f(x)$ given a value for x
- Given $f(x)=mx+b$, determine the x and y intercepts of its graph
- Given $f(x)=mx+b$, determine the slope of its graph
- Solve problems involving liner functions

Chapter 3: Quadratic Functions

- Given a quadratic function ,determine the coordinates of the highest and lowest point (vertex) of its graph
- Given a quadratic function , determine the equation of the axis of symmetry of its graph.

- Given the quadratic function, determine the direction of the opening of the graph.
- Find the roots of the quadratic equation by factoring, completing the square or the quadratic formula
- Solve problems involving quadratic function and equation

Chapter 4: Polynomial Functions

- Find by synthetic division, the quotient and the remainder when $p(x)$ is divided by $(x-c)$

Chapter 5: Exponential and Logarithmic Functions

- Determine the inverse of a given function
- Solve logarithmic equations
- Solve problems involving exponential and logarithmic functions

Chapter 6: Circular Functions and Trigonometry

- Convert angle measures from degree to radian and vice versa
- Determine the coordinates of their intersection of the given unit circle and the terminal side of an angle in standard position

- Solve simple trigonometric equations
- Apply knowledge and skills related to circular functions and trigonometric equations in problem solving

Chapter 7: Statistics

- Interpret Data
- Find the measure of Central tendency of grouped/ungrouped data (mean ,median , mode)
- Compute the different measures of variability relative to the given set of data, grouped or ungrouped

Statement of Purpose

This study aims to develop and validate an achievement test for fourth year students.

Specifically, it intended to:

1. specify the competencies, and content areas of Mathematics IV in order to succeed;
2. make a table of specifications for the skills, competencies, and content areas;
3. construct test items that will measure the math aptitude and attitude of fourth year students;

4. try out and item-analyze the test to determine the difficulty and discrimination indices of each item;
5. establish evidences of validity and reliability of the instrument ; and
6. prepare a manual for administering the test, scoring and interpreting the results.

Significance of the Study

The instrument, once validated, will help improve the students in the field of mathematics. This study will be of great help to students and teachers in mathematics.

Pupils: it can be used to determine the strength and weaknesses of the students in different competencies of mathematics IV. They will become aware of their performance, and the result may serve as an eye opener for them to work harder to level up their performance.

Teachers: Test appraisal and analysis help the teacher by the following (Hopkins, 1980):

1. providing a basis for discussing test results;
2. providing a basis for test improvement;
3. providing learning experiences for the pupils;

4. identifying alternative responses which are not functioning appropriately;
5. determining if additional instruction or remedial work is needed;
6. developing and improving the teachers' skills in the test construction;
7. providing a check against the table of specifications for balance, objectivity of the test; and
8. helping pupils discover errors and misunderstanding.

Administrator: The validated instrument will help them to develop programs for staff development in mathematics based on the needs of students as reflected on the result of the achievement test. This instrument, once validated, will be great help to increase the Mean Percentage Scores (MPS) of the students in the next National Achievement Test in the field of mathematics.

Scope and Delimitation of the Study

This study was confined to the Fourth Year high school students who are currently enrolled in a public school of Rizal district and limited in one learning area, which is mathematics. The study focused on the construction and validation of mathematics achievement test. The constructed test items are based on the Bloom's Taxonomy of objectives, namely: Knowledge, comprehension, application and analysis.

The instrument is in two parts. The first part used the multiple choice type of test with four options in each item. There is a less chance of guessing on the part of the examinees since there are four options for each item. The second part is the objective type of test, the most flexible and effective as it measure any objective except the ability to organize and present the materials (Hagen & Thorndike 1977).

Besides the multiple choice type is the most flexible and effective of the objective type of test by measuring any objective except the ability to organize and present the materials (Hagen & Thorndike 1977). The content of the test will be based on the competencies of mathematics for the fourth year in the BEC curriculum. The second part contains open ended questions. There are 10 questions for the open ended part to test if the examiners really know how to solve the given problem. The achievement test developed covered functions, linear functions, quadratic functions, polynomial functions, exponential and logarithmic functions, circular functions and trigonometry and statistics. The test was limited to measuring these skills. It was limited to establishing the validity, reliability and internal consistency of the test. Further the study was conducted during the school year 2014-2015

The first try out was administered to two sections of fourth year students from one section of each schools of Rizal district. The second try out was administered in the three high schools in Rizal districts .The final tryout which

was intended for the establishment of test validity and reliability and was administered to the remaining two sections of students.

Definition of Terminology

For the purpose of clarity, the following terms are hereby defined:

Achievement. It refers to the knowledge and skills acquired or learned from instructions and trainings. It is an indication of an individual's optimum performance. In this study, it refers to the scores obtained by the students in the achievement test.

Achievement test. The measure of what a child has done or learned and or has learned to do. In this research study, it refers to the cognitive part of the instrument that will measure the knowledge and skills acquired by the respondents in Mathematics.

National Achievement Test. Standardized test designed to determine pupils/students' achievement level, strengths and weaknesses in five key curricular subject areas at the end of the school year (Frieddenberg, 1995).

Aptitude . Refers to the condition or set of characteristics regarded as symptomatic to an individual's ability to acquire ,with some knowledge, skills or set of responses.

Aptitude Test. Measures what a person could learn to do. An instrument that can foretell one's success in a certain vocation and purports to measure inherent ability entirely apart from knowledge and skills that an individual has acquired through the process of education and living to predict achievement prior to instruction and training.

Attitude towards Mathematics. It is how one feels towards math and how one responds to situation arising from a math class.

Competency: The combination of observable and measurable knowledge, skills, abilities and personal attributes that contribute to enhanced students performance .

CHAPTER II

Review of Related Literature

This chapter presents some review of literature and studies, both foreign and local, related to the present study

Conceptual Literature

A number of literature, which have direct and related bearing on the present study, was read in order to have a better understanding of the paper under study.

The effectiveness of instruction is usually determined by means of checking accomplished results against objectives undertaken. Measures of achievement have does long been employed as an integral part of the educational program.

Achievement test is a test typically standardized, which is designed to measure subject and grade-level specific knowledge. Achievement tests are frequently used as a way to determine at what level a student is performing in subjects such as math and reading (Morin, 2003).

According to (Friedenberg,1995) achievement test is a type of a maximal performance (ability) test designed to assess previous learning. It is a systematic procedure for measuring a representative sample of learning tasks. The role of the achievement test in the instructional process is to contribute to a more

effective instruction and greater student learning in order to realize the full potential of the achievement test and as learning aids; it is necessary to make testing an integral part of the instructional process (Gronlund,1993)

Achievement tests measure the extent to which a person has "achieved" something, acquired certain information, or mastered certain skills - usually as a result of planned instruction or training. It is designed to efficiently measure the amount of knowledge and/or skill a person has acquired, usually as a result of classroom instruction. Achievement tests are exams taken to gauge the extent of what the child or student has already learned. In this regard, it measures skills and current knowledge regarding both familiar and trivial subject matter. It is administered to groups of students, and is intended to measure how well they have learned information on various academic subjects.

A standardized achievement test identifies the strength and weaknesses of what the students have learned from their teachers. It provides information regarding teaching strategies used in imparting the task given in the goals of learning. The role of achievement test in the educative process is to reassure the effects of a specific program of instruction or learning and to enhance a more effective instruction and a greater student learning. This achievement test absolutely measures the maximal performance of the students by assessing his/her previous learning.

A standardized achievement test has certain distinctive features, including a fixed set of test items designed to measure a clearly defined achievement domain, specific directions for administering and scoring the test, and norms based on representative groups of individuals like those for whom the test was designed.

In 1962, The Scholastic Aptitude Test replaced the essay test used by the College Entrance Examination Board. This test, and the advent of machine scoring led to a rapid increase in the use of standardized achievement tests in the US. Achievement testing serves many purposes: (<http://homepages.rpi.edu/~verwyc/Chap6TM.htm>)

1. Assess level of competence
2. Diagnose strength and weaknesses
3. Assign Grades
4. Achieve Certification or Promotion
5. Advanced Placement/College Credit Exams
6. Curriculum Evaluation
7. Accountability

8. Informational Purposes

Achievement tests can be written to ascertain the students' level of learning within a course, in a major, or across their entire undergraduate education (Flateby, 2003).

Schools often use these tests to determine the appropriate grade level for students who are either new to the system or need to be reassessed for one reason or another. The idea here is not to draw a conclusion about the general intelligence of the child being tested, but rather to ensure that each student is placed in a classroom where he or she will have the best opportunity to learn. This prepares the student to move on to more advanced material in later years (Tatum 2003-2015)

Tests can also be used as a benchmark for either “gifted” or “remedial” programs, both of which offer extra support to students who are in need in many places. Schools use broad achievement tests to make sure that all students are learning at similar levels. In these cases, test results are used primarily for administrative purposes and scores may or may not be associated with individual students. Schools with disproportionately low or high scores are often the subject of further evaluation by local or national education officers, though they are widely used in schools, achievement tests are not without their skeptics. Many of the most vocal opponents argue that using the tests encourages teachers and educators to skew their curricula to encourage higher scores rather than focusing on individual student learning. This can be particularly troublesome in situations where schools are offered financial incentives or other bonuses for high scores, or penalized for low ones. (Tatum, 2003-2015).

Some groups also argue that standardized achievement tests are skewed to favor certain subsets of students over others. According to Linn, Miller &

Gronlund (2010), the way questions are framed, the vocabulary employed, and even the basic baselines in use make it easier for students of certain socioeconomic, racial, or ethnic backgrounds to do well.” In response, most school boards try to regularly examine their questions to ensure that they will adequately measure all students

Educators are experiencing almost relentless pressure to show their effectiveness. Unfortunately, the chief indicator by which most communities judge a school staff's success is student performance on standardized achievement tests.

One of the chief reasons that students' standardized test scores continue to be the most important factor in evaluating a school is deceptively simple. Most educators do not really understand why a standardized test provides a misleading estimate of a school staff's effectiveness (Popham, 2011). These days, if a school's standardized test scores are high, people think the school's staff is effective. If a school's standardized test scores are low, they see the school's staff as ineffective (Yannone, 2010)

Most observers assert that the students are learning less now than they did in the past. Some however, assert that learning has not declined, in the fact, students are doing better than ever on standardized achievement test (Berliner & Biddle, 1995). Although views vary as to whether there has been a decline in achievement, there is a general agreement that students' achievement is too low

for the demands of an advanced technological society - that more will need to be achieved as work becomes more technical and knowledge based. There is also a growing consensus that the low academic achievement of minority and poor students need to be improved greatly (Jencks & Phillips, 1998; Venezky, 1998).

Most educators believe that the success in academic achievement couldn't be contributed to the intelligence alone but also to the proper attitude toward the subject. There is more learning when the attitude of the students is favorable, thus it becomes a must, that if mathematics, which is quite a "dreadful" subject, to many students has to be appreciated and learned without fear or tension, teachers themselves should develop a positive attitude towards the subject.

Academic Achievement reflects the productive integration of the student's interest and the teacher's interest in the teaching – learning process (Brookover, W. B., & Lezotte, L.W. (1979). On the other hand achievement test according to (Jones, 1978), can be used to assess what had been mastered, learned, what knowledge and skills have been developed after a study of exercise. It is a valuable means of determining to what extent the individual has attained a certain degree of progress towards a desirable goal, whether he is ready to undertake the next steps and how is his attainment compares on that of the other members of the group.

The National Achievement Test (NAT) is a Philippine made standardized test designed to determine pupils/students' achievement level, strengths and weaknesses in five key curricular subject areas at the end of the school year. The NAT was developed to measure what pupils/students in Grade Three, Grade Six and Second Year know and can do in five subject areas: Science, Mathematics, English, Filipino, and HeKaSi (Heograpiya, Kasaysayan at Sibika) in elementary and Araling Panlipunan in secondary level.

Specifically, the test aims to:

1. provide empirical information on the achievement level of pupils/students in Grade Three, Grade Six and Second Year to serve as guide for policy makers, administrators, curriculum planners, supervisors, principals and teachers in their respective courses of action.
2. identify and analyze variations on achievement levels across the years by region, division, school and other variables
3. determine the rate of improvement in basic education with respect to individual schools within certain time frames. Grade 3 public schools only Grade 6 both public and private schools Year 4 both public and private schools will take the National Achievement Test. For grade three there are 120 questions given, 30 questions for each Science, Mathematics, English and Filipino subjects. For

grade six there are 40 items in the areas of Science, Mathematics, English, Filipino and Hekasi. For secondary it composes of the 300 item test, 60 items in the subject of Mathematics, English, Filipino and Araling Panlipunan. The test development process is as follows: planning the test, developing the table of specification, item writing, test assembly and review of test items, pilot testing or try out of the test, item analysis, organize final form of the test, norming preparation of test manual /examinees handbook. The National Achievement is a multiple choice test, it is a sampling of competencies intended for the whole year coverage, standardized test with mostly moderately difficult items, it anchored on Bloom's Taxonomy of Cognitive Objectives/Dimensions, it involves High Order Thinking Skills (HOTS). The performance of an examinee is compared to the performance of a national populace and the rating is expressed in percentage score or percent of correct responses. The NAT, which is a system-based assessment, was specifically designed to gauge learning outcomes across target levels in identified periods of basic education. In particular, it spans from mid assessment of elementary education which falls on the third grade, and then to a terminal exit assessment which falls on the sixth grade (Benito, 2003-2015).

Related Studies

USAMO (USA Mathematics OLYMPIAD) is a test aimed to give further recognition and challenge to the best mathematics student in North America. It is also intended to identify the best candidate for the US team for

International Mathematics Olympiad .The USAMO is part of a worldwide system of national mathematics competitions, a movement in which both educators and research mathematician are engaged in recognizing and celebrating the imagination and resourcefulness of our youth. The USAMO is a six question, two days, 9 hour essay / proof examination. All problems can be solved with pre-calculus methods. Approximately 270 of the top scoring AMC 12 participants (based on a weighted average) are invited to take the USAMO. Approximately 230 of the top scoring AMC 10 participants (based on a weighted average) are invited to take the USAJMO. U.S. citizens and students legally residing in the United States and Canada (with qualifying scores) are eligible to take the USAMO & USAJMO. (Maureen & Mientkaa 1983)

Stanford Achievement Test Series, the most recent version of which is usually referred to simply as the “Stanford 10”, is a set of standardized achievement test used by school districts in the United State and in American schools abroad for assessing children from kindergarten through high school. The test is available in 13 level that roughly correspond to the year in school. Each level of the test is broken into subtest or strands covering various subjects such as reading comprehension , science and social science .The test is used to measure the academic knowledge of elementary and secondary school students. The report include the narrative summaries, process and cluster summaries, and graphic displays to clarify the student’s performance ad guide planning and analysis. Administrators obtain critical data to document and monitor the progress of all children and to disaggregate results according to federal

mandates. Teachers receive specific information to support instructional planning for individual students and the class as well as to improve their teaching. Parents better understand their child's achievement level and get direction for home involvement. (Pearson 2014).

Teachers may use ITP testing batteries to suggest areas where the skills of individual students are most and least developed. Sections for levels 9-14 include: Vocabulary, Reading Comprehension, Spelling, Capitalization, Punctuation, Usage and Expression, Math Concepts and Estimation, Math Problem Solving and Data Interpretation, Math Computation, Social Studies, Maps and Diagrams, Reference Materials, Word Analysis (Level 9 only), and Listening (Level 9 only).

American High School Mathematics Examination (AHSME) is an exam for second year high school students and contain problems which can be solved and understood with concepts taken before college. The test is considered the first step to International Mathematics Olympiad. It is however a standardized test but a content exam requiring ingenuity as well as knowledge "it is a multiple choice test which was also aimed to increased learning and excitement in mathematics (Maureen and Mientkaa 1983)

American Invitational Mathematics Examination (AIME) is an intermediate exam between AHSME and USAMO. It is meant to provide challenge and recognition and is considered as qualifying exam for USAMO (Maureen & Mientkaa 1983)

Wechsler Individual Achievement Test, also known as WIAT II (Psychological Corporation, 2001) is used not only to gauge achievement, but also to develop hypotheses about achievement versus abilities. It features nine subtests that sample content in each of the seven areas listed in a past revision of the Individuals with Disabilities Education Act: oral expression, listening comprehension, written expression, basic reading skill, reading comprehension, mathematics calculation and mathematics reasoning. The test was assigned to facilitate understanding of the problem solving process and strategies that test takers use in this area. Test scores allow for detailed skill analysis and specification of intervention targets for individualized education plans.

Spencer Diagnostic Test is a series of new instruments. The first is intended for grades three and four, second test for grade five and six and the third for seven and eight. The first test deals with the four fundamental process, whole numbers, money and time, measure. The second deals with numerical quantities with exercises involving whole numbers, mixed numbers, fractions and decimals. The third deals with the problem of concrete type (Garette 1961)

Sengram Reidy Survey Test in Arithmetic is another test which aims to: provide a general level of pupil's ability in the major process of arithmetic and (2) to determine the phase and arithmetic and to locate the level of difficulty which the pupils need further diagnostic testing for further diagnostic testing in order to discover his instructional needs. The test are considered in three divisions I, for grades 2 & 3 , II for grades 4 , 5 & 6 , III for grades 7 & 8 (Garette, 1961)

Other tests are:

The Kansas Diagnostic Chart of Fundamental Process in Arithmetic included 16 tests. The first six test covered simple work on addition, subtraction, multiplication and division, while test seven to eleven covered operations on fraction (Garette, 1961).

Bruswell-John Diagnostic Chart of Fundamental Process in Arithmetic. The test include materials on the four fundamental process addition, subtraction, multiplication and division. There are sixty-six exercises in all. These are arranged according to increasing difficulty in each process. The test is given to pupils individually .It is a devised to cover the strengths and weaknesses of pupils in dealing with the four fundamental processes (Fraser & Gillian 1972).

Cooperative Mathematics Test for grade 7,8 & 9. The test consist of two parts: I. Skills II. Facts, terms and Concept, III. Application, IV. Appreciation. Questions and problems covers basic arithmetic as well as simple algebra and geometry. This test may be used for survey purposes but it is more valuable in evaluation and guidance(Garrett 1959)

Los Angeles Diagnostic Test : Fundamentals of Arithmetic. This test is a survey test .It is intended for the use of grade 2 through grade 8 and it provides a measure of four fundamentals .The 167 exercises deal with whole numbers , fractions, decimals and mixed numbers (Broom 193)

Zamora (2003) developed and validated an Achievement test for Mathematics for grade six. Out of 255 participants, 45 were used for pilot testing. Convergent- divergent technique, discrete grouped technique and the Scheffe method was used to validate the developed test while Kuder–Richardson Formula 20 was used to test the reliability.

To make our educational system comparable to foreign education, the government is in pursuit of quality education. This was realized as evidenced by the research findings of Abuan and Tolentino (1998), as cited by Cayabyab (1999) and Sinson (2003). It revealed a significant relationship that exists between pupil's academic achievement and the teacher's educational qualification.

Another Achievement test in Mathematics I was developed by Mallare (2001) of Cabanatuan City and it is intended for a public school. 250 second year students were given the pretest. The author used the following procedures in the test development: (1) Development of the pretest form; (2) Pretest administration; (3) Posttest; (4) Item Analysis; (5) Establishing the reliability and validity of the test.

Legazpi (1998) developed a Literature test for college students, which initially contains 120 test items that were narrowed down to 90 after the third try out. The constructed test items were first tried out to 100 randomly selected freshmen and the results were item analyzed. The second try out was given to a different group of 150 freshmen, the result of which becomes the basis of the

final form, The final form was administered to college students of different level to be tested the reliability. The development underwent four stages: (1) planning the test; (2) preparing the test items; (3) trying out the test item; and evaluating the test.

Likewise, Florentino (1996) developed and validated an achievement test in four areas in four areas of College Algebra in New Era University. The validity of the test was tested through the use of Kuder-Richardson Formula 20. The test revealed that the test was reliable, the result was a positive correction of 0.96. The transmuted value of the test was correlated with the final grades in algebra using the Pearson Product Moment Correlation which obtained 0.778 from the value of r which indicate that the developed test has concurrent validity.

Also, Bayona (1993) developed and validated an achievement test in College Algebra for Philippine Christian University using the following procedures (1) item development; (2) establishing empirical evidences; (3) establishing validity and reliability.

A test in Science and Technology III for secondary level was developed by Zulueta (1993). Instrumentation is the focus of the study. There were 107 test items developed, validated and initially standardized. The author also created a manual for the study. All the correlation coefficients were significant. This process is related to the procedure used by the researcher in this study, however, some modifications were made.

Pasagui (1991) developed and validated an achievement test in Physics for senior high school students. The lack of existing valid achievement test in Physics encouraged him in pursuing this study. He cautiously planned, wrote and analyzed the test items with proper coordination with the experts. The Pearson Product moment correlation was used to determine the reliability of 0.848 and corrected through the computed Spearman-Brown Prophecy value of .9177. The correlated value was 0.708 it was done by correlating the scores of the students with their final grades in physics.

Tabuzo (1991) conducted an assessment test in Mathematics for College Freshman of PNC. She initially tried it out to 40 students to determine if directions were clear enough, if there were no further ambiguity in the test items, and if the vocabulary load is appropriate to the level of the students. The bases for selecting items were: item difficulty, item discrimination, context and skills. The Kuder-Richardson formula 21 was used to estimate internal consistency of the test.

Rafanan (1994) also found out that the educational attainment is positively and significantly related to the student's performance. She further concluded that the teachers who are educationally qualified to teach mathematics tend to produce better mathematics scorers.

Also, Ruiz (1996) as cited by Sinson (2003) said that the greater number of units earned in mathematics the better the teaching performance in mathematics and the better is the achievement of learners. She further said that

the academic preparation of teachers in mathematics content is one of the fundamental factors responsible for the achievement rate of students in mathematics.

The survey of related studies and literature gave substance to the research. The insights and the perspective from the studies that were read and analyzed were gained and helped in the development of the material. This made her realize that the test will undergo a series of changes, revisions and refinement before it will be made into a better one. The developmental procedures and methodologies employed are almost similar in all the studies, from planning and tryout to evaluation of the test. To test the content validity of the achievement test, the same procedure was used. The statistical treatments used in many studies were almost the same: the U-L Method to assess the difficulty and discrimination indices of each item; Kuder –Richardson Formula 20 for reliability; Pearson Product Moment Correlation for concurrent validity and convergent-divergent validation.

The notes of Maureen and Mientkaa and other writers proved to be indispensable in the conduct of study. The different studies conducted by Mallari, Legazpi, Florentino, Zulueta emphasize more of the concept, knowledge, computation, comprehension and application. The present study attempted to develop and validate a test in Mathematics. Hence, the development of test conducted by Mallare (2001) finds relevance to the present study in as much as both dealt with coming up a validated instrument with the same procedure

used. As with Zamora (2003), Mallare (2001), Florentino (1996), Bayona (1993) and Tabuzo (1991), this study addressed Mathematics.

To summarize, the reviewed studies may be different in the place, time and person involved in the inquiry; however, it was evident that those and the present study was initiated for the improvement of instruction and evaluation purposes.

CHAPTER III

Research Methodology

This chapter presents the research method used in the development and validation of mathematics achievement test. It includes the description of the participants and the statistical treatment used in the analysis of the data.

Research Design

This study used the descriptive–development design. According to Sevilla, et.al, (1992), the principal aims in employing the descriptive method are to describe the nature of a situation as it exists at the time of the study and to explore the cause of the particular phenomena. It is also used the developmental study design because it developed and tried out an achievement test of fourth year mathematics using appropriate statistical treatments.

This study dealt with the development and validation of Mathematics Achievement Test for fourth year students in a public school.

Participants

The participants of the study are fourth year students of secondary public schools in the district of Rizal, Division of Occidental Mindoro. A total of 200 students are included in the study. The first one hundred participants were from fourth year students of Rizal National High School. The second tryout had been given to the fourth year students of three secondary schools, namely Aguas

National High School, Manoot National High School and Magsikap National Vocational High School. The final tryout is intended for the establishment of test validity and reliability was administered to the remaining two sections of the Rizal National High School.

Experts in the field of mathematics, mathematics coordinators of secondary schools, and mathematics teachers were consulted to ensure the content validity instrument.

Procedure

To realize the objectives of this research study, the standard procedure in instrument development and validation was followed, namely:

Phase I --- Planning Stage

Phase II --- Item Writing Stage

Phase III --- Try out Stage

Phase IV --- Evaluation Stage

Preparation of the Test Manual

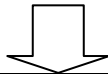
These are the stages followed in developing and validating the math achievement test. Anyone cannot do test development and validation without considering the different phases. In the test construction, its design largely depends on the purpose of the test, the objective to be evaluated and its contents. The test that was constructed was based on the objectives that the test

intends to measure, the mathematics achievement test that was constructed was based on the specific skills and knowledge the students should have acquired and their ability to perform tasks that will enrich these achievements in mathematics

Phases of the Development and Validation of a Test

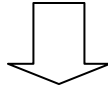
Phase I -----Planning Stage

1. Specification of Objectives and Content Areas
2. Preparation of the Table of Specifications
3. Deciding on item format



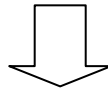
Phase II -----Item Writing Stage

1. Writing the test item
2. Editing and Content Validation of the test – Expert Validation
3. Revising and Improving the Test Items



Phase III -----Try out Stage

1. Administering the first tryout
2. First item analysis
3. First Option Analysis
4. Revision of the Test Items
5. Administration of the second Try Out
6. Second Item Analysis
7. Second Option Analysis
8. Preparation of the Final Form of the Test



Phase IV-----Evaluation Stage

1. Administration of the Final Form of the Test
2. Determination of the Reliability of the Test
3. Establishment of the Validity

Phase I – Planning Stage

The most crucial part of this phase is content validation because it sets the pace for the succeeding validity and reliability. Content validity, according to

Sevilla, et. Al. (1988), is the degree to which a test represents essence, the topics, and the areas that the test is designed to measure.

A. Content Validation

Content Validation is a process of determining the extent to which a set of tasks provides a relevant and representative sample of the domain of the task about which interpretations of the test scores are to be made (Gronlund, 1981 in Pasagui, 1991). According to Santarin (1996), it also includes the specification of objectives and content areas, the preparation of the table of specifications and selecting the item format.

1. Specification of Objectives and Content areas

To be able to determine the areas and concepts that were included in the test, the secondary schools learning competencies based on the 2002 basic education curriculum were used as reference.

2. Preparation of the Table of Specifications

The test items represented contents of Mathematics IV. Similarly, the test items were classified or categorized into four cognitive levels; knowledge /comprehension, analysis, application and problem solving. The adequacy of items in terms of the objectives does not guaranty content validity of the test. For the test to have sufficient content validity, it must be comprehensive. The comprehensiveness of the test implies not only the sampling representativeness of the items, but also the sufficiency of the skills or the levels of the domain that

the test can measure. It is for the reason that the table of specification made is the two-way grid table. The two-way grid table of specifications indicates the classification or category of every item if it falls under knowledge, analysis, application or problem solving.

In most of the objectives, about two or more questions were constructed for each objective with an assurance that these items do not belong to the same category. The item placement is based on the idea that the examinees are more motivated and inspired to answer the test if they feel that the items are arranged in an ascending order of difficulty. If the first few items in the test are difficult, the examinees might experience mental block that is sometimes a cause of discouragement.

A table of specifications was then constructed to show the distribution of items per objective or per content area or skill, the item placement and the category of each item. Table 1 shows that the table of specifications of the final form of the test. The table of specifications for the first draft and second draft are shown in Appendix F and Appendix G respectively.

TABLE OF SPECIFICATIONS

Subject: Fourth Year Mathematics

OBJECTIVES	Know ledge	Com preh ension	Ap plic ation	An aly sis	Pro ced ural	No of Ite ms	Item plac ement
1. Determine whether a given set of ordered pairs and graph represents a function or a mere relation.	/					4	1,2, 3,4
2. Determine the value of $f(x)$ given a value for x .		/	/			2	5,6
3. Given $f(x) = mx + b$, determine the x and y intercepts of its graph.		/	/		/	2	7,8
4. Given $f(x) = mx + b$, determine the slope of its graph.		/			/	1	13
5. Solve problems involving linear functions.				/		4	9,10 ,11, 12,
6. Given a quadratic function, determine the coordinates of the highest / lowest point (vertex) of its graph.		/				1	14
7. Given a quadratic function, determine the equation of the axis of symmetry of its graph.		/			/	1	15
8. Given a quadratic function, determine the direction of the opening of the graph.	/	/				2	16,1 7
9. Find the roots of the quadratic equation by factoring, completing the square or the quadratic formula.		/			/	5	18,1 9,20 ,21, 22
10. Solve problems involving quadratic function and equation.						3	23,2 4,25
11. Find by synthetic division, the quotient and the remainder when $p(x)$ is divided by $(x-c)$.		/			/	4	26,2 7,28 ,29
12. Determine the inverse of a given function.		/				1	30
13. Solve simple logarithmic equations.			/			4	31,3 2,33 ,34

14. Solve problems involving exponential and logarithmic functions.				/		2	35,3 6
15. Convert angle measures from degree to radian and vice versa.		/			/	3	37,3 8,39
16. Determine the coordinates of their intersection of the given unit circle and the terminal side of an angle in standard position.		/				2	40,4 1
17. Solve simple trigonometric equations.				/		2	42,4 3
18. Apply knowledge and skills related to circular functions and trigonometric equations in problem solving.				/		7	44,4 5,46 ,47, 48,4 9,50
19. Interpret data.		/	/			4	57,5 8,59 ,60
20. Find the measure of central tendency of grouped/ ungrouped data (mean, median, mode).		/	/	/	/	3	51,5 2,53
21. Compute the different measures of variability relative to the given set of data, grouped or ungrouped.		/				3	54,5 5,56

3. Selecting the Appropriate Item Format

The nature of the test and the wide range of skills and competencies require the multiple-choice type of test because of its flexibility. As emphasized by Grondlund and Linn (1990), multiple-choice test items is the most highly regarded and most widely used form of test because of its flexibility and capability of measuring a variety of outcomes from the simple learning outcome to the more complex ones. Hence, the item format of the test constructed is multiple-choice. According to Marquez (2004), it is the most appropriate for the measurement of educational outcomes such as knowledge, understanding and

judgment ability to solve problems and the ability to make predictions. Multiple-choice test allows more directness in inferring information from the raw data. If the items were carefully constructed, this type is less ambiguous to the students than some other test forms. Multiple-choice test can be very well serve a useful purpose in the measurement of educational achievement. It measures the best or maximum performance of the students.

Phase II – Writing Stage

After developing and evaluating the table of specifications by the experts, writing the test items is the next thing to do. The target of the researcher will be 50 test items in the final draft. The researcher constructed 100 test items in the actual draft. As Oriondo (1989) says the number of items in the first draft should be at least 25 % more than the expected number of items in the final draft, “write more items than are actually needed” as one of the principles. This will provide the allowance of rejecting undesirable items, poorly worded and defective items that may be found later.

1. Writing the Test Items

The instrument is divided into two parts. The first part of the test uses the multiple choice type of test with four options. It consists of 60% easy items 30 % average items and 10% difficult items. The test items were modeled in the samples of the division achievement test. The second part contains open ended questions. It has 10 items. The researcher included the open ended question to

test whether the examinee really knows the competencies because in the first part of the test it is a multiple type of test and it is susceptible for guessing. While writing the test items, the researcher constantly referred to the table of specification so that no content was overlooked or over emphasized. The researchers also underwent personal editing of the test items.

2. Consultation with the experts

The table of specification and the test item that was constructed was given to at least three mathematics faculty members of the school and to the researcher's adviser for further critiquing and evaluation. The experts were asked to inspect the instrument according to the choice of words and grammar. Both the table of specification and the test items were submitted for them to evaluate if the test items were constructed appropriately and represent the corresponding objectives.

The following are the criteria to be given to the experts in evaluating both tables of specifications and the test items as suggested by Oriundo (1989) and (Devine, Marjorie & Yaghlian , Nevart).

- a. Does each item measure an important learning outcome included in the table of specifications?
- b. Is every item appropriate for the learning outcome to be measured?
- c. Does each item present clearly formulated task?

- d. Is every item stated in simple, clear language?
- e. Are the items free from extraneous clues?
- f. Is the difficulty of every item appropriate?
- g. Is every item independent? And were items, as a group, free from overlapping?
- h. Do the items included in the test provide adequate coverage of the table of specifications?

3. Revision and Improvement of the test Items

After the experts have evaluated the instrument, suggestions were incorporated in the process of revising and improving the test. Some of the suggestions were incorporated in the revising and improving of the test. Some of the suggestions were the a) rewording of the items b) reduction of items in the objectives with numerous items and c) elimination of some knowledge items. In the item pool of the test, there were 85 items. Because of these suggestions, the number of items was reduced to 75. Though the items were reduced, the researcher made sure that all the objectives included in the table of specifications were sufficiently represented.

Phase III- Trying – Out Stage

1. Administration of the First Try Out

There were five objectives that the researcher would like to realize in the first tryout. The objectives of the first try out were to: 1) determine the clarity of the directions; 2) identify the desirable, weak and defective items; 3) determine the difficulty and discrimination indices of the items using John Stockleins (1957) U-L index method; 4) assess the plausibility of the options on the multiple choice items; and, 5) appraise the appropriateness of the vocabulary used. In addition, typographical errors, if there were any, will be corrected.

The first tryout was administered to 80 fourth year students of Rizal National High School, 40 students of Manoot National High School, Aguas National High School and Magsikap National Vocational High School. The conduct of the examination was coordinated through the principal, teachers and advisers of fourth year students through request letter (Appendix E).

The test was administered in Manoot National High School and Magsikap National High School on March 3, 2015, and in Rizal National High School and Aguas National high school on March 4, 2015. A total of 199 respondents took the test during the first tryout.

In the first part, each item is assigned one point so the possible maximum score for the first part is the total number of items. In the second part, the open ended questions, respondents were required to show their solution. Each item is

given 5 points if it follows the steps in solving the word problem, 4 points if it lacks 1 of the steps, 3 points if it lacks 2 of the steps, 2 points if the respondents write only two of the steps, and 1 point if the respondents write only the final answer. A total of ten items was included in the open ended question. The highest possible score in this part is 50 and the lowest possible score is zero.

Table I
Means and Standard Deviation of the Results of the First Try Out

PARTS	MEAN	STANDARD DEVIATION
Part I	36.5	11.08
Part II	17.03	9.11

2.First Item Analysis

After scoring the test papers, item analysis was conducted, the difficulty and discriminating power of the items and the effectiveness of the option were determined. According to Ferguson (1979), high validity and reliability can be built onto the instrument in advance through item analysis. This process checks whether each item is “differentiating” (Sevilla, et. al. 2002). The item was analyzed using the U-L method. This technique was advanced by John Stocklein (1957) and is appropriate for the tests whose criterion is measured along a continuous scale (e.g. scholastic ratings, job ratings performance records,

achievement test scores) and whose individual item is scored right or wrong and positive or negative. The steps are:

1. Score the test papers and rank them from highest to lowest, according to the score.
2. Separate the top 27% and the bottom 27% of the test papers.
3. Tally the responses made to each test item by each individual in the upper 27% group.
4. Tally the responses made to each test item by each individual in the lower 27%.
5. Compute the percentage of the upper group that got the item right and call it U.
6. Compute the percentage of the lower group that got the item right and call it L.
7. Average U and L percentages and the result are the difficulty index of the item.
8. Subtract the L percentage from the U and the result is the discrimination index.

The difficulty index of the item is the percentage of the respondents who got the item right. It can also be interpreted as how easy or how difficult an item is. The discrimination index separates the bright respondents from the dull

respondents. Thus, a good test item separates the bright respondents from the dull ones. After the item analysis, the table for interpreting difficulty index and discrimination index in Table 2 as suggested by Oriondo et. Al was used. Table 3 is the Action Table as suggested by (Padua, et. al. 1997). It suggests what to do with each item if it is being retained, to be revised, or to be discarded. Items with both poor discrimination and difficulty indices were either discarded or revised depending on whether or not they were the only ones measuring an objective.

Table 2
Table for Interpreting Difficulty Index and Discrimination Index

<i>Difficulty Level</i>		<i>Discrimination Level</i>	
<i>Range of Difficulty Indices</i>	<i>Interpretation</i>	<i>Range of Discrimination Indices</i>	<i>Interpretation</i>
0.00-0.20	Very Difficult	-1.00-0.10	Questionable
0.21-0.40	Difficult	-0.09-.10	Not Discriminating
0.41-0.60	Moderately Difficult	0.11-0.20	Moderately Discriminating
0.61-0.80	Easy	0.21-0.80	Discriminating
0.81-1.00	Very Easy	0.81-1.00	Very Discriminating

Difficulty indices that show very difficult or very easy items are likely to be discarded, while overly discriminating or questionable items are also to be

discarded. It follows that we only have nine possible combinations to be studied for action.

Table 3
Action Table

Difficulty Level	Discriminating Level	Action
	Not Discriminating	Discard
Difficult	Moderately Discriminating	Needs Revision
	Discriminating	May need revision
Moderately Difficult	Not Discriminating	Needs Revision
	Moderately Discriminating	May need revision
	Discriminating	Accept
Easy	Not Discriminating	Discard
	Moderately Discriminating	Needs revision
	Discriminating	May need revision

The level of difficulty of an item has some relation with the discriminatory power of the item. In fact, difficult items were more likely discriminating while easy items were non–discriminating.

The 199 test papers were then arranged according to the scores from the highest down to the lowest. The U-L Index method was then employed to separate the upper 27% and the lower 27%. From the 199 test papers that were used in the item analysis as shown in Appendix A, the result generally shows that the most of the items were desirable or to be retained. Table 4 contains the summary of the results of the first tryout. The number of items to be retained, to be revised, and to be rejected are indicated below.

Table 4
Summary of the Results of the First Try –Out

Number of Items	Remarks
16	Retained
53	Revised
6	Rejected

The items whose difficulty index within the range of 0.20 and 0.80 and at least 0.20 discrimination index were retained. Items that passed either criterion, but not both, were considered for revision, while items that failed both criteria were rejected. The item analysis in the first draft yielded about 21% of the 75 items or 16 items were for retention, about 71% of the 75 items or 53 items were for revision and about 8% of the 75 items were for rejection. The researcher properly viewed the items that needed revision. Items that were found to be very difficult or very easy, revisions were made on the stem and or the options of the items.

2. Administering the Second Try Out

After the analysis of the table of specification and the retained and revised test items a new table of specification indicating the new item placement

prepared. The objectives and the content areas were the same as the first one used in the beginning.

The second tryout was conducted with the other 80 students of Rizal National High School, and 50 fourth year students from the remaining secondary schools of Rizal district. The researcher asked permission from the three secondary school head through a letter of request to administer the instrument in their respective school. A total of 128 respondents took the examination during the second tryout. The second try out yielded a mean of 27.93 with the standard deviation of 9.62. Table 5 summarizes the result of the second tryout.

Table 5
Mean and Standard Deviation of the Results of the Second Try Out

Mean	Standard Deviation
27.93	9.62

4. Second Item Analysis

Another item analysis was conducted on the results of the second tryout following the steps that were undertaken in the first tryout. All the 128 test papers were considered in determining the upper 27% and lower 27% that were used in the analysis of the test items. The purpose of the second tryout is to determine if the revised items had improved in terms of difficulty and discrimination indices and if the revised items are consistently good in terms of the two indices. The

same table of values was used in defining the difficulty and discrimination indices of each item. The results of the second analysis are shown in Appendix C. Table 6 contains the summary of the item analysis.

Table 6
Summary of the Results of the Second Try- Out

Number of Items	Remarks
21	Number of retained items
35	Number of items for revision
13	Number of rejected items
4	Number of item to be rejected but retained

Out of 69 items in the second draft, 21 items were identified for retention, 35 items for revision and the remaining 13 items for rejection. The table of specifications was again used in evaluating items that need to be retained. All of the 4 items to be rejected were revised and were included in the final draft, the four items are the only items representing the objective. Option analysis was also undertaken and the result is shown in Appendix D.

Phase IV- Evaluation Stage

1 .Administration of the Final Form of the Instrument

After the thorough preparation of the final draft of the achievement test, the researcher coordinated for the conduct of the final try out to the remaining 80 students of Rizal National High School. The test administration was intended for the evaluation of the instrument, the result was used in estimating the reliability and validity of the instrument.

2. Establishing Reliability

Reliability refers to the degree to which the instrument yields consistent results. Reliability is a prerequisite to validity, and that an instrument may only be valid if it is reliable.

The remaining two sections of fourth year students of Rizal National High School were the respondents used in establishing reliability of the instrument.

2.1 Internal consistency

One way of estimating internal consistency is using the **split-half method**. The split-half method was only applied to the first half of the test, the multiple type of test, that is, dividing the whole test into two comparable parts. The scores from the odd-numbered and even-numbered items were separated. The coefficient of correlation obtained using the Pearson r through the Microsoft Excel is 0.55 for the first part and 0.77 for the open ended question. Since the

two sets of scores were just halves of the test, the obtained Pearson r is the reliability of the half of the test. A correction formula, the Spearman-Brown Prophecy formula was used to determine the coefficient of the whole test. Using the Spearman–Brown Correction formula yielded a coefficient of 0.70 for the whole test. The use of this formula was guided by certain principles (Padua, 1997): a. the reliability computed reveals only the internal consistency of the test; b. split –half reliability coefficient is meaningful in speed tests; and c. reliability coefficients computed in this manner will generally be higher than the other coefficients.

Table 7 summarizes the internal consistency coefficient of the instrument as gleaned from the split half methods using the Pearson Product–Moment correlation formula or the Pearson r and corrected by the Spearman–Brown Prophecy formula.

Table 7

Internal Consistency Coefficients from Split –half Methods

	Pearson r Formula	Spearman Brown Formula
Odd-Even Halves	0.55	0.70

3. Establishing Validity

Validity is the most important characteristic of a test. Validity encompasses all other desirable characteristics. One of these types of validity is

the criterion–related validity. This validity is determined by relating performance on a test on another criterion (Gay, 1987). One of the ways of estimating criterion–related validity is congruent validity.

The researcher asked the permission from the department head of mathematics of Rizal National High school to use the 2013-2014 National Achievement test for the tryout of the test among 80 of their students.

Table 8

Means and Standard Deviation of 71 Fourth year Respondents

Mean	Standard Deviation
38.85	7.05

Table 8 contains the means and standard deviation of 71 students who took the 2013-2014 National Achievement Test. The 71 students get 38.85 mean and the standard deviation of 7.05.

Chapter IV

Analysis of Findings and Interpretation of Data

TEST MANUAL

A. Descriptions

What the Test Measures

The 60-item test instrument is designed to determine the strength and weaknesses of the students in different competencies of mathematics IV. The first part is a multiple choice type of test. It measures the amount of mathematical knowledge and skills they acquired from the whole year round. It also determines the readiness and the ability to perform mathematical tasks related to topics that were not yet encountered. The second part contains open ended questions, the examinee is required to solve the items and show their solution.

B. Test Administration

Mathematics examinations require concentration and focus. It needs venues and environment that are free from disturbances. Examination room must be properly prepared, certain factors be looked into such as the physical condition of the room and the seating arrangement, and the examinee. It

takes one and a half hour to finish. Test paper, answer sheet, scratch paper, and pencil or ball pen are the needed materials.

Standard Procedures

The examiner will distribute the test papers, scratch papers and the answer sheet to the examinees and will say, "In your answer sheet write the necessary information, your name, section, date, and name of your school." The examiner should see to it that the examinees supplied the data completely before allowing them to start the examination.

The examiner will instruct the examinees by saying, "Do not write anything or put any mark on the test booklet. A separate answer sheet is provided for your answers. You are given 1 and $\frac{1}{2}$ hours to finish the test. Each item has four answer options to choose from. Select your answer from the given choices. You may use a clean sheet of paper for your computation. Work quietly and mind only your own work. Do not use calculators and cell phones." The examiner will write on the board the time the test started and time the test is to be ended. The examiner may further say, "Work fast enough so you can finish the test in the given time. If you finish the test ahead of time, review your answers. You may change your answer by erasing it neatly. If there is any question regarding the exam, ask now before you start the test. If none, you may start now."

After the examinees finished the test, the examiner will say, "Put the answer sheet above the test paper together with the scratch paper. Pass it to your right and pass it to the front." The examinees will then be allowed to leave the examination room quietly. The examiner separates the answer sheet, scratch paper and the test paper.

C. SCORING

The items in the multiple-choice type will be assigned one point each. Since there are 60 items, the highest possible score would be 60 and the lowest possible score would be zero for the first part. In the second part, the open ended questions, respondents were required to show their solution. Each item is given 5 points if it follows the steps in solving the word problem, 4 points if it lacks 1 of the steps, 3 points if it lacks 2 of the steps, 2 points if the respondents write only two of the steps, and 1 point if the respondents write only the final answer. A total of ten items was included in the open ended question.. The highest total score an individual can earn is 110, or 60 for the first part and 50 for the second part.

Philippine Normal University

Taft Avenue, Manila

FOURTH YEAR MATHEMATICS ACHIEVEMENT TEST FOR PUBLIC SCHOOLS

Part I. Directions: Answer each of the following items and choose the best answer. Write only the letter on the provided answer sheet.

1. Which of the following relations is **NOT** a function?
a. $\{(0,1), (1,2), (2,3)\}$
b. $\{(0,1), (1,2), (2,3)\}$
c. $\{(-1,1), (1,1), (-2,1)\}$
d. $\{(5,5), (6,6), (7,7)\}$
2. If a point has the coordinates $(\frac{-\sqrt{2}}{2}, \frac{-\sqrt{2}}{2})$ on a unit circle, then it lies in what quadrant?
a. IV
b. III
c. II
d. I
3. What is the mode?
a. 11
b. 10.5
c. 10.4
d. 10
4. What is the mean?
a. 11
b. 10.5
c. 10.4
d. 10
5. What is the range?
a. 10
b. 10.4
c. 10.5
d. 11
6. The greatest number of members is in what age group?
a. 60
b. 55
c. 50
d. 40
7. If $f(x) = 5x^2 - 3x + 2$, what is $f(-2)$?
a. 28
b. -16
c. 24
d. 22
8. The sum of the digits of a two-digit number is 8. If the digits are reversed, the new number is 18 more than the original number. Find the original number.
a. 33
b. 35
c. 53
d. 34
9. What is the remainder when $(2x^3 - 8x^2 + 5x - 3)$ is divided by $(x - 1)$?
a. 4
b. -3
c. 2
d. -4

10. Given: $P(x) = 2x^4 + 3x^3 - 6x^2 - 5x + 6$ and $D(x) = 2x + 3$. If $P(x)$ is divided by $D(x)$ what will be the result?

a. $x^3 - 3x + 2$
b. $x^3 + 3x - 2$

c. $x^2 - 3x + 2$
d. $x^3 + 3x + 2$

11. Using the factor theorem, which is a factor of $x^2 - 5x + 6$?

a. $x - 2$

b. $x - 1$

c. $x + 1$

d. $x + 3$

12. Convert 480° to radian measure.

a. $\frac{2\pi}{3}$

b. $\frac{4\pi}{3}$

c. $\frac{7\pi}{3}$

d. $\frac{8\pi}{3}$

13. In a 30° - 60° - 90° triangle, the hypotenuse measures 10 cm. What is the measure of the side opposite the 30° angle?

a. 5 cm

b. 10 cm

c. 15 cm

d. 20

14. What is the median of the recorded scores?

a. 63.98

b. 58.99

c. 56.50

d. 56.45

15. If the range of a set of scores is 14 and the lowest score is 7, what is the highest score?

a. 21

b. 20

c. 19

d. 7

Part II. Answer the following questions. Write your detailed computation and encircle your final answer.

1. If $f(x) = 2x^2 + 5x - 3$, what is $f(-1)$?

2. What is the x intercept of $-2x - 5y - 8 = 0$?

3. Find the slope of the line through the points G(-2,3) and H(4,3).

4. Find the roots of $x^2 - 6x - 7 = 0$.

5. What is the equation of the axis of symmetry of the parabola defined by $y = \frac{1}{2}x^2 + 4x - 1$?

6. What is the remainder when $x^3 - 5x^2 - 7x + 4$ is divided by $x + 1$?

7. What is $\frac{11}{\pi}$ in degrees?

Consider the following to answer question numbers 8 to 10: Nine people gave contributions in pesos 100, 200, 100, 300, 300, 200, 150, 100, and 100 for a door prize.

8. What is the median of the contributions?
9. What is the mean of the contributions?
10. What is the mode of the contributions

Chapter V

SUMMARY OF FINDINGS, CONCLUSIONS and RECOMMENDATIONS

Summary

The study focused on the development and validation of mathematics achievement test in a public school. The instrument has 60 items in the multiple-choice type and ten items of open ended question.

The process of developing and validating the instrument involved the following phases: Phase I- Planning Stage, Phase II – Item Writing Stage, Phase III- Trying Out Stage, Phase IV- Evaluation Stage and the Preparation of the test Manual.

To identify the major parts of the test is the first stage in the test development process. The achievement test would measure the cognitive skills (knowledge/comprehension, application, analysis and problem solving) of the respondents. The contents of the instrument were based from the secondary fourth year mathematics learning competencies. Content areas were specified in the two-way grid table of specifications. To ensure the content validity of the instrument, the table of specification was prepared in addition to the suggestions made by the experts during the consultation with them.

Item analysis was also undertaken every after the first two try outs using the U-L Method. The item analyses resulted in the reduction of items from 75 in the first draft to 60 items respectively in the final draft.

In the Evaluation stage of the instrument, the split –half method was used to measure the reliability, internal consistency was estimated using the split–half method. The reliability coefficient in the split- half was computed using Pearson Product Moment Correlation (Pearson r) and was corrected using the Spearman

Brown Prophecy Formula. The validity of the instrument was the ultimate goal of the researcher for the instrument. Aside from the content validity of the instrument, criterion related validity was also determined, specifically the concurrent validity of the instrument. The scores of the respondents in part I of the test was correlated with their scores in the open ended questions using the Pearson Product Moment Correlation. The scores of the examinees were also correlated with their scores in 2013-2014 National Achievement Test using the Pearson Product Moment Correlation.

Finally, the researcher also prepared test manual for the instrument. It includes the descriptions of the instrument, test administration procedures, scoring system and score interpretation.

Findings

The newly developed instrument, mathematics achievement test for the fourth year is composed of the 60 item multiple-choice type test for the first part, and the 10 item open-ended question type test for the second part.

0.55 and 0.70 are two reliability coefficients obtained using the split-half method through the Pearson r and corrected by Spearman Brown formula both which imply that the test has internal consistency.

The instrument was found to be valid. First, the concurrent validity was established by correlating the scores of the first part of the scores in the open ended questions which yielded 0.76. Second the scores of the examinees were correlated with their score in 2013-2014 National Achievement Test, 0.88 was the obtained coefficient of correlation. Both were found to be significant.

Recommendations

The researcher is aware that much is still to be done to refine the instrument. To this end and for the instrument to yield more reliable and more valid results she recommends that:

1. The instrument must also be tried out in the other districts in the Division of Occidental Mindoro.
2. Test-retest as a method of establishing reliability should be undertaken to determine the stability of the instrument, and to strengthen what was derived earlier.
3. Similar studies in other major fields like Science, Filipino, English, Araling Panlipunan be conducted
4. The developed achievement test be utilized in evaluating the achievement level of fourth year students in Mathematics.
5. Pupils mathematical strength and weaknesses be identified using the result of the test
 - The result of the achievement test be utilized as basis of programs for the student's development or remediation.

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APPENDICES

Appendix A

Item Analysis Based on the First Try Out								
Item No.	Correct Answer	F U 27%	F L 27%	P U 27%	P L 27%	Difficulty Index	Discrimination Index	Remarks
1	a	53	20	0.981	0.37	1.167	0.611	Reject
2	c	52	29	0.963	0.537	1.231	0.426	Revise
3	b	32	23	0.593	0.426	0.806	0.167	Revise
4	a	48	33	0.889	0.611	1.194	0.278	Revise
5	c	50	29	0.926	0.537	1.194	0.389	Revise
6	a	50	29	0.926	0.537	1.194	0.389	Revise
7	d	48	24	0.889	0.444	1.111	0.444	Revise
8	a	31	16	0.574	0.296	0.722	0.278	Accept
9	d	36	12	0.667	0.222	0.778	0.444	Accept
10	c	45	9	0.833	0.167	0.917	0.667	Revise
11	b	12	10	0.222	0.185	0.315	0.037	Revise
12	d	16	6	0.296	0.111	0.352	0.185	Revise
13	b	12	9	0.222	0.167	0.306	0.056	Revise
14	d	17	7	0.315	0.13	0.38	0.185	Revise
15	a	38	19	0.704	0.352	0.88	0.352	Revise
16	c	41	10	0.759	0.185	0.852	0.574	Revise
17	a	45	4	0.833	0.074	0.87	0.759	Revise
18	d	48	19	0.889	0.352	1.065	0.537	Revise
19	a	48	11	0.889	0.204	0.991	0.685	Revise
20	c	43	17	0.796	0.315	0.954	0.481	Revise
21	a	32	17	0.593	0.315	0.75	0.278	Accept
22	d	37	12	0.685	0.222	0.796	0.463	Accept
23	b	39	13	0.722	0.241	0.843	0.481	Revise
24	c	36	9	0.667	0.167	0.75	0.5	Accept
25	b	26	10	0.481	0.185	0.574	0.296	Accept
26	c	45	10	0.833	0.185	0.926	0.648	Revise
27	b	24	19	0.444	0.352	0.62	0.093	Revise
28	a	10	9	0.185	0.167	0.269	0.019	Revise
29	d	38	16	0.704	0.296	0.852	0.407	Revise
30	a	46	19	0.852	0.352	1.028	0.5	Revise
31	a	50	20	0.926	0.37	1.111	0.556	Revise

32	c	46	20	0.852	0.37	1.037	0.481	Revise
33	a	44	14	0.815	0.259	0.944	0.556	Revise
34	c	35	8	0.648	0.148	0.722	0.5	Accept
35	a	25	9	0.463	0.167	0.546	0.296	Accept
36	d	33	10	0.611	0.185	0.704	0.426	Accept
37	a	38	12	0.704	0.222	0.815	0.481	Revise
38	d	44	12	0.815	0.222	0.926	0.593	Revise
39	a	32	7	0.593	0.13	0.657	0.463	Accept
40	b	36	21	0.667	0.389	0.861	0.278	Revise
41	c	19	6	0.352	0.111	0.407	0.241	Accept
42	a	15	15	0.278	0.278	0.417	0	Revise
43	c	44	29	0.815	0.537	1.083	0.278	Revise
44	a	48	22	0.889	0.407	1.093	0.481	Revise
45	d	39	18	0.722	0.333	0.889	0.389	Revise
46	b	39	17	0.722	0.315	0.88	0.407	Revise
47	c	38	19	0.704	0.352	0.88	0.352	Revise
48	b	50	16	0.926	0.296	1.074	0.63	Reject
49	d	39	9	0.722	0.167	0.806	0.556	Revise
50	a	27	9	0.5	0.167	0.583	0.333	Accept
51	d	12	8	0.222	0.148	0.296	0.074	Revise
52	a	23	18	0.426	0.333	0.593	0.093	Revise
53	b	7	6	0.13	0.111	0.185	0.019	Revise
54	c	14	7	0.259	0.13	0.324	0.13	Revise
55	a	16	11	0.296	0.204	0.398	0.093	Revise
56	d	21	13	0.389	0.241	0.509	0.148	Revise
57	a	20	15	0.37	0.278	0.509	0.093	Revise
58	c	18	14	0.333	0.259	0.463	0.074	Revise
59	d	23	11	0.426	0.204	0.528	0.222	Accept
60	d	8	17	0.148	0.315	0.306	-0.17	Revise
61	a	38	32	0.704	0.593	1	0.111	Reject
62	c	35	26	0.648	0.481	0.889	0.167	Reject
63	a	30	26	0.556	0.481	0.796	0.074	Reject
64	c	13	12	0.241	0.222	0.352	0.019	Revise
65	b	22	9	0.407	0.167	0.491	0.241	Accept
66	d	16	7	0.296	0.13	0.361	0.167	Revise
67	a	43	28	0.796	0.519	1.056	0.278	Revise
68	b	11	17	0.204	0.315	0.361	-0.11	Revise
69	d	18	4	0.333	0.074	0.37	0.259	Accept

70	c	31	16	0.574	0.296	0.722	0.278	Accept
71	b	46	37	0.852	0.685	1.194	0.167	Reject
72	d	44	32	0.815	0.593	1.111	0.222	Revise
73	a	45	27	0.833	0.5	1.083	0.333	Revise
74	c	40	24	0.741	0.444	0.963	0.296	Revise
75	a	35	22	0.648	0.407	0.852	0.241	Revise

N= 199

16- Number of items to be retained

53- Number of items to be revised

6- Number of items to be rejected

Appendix B

Plausibility Index of Options Based on the First Try Out														
	A		B		C		D		No Answer		Option Plausibility Index (U-L)			
Item No	U 27 %	L 27 %	U 27 %	L 27 %	U 27 %	L 27 %	U 27 %	L 27 %	U 27 %	L 27 %	A	B	C	D
1	54	9	0	2	0	4	1	3	2	0	*45	-2	-4	-2
2	1	8	0	2	54	8	0	0	0	2	-7	-2	*42	0
3	8	7	33	10	0	0	11	3	0	0	1	*23	0	8
4	51	11	2	3	0	0	2	6	0	0	*40	-1	0	-4
5	0	0	2	3	53	13	1	4	0	0	0	-1	*40	-3
6	42	6	0	4	3	6	1	4	0	0	*36	-4	-3	-3
7	3	7	0	1	1	0	51	12	0	0	-4	-1	1	*39
8	27	8	16	8	2	2	6	2	0	0	*19	8	0	4
9	0	6	2	5	11	7	43	2	0	0	-6	-3	4	*41
10	4	6	3	5	46	7	2	2	0	0	-2	-2	*39	0
11	29	6	6	4	12	6	8	4	0	0	23	*2	6	4
12	27	6	10	5	15	7	14	2	0	0	21	5	8	*12
13	31	11	11	8	7	1	4	0	0	0	20	*3	6	4
14	12	8	7	5	13	4	22	3	0	0	4	2	9	*19
15	45	7	2	5	8	6	6	2	0	0	*38	-3	2	4
16	5	7	7	6	39	5	4	2	0	0	-2	1	*34	2
17	6	2	8	6	0	4	1	8	0	0	*4	2	-4	-7
18	0	1	1	2	4	9	35	8	0	0	-1	-1	-5	*27
19	34	9	6	3	15	7	0	1	0	0	*25	3	8	-1
20	15	7	0	6	38	6	2	1	0	0	8	-6	*32	1
21	38	5	0	4	16	7	0	4	0	0	*33	-4	9	-4
22	7	6	2	5	4	7	42	2	0	0	1	-3	-3	*40
23	13	5	37	8	7	3	0	4	0	0	8	*29	4	-4
24	0	3	16	5	38	5	3	7	0	0	-3	11	*33	-4
25	1	1	22	8	22	9	8	2	0	0	0	*14	13	6
26	2	3	6	8	42	5	6	6	0	0	-1	-2	*39	0
27	6	9	12	8	21	1	16	2	0	0	-3	*4	20	14
28	8	3	27	8	16	8	4	0	0	0	*5	19	8	4
29	5	8	6	2	3	5	40	5	0	0	-3	4	-2	*35
30	42	6	11	9	1	3	1	2	0	0	*36	2	-2	-1

31	53	12	2	4	0	4	0	4	0	0	*41	-2	-4	-4
32	2	6	4	0	45	10	3	2	0	0	-4	4	*35	1
33	44	6	3	6	3	6	5	4	0	0	*38	-3	-3	1
34	7	5	13	9	32	2	0	4	0	0	2	4	*30	-4
35	34	2	13	9	5	6	3	4	0	0	*32	4	-1	-1
36	12	14	3	1	5	1	36	4	0	0	-2	2	4	*32
37	38	5	10	6	1	6	6	4	0	0	*33	4	-5	2
38	5	4	1	7	3	4	46	7	0	0	1	-6	-1	*39
39	27	1	9	7	0	5	17	6	0	0	*26	2	-5	11
40	10	5	35	9	7	0	9	2	0	0	5	*26	7	7
41	11	10	9	0	16	8	13	3	0	0	1	9	*8	10
42	15	10	9	5	21	2	10	2	0	0	*5	4	19	8
43	3	5	1	2	59	2	2	3	0	0	-2	-1	*57	-1
44	49	8	6	4	0	1	0	6	0	0	*41	2	-1	-6
45	0	5	6	3	10	6	39	6	0	0	-5	3	4	*33
46	2	3	42	5	17	6	3	6	0	0	-1	*37	11	-3
47	4	5	4	5	44	8	4	2	0	0	-1	-1	*36	2
48	4	2	31	8	6	2	12	8	0	0	2	*23	4	4
49	4	4	3	5	4	7	3	4	0	0	0	-2	-3	*-1
50	30	4	8	5	9	8	7	3	0	0	*26	3	1	4
51	6	5	8	8	25	2	11	5	0	0	1	0	23	*6
52	27	6	10	4	3	7	5	4	0	0	*21	6	-4	1
53	10	5	6	5	33	7	6	3	0	0	5	*1	26	3
54	11	6	11	6	15	3	19	5	0	0	5	5	*12	14
55	13	4	7	4	28	5	7	5	0	0	9	*3	23	2
56	11	6	7	6	8	3	19	4	0	0	5	1	5	*15
57	19	6	10	4	9	5	12	5	0	0	*13	6	4	7
58	27	4	4	8	19	3	5	5	0	0	23	-4	*16	0
59	1	3	12	5	21	7	11	5	0	0	-2	7	14	*6
60	10	3	10	7	26	7	9	3	0	0	7	3	19	*6
61	39	5	2	3	12	7	2	3	0	0	*34	-1	5	-1
62	4	5	12	3	40	7	9	5	0	0	-1	9	*33	4
63	35	4	5	7	5	4	10	5	0	0	*31	-2	1	5
64	11	5	8	7	12	5	24	3	0	0	6	1	*7	21
65	8	5	22	6	10	4	15	5	0	0	3	*16	6	10
66	17	8	11	5	8	4	19	3	0	0	9	6	4	*16

67	44	6	5	4	2	8	4	2	0	0	*38	1	-6	2
68	17	5	15	5	11	5	12	5	0	0	12	*10	6	7
69	13	5	8	8	11	4	22	4	0	0	8	0	7	*18
70	8	8	5	6	35	4	7	3	0	0	0	-1	*31	4
71	1	6	49	6	4	6	1	2	0	0	-5	*43	-2	-1
72	0	5	4	4	3	5	48	6	0	0	-5	0	-2	*42
73	42	5	7	5	3	5	3	4	0	0	*37	2	-2	-1
74	2	4	4	5	40	7	9	4	0	0	-2	-1	*33	5
75	37	5	12	6	6	6	5	3	0	0	*32	6	0	2

Legend:

- * Correct Answer
- The index of plausibility of a correct option is positive
- The index of plausibility of a correct option is negative

Appendix C

Item Analysis Based on the Second Try Out								
Item No.	Correct Answer	F U 27%	F L 27%	P U 27%	P L 27%	Difficulty Index	Discrimination Index	Remarks
1	C	26	19	0.74	0.54	1.01	0.20	Revise
2	B	17	13	0.49	0.37	0.67	0.11	Revise
3	A	15	7	0.43	0.20	0.53	0.23	Accept
4	C	27	15	0.77	0.43	0.99	0.34	Revise
5	A	29	5	0.83	0.14	0.90	0.69	Reject
6	D	30	10	0.86	0.29	1.00	0.57	Revise
7	A	20	9	0.57	0.26	0.70	0.31	Accept
8	D	21	2	0.60	0.06	0.63	0.54	Accept
9	C	18	13	0.51	0.37	0.70	0.14	Revise
10	B	17	6	0.49	0.17	0.57	0.31	Accept
11	D	7	4	0.20	0.11	0.26	0.09	Revise
12	B	28	12	0.80	0.34	0.97	0.46	Revise
13	D	3	11	0.09	0.31	0.24	-0.23	Revise
14	A	21	5	0.60	0.14	0.67	0.46	Accept
15	C	27	5	0.77	0.14	0.84	0.63	Reject
16	A	27	2	0.77	0.06	0.80	0.71	Reject
17	D	28	11	0.80	0.31	0.96	0.49	Revise
18	A	23	12	0.66	0.34	0.83	0.31	Revise
19	C	22	7	0.63	0.20	0.73	0.43	Accept
20	A	25	9	0.71	0.26	0.84	0.46	Revise
21	D	27	5	0.77	0.14	0.84	0.63	Revise
22	B	23	3	0.66	0.09	0.70	0.57	Accept
23	C	24	3	0.69	0.09	0.73	0.60	Accept
24	B	2	8	0.06	0.23	0.17	-0.17	Reject
25	C	23	11	0.66	0.31	0.81	0.34	Revise
26	B	28	2	0.80	0.06	0.83	0.74	Reject
27	A	4	8	0.11	0.23	0.23	-0.11	Revise
28	D	26	4	0.74	0.11	0.80	0.63	Reject
29	A	28	5	0.80	0.14	0.87	0.66	Reject
30	A	28	16	0.80	0.46	1.03	0.34	Revise
31	C	26	11	0.74	0.31	0.90	0.43	Revise
32	A	4	8	0.11	0.23	0.23	-0.11	Reject

33	C	24	4	0.69	0.11	0.74	0.57	Accept
34	A	21	4	0.60	0.11	0.66	0.49	Accept
35	D	20	7	0.57	0.20	0.67	0.37	Accept
36	A	25	10	0.71	0.29	0.86	0.43	Revise
37	D	8	6	0.23	0.17	0.31	0.06	Revise
38	A	23	4	0.66	0.11	0.71	0.54	Accept
39	B	7	8	0.20	0.23	0.31	-0.03	Revise
40	C	11	8	0.31	0.23	0.43	0.09	Revise
41	A	17	4	0.49	0.11	0.54	0.37	Accept
42	C	29	9	0.83	0.26	0.96	0.57	Revise
43	A	32	14	0.91	0.40	1.11	0.51	Revise
44	D	31	9	0.89	0.26	1.01	0.63	Reject
45	B	25	8	0.71	0.23	0.83	0.49	Revise
46	C	17	3	0.49	0.09	0.53	0.40	Accept
47	D	2	5	0.06	0.14	0.13	-0.09	Reject
48	A	3	3	0.09	0.09	0.13	0.00	Reject
49	D	8	5	0.23	0.14	0.30	0.09	Revise
50	A	11	2	0.31	0.06	0.34	0.26	Accept
51	B	7	9	0.20	0.26	0.33	-0.06	Revise
52	C	13	9	0.37	0.26	0.50	0.11	Revise
53	A	10	4	0.29	0.11	0.34	0.17	Revise
54	D	5	7	0.14	0.20	0.24	-0.06	Revise
55	A	10	8	0.29	0.23	0.40	0.06	Revise
56	C	16	10	0.46	0.29	0.60	0.17	Revise
57	D	18	14	0.51	0.40	0.71	0.11	Revise
58	D	21	11	0.60	0.31	0.76	0.29	Accept
59	C	7	8	0.20	0.23	0.31	-0.03	Revise
60	B	11	7	0.31	0.20	0.41	0.11	Revise
61	D	5	3	0.14	0.09	0.19	0.06	Reject
62	A	13	4	0.37	0.11	0.43	0.26	Accept
63	B	4	4	0.11	0.11	0.17	0.00	Reject
64	D	5	6	0.14	0.17	0.23	-0.03	Revise
65	C	19	9	0.54	0.26	0.67	0.29	Accept
66	D	21	8	0.60	0.23	0.71	0.37	Accept
67	A	18	3	0.51	0.09	0.56	0.43	Accept
68	C	11	9	0.31	0.26	0.44	0.06	Revise
69	A	19	4	0.54	0.11	0.60	0.43	Accept

N= 128

13= Number of rejected items

21= Number of retained items

35= Number of items for revision

4= Number of items for rejection but retained

Appendix D

Plausibility Index of Options Based on the Second Try Out														
Item No.	A		B		C		D		No Answer		Option Plausibility Index (U-L)			
	U 27 %	L 27 %	U 27 %	L 27 %	U 27 %	L 27 %	U 27 %	L 27 %	U 27 %	L 27 %	A	B	C	D
1	0	1	0	4	35	25	0	5	0	0	-1	-4	*1 0	-5
2	0	1	10	20	25	4	0	10	0	0	-1	* 10	21	-10
3	17	5	3	12	12	8	3	10	0	0	*12	-9	4	-7
4	0	1	0	5	32	27	3	2	0	0	-1	-5	*5	1
5	30	5	2	23	1	4	2	3	0	0	*25	-21	-3	-1
6	1	8	1	7	2	8	31	7	0	0	-7	-6	-6	*24
7	24	13	3	8	6	11	2	3	0	0	*11	-5	-5	-1
8	3	12	6	5	6	8	20	10	0	0	-9	1	*-2	*10
9	6	15	11	8	15	8	3	4	0	0	-9	3	*7	-1
10	13	11	12	15	9	4	1	5	0	0	2	*-3	5	-4
11	7	5	13	8	12	12	2	10	0	0	2	5	0	*-8
12	2	15	29	16	1	1	3	2	0	0	-13	*1 3	0	*1
13	25	5	4	8	4	11	2	12	0	0	20	-4	-7	*-10
14	25	8	2	12	5	11	2	4	0	0	*17	-10	-6	-2
15	5	15	7	4	24	5	0	11	0	0	-10	3	*1 9	-11
16	22	4	4	11	5	7	4	13	0	0	*18	-7	-2	-9
17	5	3	3	12	3	8	24	13	0	0	2	-9	-5	*11
18	17	6	3	12	5	8	15	9	0	0	*11	-9	-3	6
19	17	14	0	8	26	6	1	6	0	0	3	-8	20	-5
20	28	15	4	4	2	5	1	11	0	0	13	0	*-3	-10
21	9	5	1	8	2	11	23	12	0	0	4	-7	-9	*11
22	3	5	23	10	3	15	3	5	0	0	-2	*1 3	-12	-2
23	6	18	1	12	27	5	1	5	0	0	-12	-11	*	-4
24	13	6	6	16	9	2	7	11	0	0	7	* 10	7	-4
25	2	14	3	5	28	9	2	7	0	0	-12	-2	*1 9	-5

26	5	7	23	13	4	4	4	11	0	0	-2	*1 0	0	-7
27	0	18	0	7	33	5	2	5	0	0	*-18	-7	28	-3
28	1	9	3	13	3	8	28	5	0	0	-8	-10	-5	*23
29	13	12	6	1	8	17	8	5	0	0	*1	5	-9	3
30	21	2	3	2	11	20	0	3	0	0	*19	1	-9	-3
31	1	15	8	7	2	3	6	10	0	0	-14	1	*-1	-4
32	2	14	19	8	3	12	11	1	0	0	*-12	11	-9	10
33	3	8	0	12	27	13	5	2	0	0	-5	-12	*1 4	3
34	25	7	3	15	2	10	5	3	0	0	*18	-12	-8	2
35	18	16	1	12	4	3	12	4	0	0	2	-11	1	*8
36	31	7	0	6	3	12	1	10	0	0	*24	-6	-9	-9
37	17	18	5	7	6	6	7	4	0	0	-1	-2	0	*3
38	27	9	4	1	1	2	3	23	0	0	*18	3	-1	-20
39	12	1	3	27	14	6	5	1	0	0	11	*- 24	8	4
40	5	5	6	23	24	4	0	4	0	0	0	-17	*2 0	-4
41	23	12	4	1	6	6	2	9	0	0	*11	3	0	-7
42	0	8	2	16	32	5	1	12	0	0	-8	-14	*2 7	-11
43	16	17	2	5	14	6	3	7	0	0	*-1	-3	8	-4
44	3	19	8	2	2	3	22	11	0	0	-16	6	-1	*11
45	3	0	27	21	1	11	4	3	0	0	3	*6	-10	1
46	15	14	4	4	14	6	4	12	0	0	1	0	*8	-8
47	10	23	15	5	8	5	2	7	0	0	-13	10	3	*-5
48	21	8	1	5	10	16	3	6	0	0	*13	-4	-6	-3
49	6	12	7	1	12	6	10	9	0	0	-6	6	6	*1
50	14	20	4	10	6	2	12	3	0	0	*-6	-6	4	9
51	8	3	16	22	5	3	6	7	0	0	5	*-6	2	-1
52	11	4	9	13	9	7	6	11	0	0	7	-4	*2	-5
53	23	6	5	14	5	8	2	6	0	0	*17	-9	-3	-4
54	1	4	6	13	9	7	12	11	0	0	-3	-7	2	*1
55	20	5	10	12	2	8	3	5	0	0	*15	-2	-6	-2
56	3	10	3	15	22	3	7	7	0	0	-7	-12	*1 9	0
57	7	11	7	16	6	6	15	2	0	0	-4	-9	0	*13
58	26	3	2	10	4	2	3	20	0	0	23	-8	2	*-17
59	13	25	8	1	9	5	5	4	0	0	-12	7	*4	1
60	5	4	8	13	19	7	9	11	0	0	1	*-5	12	-2
61	20	8	4	17	9	8	3	4	0	0	12	-13	1	*-1

62	24	13	9	13	4	15	5	1	0	0	*11	-4	-11	4
63	17	8	8	15	8	10	4	2	0	0	9	*-7	-2	2
64	14	14	8	1	7	8	6	12	0	0	0	7	-1	*-6
65	19	9	4	1	7	12	6	6	0	0	10	3	*-5	0
66	11	6	3	20	5	7	3	2	0	0	5	-17	-2	*1
67	14	13	12	11	3	8	8	3	0	0	*1	1	-5	5
68	13	8	5	5	15	11	1	12	0	0	5	0	*4	-11
69	18	8	6	7	7	8	4	7	0	0	*10	-1	-1	-3

Appendix E

Letters of Request

And

Communications

Appendix E1

Philippine Normal University
College of Science
DEPARTMENT OF MATHEMATICS
Manila

February 25, 2015

MARIFE A. PAREDES
Principal III
Rizal National High School

Madame:

I am presently enrolled in MAT 550 (Seminar Paper) this 2nd Semester , school year 2014-2015 and working on my paper entitled 'Development and Validation of Fourth Year Mathematics Achievement Test for Public Schools'.

I intend to administer my instrument for my 'first try out' to fourth year students this coming March 3, 2015.

In this regard, may I ask permission from your Office to allow me to conduct my first try out to the two sections of fourth year students (IV-Aries and IV- Gemini).

Thank you very much.

Very respectfully yours,

CHARMIE R. CLATARO

Researcher

Noted:

WILMER G. MARQUEZ

Adviser

Appendix E2

Philippine Normal University
College of Science
DEPARTMENT OF MATHEMATICS
Manila

February 25, 2015

ELENA B. GENESE

Teacher –In Charge
Manoot National High School

Madame:

I am presently enrolled in MAT 550 (Seminar Paper) this 2nd Semester , school year 2014-2015 and working on my paper entitled “Development and Validation of Fourth Year Mathematics Achievement Test for Public Schools’. I intend to administer my instrument for my ‘first try out’ to fourth year students this coming March 3,2015.

In this regard, may I ask permission from your Office to allow me to conduct my first try out to one section of your fourth year students (IV-Diamond).

Thank you very much.

Very respectfully yours,

CHARMIE R. CLATARO

Researcher

Noted:

WILMER G. MARQUEZ

Adviser

Appendix E3

Philippine Normal University
College of Science
DEPARTMENT OF MATHEMATICS
Manila

February 25, 2015

GRACE A. OSANO

Principal I
Magsikap National High School

Madame:

I am presently enrolled in MAT 550 (Seminar Paper) this 2nd Semester , school year 2014-2015 and working on my paper entitled 'Development and Validation of Mathematics Achievement Test in a Public School'. I intend to administer my instrument for my 'first try out' to fourth year students this coming March 4, 2015.

In this regard, may I ask permission from your Office to allow me to conduct my first try out to one section of your fourth year students (IV-Peacock).

Thank you very much.

Very respectfully yours,

CHARMIE R. CLATARO

Researcher

Noted:

WILMER G. MARQUEZ

Adviser

Appendix E4

Philippine Normal University
College of Science
DEPARTMENT OF MATHEMATICS
Manila

February 25, 2015

MELINDA O. MENDOZA
Head Teacher III
Aguas National High School

Madame:

I am presently enrolled in MAT 550 (Seminar Paper) this 2nd Semester, school year 2014-2015 and working on my paper entitled. 'Development and Validation of Mathematics Achievement Test in a Public School'. I intend to administer my instrument for my 'first try out' to fourth year students this coming March 4, 2015.

In this regard, may I ask permission from your Office to allow me to conduct my first try out to one section of your fourth year students (IV-Diamond).

Thank you very much.

Very respectfully yours,

CHARMIE R. CLATARO

Researcher

Noted:

WILMER G. MARQUEZ

Adviser

Appendix E5

Philippine Normal University
College of Science
DEPARTMENT OF MATHEMATICS
Manila

February 26, 2015

Dear Colleagues,

In connection with my research paper entitled “Development and Evaluation of Fourth Year Mathematics Achievement Test for Public Schools”.

In this regard, may I ask you to announce the schedule to your respective Math IV class/es. May I ask you further to note that the administration of the examination on said date will not be made to appear to the examinee as a try out but as a part of their posttest in mathematics in preparation for the incoming National Achievement Test and included in the computation of their final grade in Mathematics.

Attached is my tentative schedule of visiting your school to administer the instrument for the first, second and final try out.

Thank you very much.

Very respectfully yours,

CHARMIE R. CLATARO

Researcher

Noted:

AMELITA E. LAREDO
Department Head

Schedule of Try outs

First Try Out

Date	School
March 3,2015	Rizal National High(IV-Aries and Pisces)
March 3, 2015	Manoot National High School (IV-Diamond)
March 4,2015	Aguas National High School
March 4,2015	Magsikap National High School (IV-Peacock)

Second Try out

March 9, 2015	Rizal National High
March 9, 2015	Manoot National High School (Iv- Capricorn and IV- Virgo)
March 10,2015	Aguas National High School
March 10,2015	Magsikap National High School (IV –Eagle)

Final try out

March 16,2015	and	Rizal National High
March 18,2015		School (IV- Libra and Iv-Gemini)

Appendix E6

Philippine Normal University
College of Science
DEPARTMENT OF MATHEMATICS
Manila

March 3, 2015

MARIFE A. PAREDES
Principal III
Rizal National High School

Madame:

I am presently enrolled in MAT 550 (Seminar Paper) this 2nd Semester, school year 2014-2015 and working on my paper entitled "Development and Evaluation of Fourth Year Mathematics Achievement Test for Public Schools".

I intend to administer my instrument for my 'second try out' to fourth year students this coming March 9, 2015. The objectives of my second try out are :a) to determine if the revised test items improved in terms of difficulty and discrimination indices; and b) to find out if the discrimination and difficulty indices of the retained items are reliable and consistent.

In this regard, may I ask permission from your Office to allow me to conduct my second try out to the two sections of fourth year students (IV-Capricorn and IV- Virgo).

Thank you very much.

Very respectfully yours,

CHARMIE R. CLATARO
Researcher

Noted:

WILMER G. MARQUEZ
Adviser

Appendix E7

Philippine Normal University
College of Science
DEPARTMENT OF MATHEMATICS
Manila

March 3, 2015

ELENA B. GENESE

Teacher In Charge
Manoot National High School

Madame:

I am presently enrolled in MAT 550 (Seminar Paper) this 2nd Semester , school year 2014-2015 and working on my paper entitled 'Development and Validation of Mathematics Achievement Test in a Public School'. I intend to administer my instrument for my 'second try out' to fourth year students this coming March 9, 2015. The objectives of my second try out are :a) to determine if the revised test items improved in terms of difficulty and discrimination indices; and b) to find out if the discrimination and difficulty indices of the retained items are reliable and consistent.

In this regard, may I ask permission from your Office to allow me to conduct my second try out to one sections of fourth year students (IV- Topaz).

Thank you very much.

Very respectfully yours,

CHARMIE R. CLATARO
Researcher

Noted:

WILMER G. MARQUEZ

Adviser

Appendix E7

Philippine Normal University
College of Science
DEPARTMENT OF MATHEMATICS
Manila

March 3 2015

GRACE A. OSANO
PRINCIPAL I
Magsikap National High School

Madame:

I am presently enrolled in MAT 550 (Seminar Paper) this 2nd Semester , school year 2014-2015 and working on my paper entitled 'Development and Validation of Mathematics Achievement Test in a Public School'. I intend to administer my instrument for my 'second try out' to fourth year students this coming March 9, 2015. The objectives of my second try out are :a) to determine if the revised test items improved in terms of difficulty and discrimination indices; and b) to find out if the discrimination and difficulty indices of the retained items are reliable and consistent.

In this regard, may I ask permission from your Office to allow me to conduct my second try out to one sections of fourth year students (IV- Eagle).

Thank you very much.

Very respectfully yours,

CHARMIE R. CLATARO
Researcher

Noted:

WILMER G. MARQUEZ

Adviser

Appendix E8

Philippine Normal University
College of Science
DEPARTMENT OF MATHEMATICS
Manila

March 3, 2015

MELINDA O. MENDOZA
Head Teacher V
Aguas National High School

Madame:

I am presently enrolled in MAT 550 (Seminar Paper) this 2nd Semester , school year 2014-2015 and working on my paper entitled 'Development and Validation of Mathematics Achievement Test in a Public School'. I intend to administer my instrument for my 'second try out' to fourth year students this coming March 9, 2015. The objectives of my second try out are a) to determine if the revised test items improved in terms of difficulty and discrimination indices; and b) to find out if the discrimination and difficulty indices of the retained items are reliable and consistent.

In this regard, may I ask permission from your Office to allow me to conduct my second try out to one sections of fourth year students (IV-Opal).

Thank you very much.

Very respectfully yours,

CHARMIE R. CLATARO
Researcher

Noted:

WILMER G. MARQUEZ

Adviser

Appendix E9

Philippine Normal University
College of Science
DEPARTMENT OF MATHEMATICS
Manila

March 10, 2015

MARIFE A. PAREDES
Principal III
Rizal National High School

Madame:

I am in the process of establishing the reliability and validity of the Mathematics Achievement Test of fourth year in a Public School. In this regard, may I ask permission from your office for me to use the two remaining sections of fourth year students (IV- Libra and IV- Gemini) as my respondents. The third and final draft of the instrument will be administered twice to these students for the evaluation of its internal consistency and its concurrent validity. I intend to conduct my first administration of the test on March 16, 2015 and the second administration is on March 18, 2015.

Thank you very much.

Very respectfully yours,

CHARMIE R. CLATARO
Researcher

Noted:

WILMER G. MARQUEZ

Adviser

Appendix E10

Philippine Normal University
College of Science
DEPARTMENT OF MATHEMATICS
Manila

March 10, 2015

AMELITA E. LAREDO
Head Teacher IV
Rizal National High School

Madame:

I am in the stage of establishing the reliability and validity of the Mathematics Achievement Test of fourth year in a Public School. In this regard, may I ask permission from your office to allow me to use the 2013-2014 National Achievement test instrument. The said instrument will be administer to IV- Libra and IV –Gemini .The third and final draft of the instrument has been administered twice to these students for the evaluation of its internal consistency and its concurrent validity.

Thank you very much.

Very respectfully yours,

CHARMIE R. CLATARO
Researcher

Noted:

WILMER G. MARQUEZ

Adviser

Appendix F
TABLE OF SPECIFICATIONS
 (First Draft)

OBJECTIVES	Knowledge	Comprehension	Application	Analysis	Procedural	No. of items	Item Placement
1. Determine whether a given set of ordered pairs and graph represents a function or a mere relation.	/					5	1,2,3,4,5
2. Determine the value of $f(x)$ given a value for x .		/	/			3	6,7,8
3. Given $f(x)=mx + b$, determine the x and y intercepts of its graph.		/	/		/	2	9,10
4. Given $f(x)= mx + b$, determine the slope of its graph.		/			/	1	15
5. Solve problems involving linear functions.				/		4	11,12,13,14
6. Given a quadratic function, determine the coordinates of the highest / lowest point (vertex) of its graph.		/				1	16
7. Given a quadratic function, determine the equation of the axis of symmetry of its graph.		/			/	1	17
8. Given a quadratic, determine the direction of the opening of the graph.	/	/				2	18,19
9. Find the roots of the quadratic equation by factoring, completing the square or quadratic formula.		/			/	5	20,21,22,23,24
10. Solve problems involving quadratic function and equation.						4	25,26,27,28
11. Find by synthetic division, the quotient and the remainder when $p(x)$ is divided by $(x-c)$.		/			/	7	29,30,31,32,33,34,35

12. Determine the inverse of a given function.		/				1	36
13. Solve simple logarithmic equations.			/			4	37,38,39,40
14. Solve problems involving exponential and logarithmic functions.				/		2	41,42
15. Convert angle measures from degree to radian and vice versa.		/			/	4	43,44,45,46
16. Determine the coordinates of their intersection of the given unit circle and the terminal side of an angle in standard position.		/				3	47,48,49
17. Solve simple trigonometric equations.				/		3	50,51,52
18. Apply knowledge and skills related to circular functions and trigonometric equations in problem solving.				/		7	53,54,55,56,57,58,59
19. Interpret data.		/	/			5	71,72,73,74,75
20. Find the measure of central tendency of grouped/ ungrouped data (mean, median, mode).		/	/	/	/	8	60,61,62,63,64,65,66,67
21. Compute the different measures of variability relative to the given set of data, grouped or ungrouped.		/				3	68,69,70
Total						75	

Appendix G
TABLE OF SPECIFICATIONS
(Second Draft)

OBJECTIVES	Knowledge	Comprehension	Application	Analysis	Procedural	No. of Items	Item Placement
1. Determine whether a given set of ordered pairs and graph represents a function or a mere relation.	/					4	1,2,3,4
2. Determine the value of $f(x)$ given a value for x .		/	/			3	5,6,7
3. Given $f(x)=mx + b$, determine the x and y intercepts of its graph.		/	/		/	2	8,9
4. Given $f(x)= mx + b$, determine the slope of its graph.		/			/	1	14
5. Solve problems involving linear functions.				/		4	10,11,12,13
6. Given a quadratic function, determine the coordinates of the highest / lowest point (vertex) of its graph.		/				1	15
7. Given a quadratic function, determine the equation of the axis of symmetry of its graph.		/			/	1	16
8. Given a quadratic, determine the direction of the opening of the graph.	/	/				2	17,18
9. Find the roots of the quadratic equation by factoring, completing the square or quadratic formula.		/			/	5	19,20,21,22,23
10. Solve problems involving quadratic function and equation.						4	24,25,26,27
11. Find by synthetic division, the quotient and the remainder when $p(x)$ is divided by $(x-c)$.		/			/	7	28,29,30,31,32,33,34
12. Determine the inverse of a given function.		/				1	35
13. Solve simple logarithmic equations.			/			4	36,37,38,39

14. Solve problems involving exponential and logarithmic functions.				/		2	40,41
15. Convert angle measures from degree to radian and vice versa.		/			/	4	42,43, 44,45
16. Determine the coordinates of their intersection of the given unit circle and the terminal side of an angle in standard position.		/				2	46,47
17. Solve simple trigonometric equations.				/		3	48,49, 50
18. Apply knowledge and skills related to circular functions and trigonometric equations in problem solving.				/		7	51,52, 53,54, 55,56, 57
19. Interpret data.		/	/			4	66,67, 68,69
20. Find the measure of central tendency of grouped/ ungrouped data (mean, median, mode).		/	/	/	/	5	58,59, 60,61, 62,
21. Compute the different measures of variability relative to the given set of data, grouped or ungrouped.		/				3	63,64, 65
Total						69	



AUTHENTICITY RESULT

Date of Release: January 13, 2016
Result Code: 2015-036
Submission ID: 620194593
Title of Output: Development and Validation of Mathematics Achievement Test in a Public School
Author(s): Charmie Clataro

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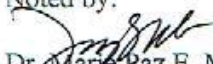
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(Authenticity Administrator)

Noted by:


Dr. Marie Paz E. Morales
Director, Publications Office

From the Desk of
Heidi Barcelo-Macahilig, Ph.D.
Faculty of Education Sciences
College of Teacher Development

CERTIFICATION

This is to certify that the Seminar paper of Ms. Charmie R. Clataro entitled, "Development and Validation of Fourth Year Mathematics Achievement Test," submitted as fulfillment of the requirements for the degree Master of Arts in Teaching Mathematics, has been proofread and edited by the undersigned.

This certification is issued on the 15th day of December 2015 upon the request of Ms. Clataro for whatever legal purpose this may serve.


Heidi Barcelo-Macahilig, Ph.D.
Editor

Curriculum Vitae

CHARMIE R. CLATARO

City Address: Block 11 lot 4, Rosewood Street, Hillcrest Townhomes, North Olympus Subdivision, Novaliches, Quezon City
Home Address: Adela Rizal, Occidental Mindoro
Date of Birth: October 30, 1985
CP No. 09999904838

EDUCATIONAL BACKGROUND			
Level	School	Inclusive Dates	Honors
Elementary	Adela Elementary School Adela, Rizal, Occidental Mindoro	1991-1998	1 st Honorable Mention
Secondary	Rizal National High School Adela, Rizal, Occidental Mindoro	1998-2002	Salutatorian
College	Divine Word College-San Jose San Jose , Occidental Mindoro	2002-2007	Cum Laude
Graduate	Philippine Normal University Taft Avenue , Manila		

EMPLOYMENT

Faculty Member
Rizal National High School
January 2013-Present