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High School Achievement and Motivation as Antecedents of College Freshmen's Achievement in Basic Mathematics

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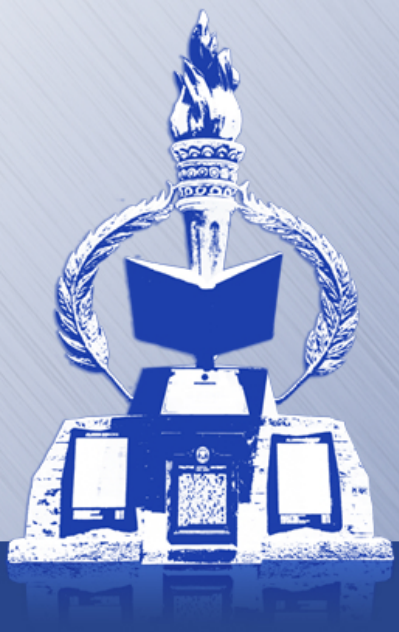

HIGH SCHOOL ACHIEVEMENT AND MOTIVATION AS ANTECEDENTS OF COLLEGE FRESHMEN'S ACHIEVEMENT IN BASIC MATHEMATICS

A Thesis

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by

ALEXIS CORONACION VILLAFLOR

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APPROVAL SHEET

This thesis entitled **"HIGH SCHOOL ACHIEVEMENT AND MOTIVATION AS ANTECEDENTS OF COLLEGE FRESHMEN'S ACHIEVEMENT IN BASIC MATHEMATICS"** prepared and submitted by **ALEXIS C. VILLAFLOR** in partial fulfillment of the requirements for the degree of **Master of Arts in Education with Specialization in Mathematics Education**, is hereby recommended for approval and acceptance.

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ABSTRACT

Name:	Alexis C. Villaflor
Title:	High School Achievement and Motivation as Antecedents of College Freshmen's Achievement in Basic Mathematics
Key Concepts:	Basic Math Achievement, College Students, High School Achievements, Motivation Variables, Relationships
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The purpose of this study was to evaluate basic mathematics achievement among college freshmen in Northern Quezon and to determine the relationships existing between high school achievement variables, motivation variables, and basic math achievement. The study employed 92 respondents randomly selected from two collegiate institutions in Infanta, Quezon. Some common descriptive statistics, as well as Pearson r and multiple regression, were used in the data analysis. The key findings were (1) The basic mathematics achievement of the college freshmen is very poor, (2) The beliefs in the usefulness of math of the college freshmen are high, while their interest in math is only moderately high. Their most important attribution of success in math is effort, and their most important attribution of failure in math is lack of effort; (3) All the high school achievements (selected subject grades and averages)

are positively related to basic math achievement; (4) Of the motivation variables, only interest in mathematics has significant positive relationship with basic math achievement; (5) There exist at least moderately high, positive relationships among high school math, science, and English grades. Also, taking all the high school achievements and motivation variables together, regression model shows that a moderate amount of variation in the basic mathematics achievement of the college freshmen can be explained by the variation in the mentioned dependent variables. The results of the study have implications in improving teaching math in high school and also in improving student selection for math-related college programs. The study recommends for future researchers to explore other variables - such as the college entrance examination - in future studies in order to fine-tune student selection process, especially in countryside collegiate institutions. Also, the study recommends for other educational researchers to explore the issue of mass promotion in the educational system.

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ACV

This piece of work is dedicated to my Tatay and Nanay, and to my Lola Esperanza.

Table of Contents

List of Tables

Page Number

List of Figures

Page Number

List of Appendices

Page Number

CHAPTER I

THE PROBLEM AND ITS BACKGROUND

Introduction

From generation to generation, mathematics has been seen as a very important tool for scientific literacy, which is essential for developing the technology of a nation (Oyedeji, 2011). Japan and Korea, for example, are known to be highly developed and sophisticated countries today. They are also known to be nations that place very high value for education. In fact, these are some of the countries that consistently rank on top in international measures of achievement in mathematics (Coughlan, 2016; Johnston, 2016; TIMSS and PIRLS, 2016). If this was not merely a result of coincidence, then there would be a reason to believe that the quality of mathematics education in a country has something to do with the scientific and technological aspect of national development.

While Japan, Korea, and other few nations might not have a problem with mathematics learning and achievement among their students, many parts of the world do have that problem. The United States, for example, a country that leads the world in many ways, admits a problem with mathematics achievement, with students ranking behind many nations in international assessments such as the Trend in International Math and Science Study [TIMSS] and Programme for International Student Assessment [PISA] (Giang, 2013; Lubin, 2010). As Beard (2013) put it, America had fallen far from its position of being the leader in mathematics, science, and technology. The nation, according to Green (2014), suffers from

something called innumeracy, which is the mathematical equivalent of being illiterate according to a math professor of an American university. Even their adults are not an exemption to mathematical deficiency. According to the same report, a 2012 study of numeracy on teenagers, adults and old-age citizens of 20 countries revealed that the Americans' performance was in the bottom five. More alarmingly, there were a number of reports saying that American students were weak in basic mathematics, especially in the number system knowledge or understanding different forms of numbers (Giang, 2013). These deficiencies have a number of implications and consequences, including employment disqualification (Giang, 2013), inability to make wise financial decisions (Richards, 2014), and life-threatening errors in the practice of medicine, pharmacy, and other health-related disciplines (Green, 2014). Aside from these, other implications are purely educational. As David Geary wrote (cited in Giang, 2013), early deficit in basic mathematics could cause weak foundation for future learning. This is why deficiency in basic math skills is a pressing educational issue among Americans even today.

If such could be the situation in a powerful country such as the United States, then how much worse would be expected of the less fortunate countries of the world? The Philippines is one of the countries that fall behind in terms of mathematics education, as reflected in international reports on achievement. Though the Philippines is not always a participant in the Trend in International Math and Science Study (TIMSS), the largest and longest-running study on math and science achievement (Gurney-Read, 2016), the TIMSS 2003 and TIMSS Advanced 2008 data have given us glaring evidence how badly the Filipino

students fared in international achievement tests. In 2003, the Philippines ranked 34th out of 38 participating countries in the high school mathematics category, while it placed 23rd out of 25 countries in the grade school mathematics category. And in 2008, even with only the science high schools representing our country in Advanced Mathematics category, the Philippines placed last: 10th out of 10. All in all, our country scored far below the international average and was significantly behind in terms of mathematics achievement and performance (Department of Education, 2010).

The Department of Education (2010) also pointed out that local measures also continue to show the same depressing trend. The results of National Achievement Test, an examination administered among graduating high school students, also indicate that the general population of the examinees are low-achievers. All these apparently reflect the poor quality of basic education in the country.

In a countryside area such as northern Quezon, this issue of low achievement and ill-preparedness in mathematics can be seen – much more alarmingly – in tertiary level students. Many college students, particularly those in their first year, show evident deficiency in their beginning college mathematics courses. Many of them perform badly even in the most basic of the mathematics knowledge that they would be expected to have acquired prior to being in college. This might suggest an issue on the quality and standard of education in mathematics, in the local colleges, and in the secondary schools, more especially.

The college freshmen participating in this study were the last high school batch to experience the old Basic Education Curriculum. Thus they had experienced the following mathematics subjects: elementary algebra for first year; intermediate algebra for second year; geometry for third year; and advanced algebra, basic trigonometry, and basic statistics for fourth year. Although this was already modified by the new K-12 curriculum, these mathematics subjects remain to be already at the core of the school mathematics curriculum used today.

Four years in high school with such prescribed mathematics curriculum seems good enough as a learning period so that the transition to college beginning math course such as general math/basic math or college algebra would be smooth and well-supported. Yet, as experience in teaching would attest, students that get into college are far below from prepared. Many first year college students grapple with their beginning courses in mathematics, showing very poor performance even in the most basic concepts of the subject.

There are some possible reasons that may account for this educational situation. For one, the student did not learn enough of the high school mathematics curriculum content (Department of Education, 2010). Students with such learning deficiencies nonetheless graduate from high school because of the so-called ‘mass promotion’ (De Guzman, 2014; “To Retain or Promote”, 2014; “Open Letter”, 2014), which is another reason accounting for the deteriorating quality of students in college. Because of this non-restrictive practice done by the secondary schools in northern Quezon, many students reach college without enough

preparation. This might explain why today's high school graduates cannot meet the standards of tertiary education institutions nor have the skills necessary to progress in college ("Filipino HS", 2004). Still another reason could be the observed unsuitability of many students to their chosen college programs – a matter that might be attributed to the leniency of countryside colleges with its freshman admission procedures.

Early deficiencies of students in mathematics, if not diagnosed or solved properly, can cause further problems. Aside from employment-related problems for graduates (Giang, 2013), international education papers have repeatedly emphasized that if basic mathematics skills are poor, students will have difficulty learning and finishing higher mathematics subjects in college such as advanced algebra and calculus. In fact, even in America, it was reported that university instructors complained that their newly accepted students had weak math skills and thus needed remedial classes to cope (Loveless, as cited in Belyavskaya, 2014).

In northern Quezon, there are problems that may be consequences of early academic deficiencies not properly addressed. There are colleges that keep on producing graduates that do not pass standardized pre-employment examinations such as licensure examination for mathematics teachers. Some of these college graduates take the examination multiple times and until now, still have not made it. Such a situation only suggests that the quality of education these graduates received were not good enough.

Another educational situation that is characteristic of tertiary institutions in northern Quezon is the preponderance of students in mathematics-related programs such as engineering and mathematics education who are extremely poor in their first year mathematics subjects. These students repeat certain subjects in multiple semesters before they can move to the next prescribed subjects. This situation could have been made better if student selection and placement was done properly by schools.

Though there have been many similar studies addressing the issues on mathematics education such as the ones in the aforementioned discussion, there is still room for further exploration of the topic. For one, not many studies have focused on college students, and for another, the mathematics area to be considered here is basic mathematics - topics supposed to be easy for most college students - and not higher mathematics nor a specific mathematics subject area like the ones usually explored in other studies. The choice of other variables to be included in this study such as interest in mathematics or beliefs in the usefulness of mathematics was influenced by observations derived from actual classroom practice.

Assessing math achievement is important because when it is done continually, the obtained student data serve as evidence of the current educational status of schools (Organization for Economic Cooperation and Development, 2016). The TIMSS and PISA – two of the largest studies that assess math achievement every four years and three years respectively – publish results so that educational institutions are aware from time to time of the changes in achievement of students across the globe and can apply the results toward

continuous improvement of teaching and the educational system at large (Johnston, 2016; OECD 2016). On a very much smaller scale though, investigating math achievement among college freshmen in the locality of northern Quezon will help produce information that may be useful to mathematics teaching both in secondary and tertiary levels. Achievement results for college freshmen are important especially because, unlike in elementary and high school, college does not have a comprehensive type of assessment examination to gauge how better or worse the college students are performing in specific subject areas.

In addition to achievement in basic mathematics, this study will also assess an affective side of the college freshmen by including selected motivation variables in its list of variables to measure. These variables together with the students' previous achievements in high school will be subjected to relation analysis – first with the basic mathematics achievement and second among themselves.

The relation analysis part of the study aims at identifying and verifying variables related to the current achievement in basic mathematics. These variables, to be called antecedents of college freshmen's achievement in basic mathematics, will not only provide a glimpse of the students' achievement history but also to re-emphasize the factors that help shape or predict the present math achievement. Results of relationships analysis therefore have certain educational uses. As De Winter and Dodou (2011) put it, predicting performance is important for schools – especially colleges and universities – because it can determine

students who are most likely to do well and be successful with their studies. In that manner, prediction helps in maximizing resources and avoiding wastage.

In northern Quezon, the results of such relation analysis will help colleges improve their selection of students by looking at certain variables as indicators of their qualification into college programs, especially those that are mathematics-related and have board examinations after graduation.

The outcomes of this study – the math achievement assessment and the relationship – will lead to formulations of suggestions and recommendations geared toward improvement of teaching and learning both in the secondary and tertiary levels, screening procedures, and school admission policies of collegiate educational institutions of northern Quezon.

Conceptual Framework

This study zeroes in on the basic mathematics achievement of college freshmen and possible variables that influence or affect such achievement. The choice of variables – high school achievement and motivation – for this study was based on results of some previous studies perused during literature review. Some theories were also discussed, explaining some of the variables investigated in the study.

As can be seen more clearly in the conceptual paradigm, the dependent variable in this study is the achievement of college freshmen in basic mathematics, while the independent variables are classified into two categories: (1) high school achievement variables, and (2)

motivation variables. In this study the considered high school achievements of students are the final grades they obtained in high school subjects such as mathematics, science, and English, while variables under the motivation category are interest in mathematics, beliefs in the usefulness of math, and attribution of success and failure in mathematics.

Several studies identified previous achievements as a major determinant or predictor of current achievement in mathematics. According to Matthews and Farmer (2008), prior achievement in mathematics varies strongly as the current performance. On a similar note, a study by Cappellari, Lucifora, and Pozzoli (2009) suggests that good high school achievements are significantly related with college math grades. Related studies conducted by Harvard University also point to some previous achievement factors as determinants of college grades: they found out that Scholastic Aptitude Test (SAT) Subject Tests are the best predictors of college grades, followed by high school grade point average (GPA) (Cohen, 2007 as cited in Espenshade and Chung, 2010).

Motivation variables are students' personal beliefs, feelings, and opinions about something. Because researchers have found out that not only cognitive factors are related to mathematics achievement, affective variables have been identified and been subjects of many studies in mathematics education.

Interest has been a widely explored variable in both psychology and education. It is probably even the most discussed affective factor in the field of teaching and learning. Researchers believe that interest plays a role in promoting academic achievement as well as in

course and career decisions. According to a study of Hidi (2005), as cited in Harackiewicz and Hulleman (2009), research had demonstrated that interest promotes attention, ability to remember, and effort and persistence with tasks. Thus, interest in a topic is a mental resource that enhances learning and achievement. In fact, Schiefele, Krapp, and Winteler (1992) (cited in Harackiewicz and Hulleman, 2009) found that the correlation between interest and academic performance was $r = 0.31$, while that between interest and laboratory performance was $r = 0.27$. Apart from being a component of success in academics, interest is believed to be important by itself.

The role of beliefs in learning mathematics has also been a subject of much research. McLeod (1994) (as cited in Goldin, Rosken, & Torner, 2009) proposed beliefs as included in the affective domain of learning mathematics. According to Furinghetti and Pehkonen (2000) (cited in Breiteig, Grevholm, & Kislenko, 2005), learning outcomes of students are strongly related to their beliefs about mathematics, such as its usefulness, among others. Many students hold the beliefs that math is a boring subject and that it is a difficult subject to learn. Nonetheless, many students still believe that learning mathematics is important because they are aware that competence in this subject opens doors to many good opportunities (Niss, cited in Breiteig, Grevholm, & Kislenko, 2014).

Attributions are reasons that people use to explain something such as success or failure. According to Weiner (1985) (as cited in Slavin, 2006), attribution theory identifies four main explanations for success and failure when it comes to situations regarding

achievement. These are ability, effort, task difficulty, and luck. These attributions are classified as internal or external. Internal attributions are within the person, such as ability and effort. External attributions are other factors outside the person, such as task difficulty, luck, and other reasons.

The central assumption of attribution theory according to Thompson, Davidson, and Barber (1995) (as cited in Slavin, 2006), is that individuals will try to maintain a good self-image. This would mean that when they succeed in an activity, they are likely to say that their success is due to their abilities or efforts. But when their performance is not good, they would tend to believe that the failure is caused by something outside of them. Psychologists believe that students' beliefs on the causes of their success and failure have great influence on their academic achievement (Basturk & Yavuz, 2010).

The schematic diagram in Figure 1 shows the conceptual framework of the study. It explicitly shows the list of the variables that were measured in this study, symbolizes the hypotheses that high school achievement variables as well as motivation variables are positively related with and therefore help determine achievement or current performance in mathematics, and serves as a picture of how this study was undertaken.

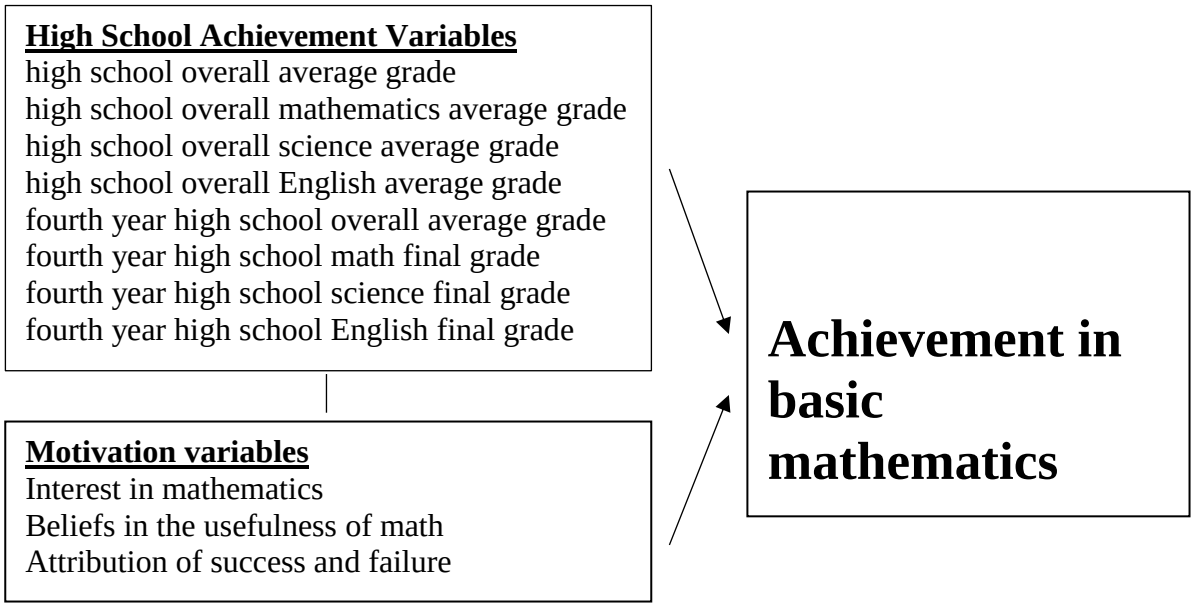

Figure 1.1. The conceptual paradigm of the study

STATEMENT OF THE PROBLEM

This study aimed to evaluate the current achievement in basic mathematics, past achievements and performances in various subjects, and selected motivation variables of college students in the northern Quezon area. The study investigated possible relationships existing among the mentioned variables and derived implications that might be useful in education. Considering all ethical concerns regarding the safety and protection of its participants, research site, and researcher, this study sought to answer the following specific questions.

1. What is the profile of the students in terms of the following variables?

    1.1 achievement in basic mathematics

    1.2 high school achievement variables

        1.2.1 high school overall average grade

        1.2.2 high school overall Mathematics average grade

        1.2.3 high school overall Science average grade

        1.2.4 high school overall English average grade

        1.2.5 fourth year high school overall average grade

        1.2.6 fourth year high school Mathematics final grade

        1.2.7 fourth year high school Science final grade

        1.2.8 fourth year high school English grade

    1.3 Motivation variables

        1.3.1 interest in mathematics

        1.3.2 beliefs in the usefulness of math

        1.3.3 attribution for success and failure

2. Are the high school achievement variables related to current achievement in basic mathematics?
3. Are the motivation variables related to the current achievement in basic mathematics?
4. Do high school achievement and motivation variables predict achievement in basic mathematics?

Research Hypothesis

The following hypotheses will be tested in this study.

1. There is a significant relation between high school achievement variables and the current achievement in basic mathematics.
2. There is a significant relation between motivation variables and the current achievement in basic mathematics.
3. High school achievement variables and motivation variables predict college freshmen's achievement in basic mathematics.

Significance of the Study

The results of this study are intended to be useful to the following educational stakeholders:

(1) Teachers

The information on student achievement that will be revealed through this study are supposed to inform teachers – in both high school and college – of the students' mathematics performance status. Awareness of the most recent achievement data of students is one small step that can call the attention of teachers and educators to address the issue accordingly. Whichever motivation variables that will be verified by this study as antecedents of achievement will inform educators that these are the attributes that they could infuse their students with, to improve in their learning and achieving.

(2) Administrators of college admission system

The results on previous achievements are particularly intended for school admission system. The main hypothesis to be tested in this study is the existence of a significant relationship between high school achievement variables and the current achievement in basic mathematics. One use of the result of this testing is that if some variables are determined to affect the current achievement of college freshmen in basic mathematics, school admission and selection of students for its programs, especially the mathematics-related programs might be improved. For example, specific subject score in entrance examination and specific score in a student's high school record might be taken into account in the admission criteria – and not just the usual final grade in the fourth year high school card or the total score in the entrance examination result slip – if they are found to be related to or antecedent of their current performance in basic mathematics.

(3) Other researchers

All the data used in this study, the literature reviews, and the results can be used as additional reference material by other student researchers who will be exploring or investigating similar areas of research.

So that the results of the study will be disseminated to the locality where the study is conducted, copies of the finished reports will be distributed to the colleges that participated when the study is complete.

Scope and delimitation

This study investigated the basic mathematics achievement of college freshmen in northern Quezon and two other variables that might be related to it: the high school achievement variables and selected motivation variables.

The study included 92 students, who were in their first year in college during the school year 2016-2017 and were randomly selected from two schools: one public university and one private college. The students came from different parts of northern Quezon, although the schools used were both located in Infanta, Quezon.

Definitions of Terms

This section defines key terms used in this study. A definition consists of two parts: a conceptual definition and an operational definition.

Achievement refers to what an individual has learned so far, which is also his or her present level of performance (Best & Kahn, 1993). The term achievement in this study refers to the student's achievement in basic mathematics. This achievement is operationally defined here as the score that a college freshman obtained in the achievement test.

Antecedent is something that precedes behaviors (Slavin, 2006). In this study, these are the factors or variables that came before the current achievement. Antecedents considered

in this study are delimited to high school achievement variables and some motivation variables.

Attribution is the reason a student uses to explain his or her success or failure in academic tasks including performance in mathematics (Weiner, as cited in Maidinsah, Embong & Wahab, 2014). In this study, attribution is the score a student obtained in the inventory of student's attribution of success and failure in mathematics.

Basic mathematics refers to the math skills that high school graduates are supposed to be able to perform well after exposure to the common mathematics curriculum (Trombley & Weiss, as cited in Oyedeji, 2011). In this study, basic mathematics refers to the scope of high school mathematics prescribed in the Basic Education Curriculum, experienced by the current college freshmen in northern Quezon (elementary algebra, intermediate algebra, geometry, advanced algebra, basic trigonometry, and basic statistics).

Interest is defined as being engaged or engrossed in an object, topic, or activity (Dewey, as cited in Harackiewicz and Hulleman, 2009). Interest in mathematics may be thought of as the tendency of a student to like, care about, and have positive feelings toward mathematics. In this study, this is the score that the student obtained in the mathematics interest inventory.

High school achievement variables refers to the student's scores or grades in past subjects before he or she takes up any college subject. In this study, high school achievement variables are the respondents' high school grades.

Motivation variables are variables involving affective responses, which are positive or negative feelings or opinions towards something (Grootenboer & Marshman, 2016). In this study the following are considered motivation variables: interest in mathematics, beliefs in the usefulness of math, and attribution of success and failure.

CHAPTER II

REVIEW OF RELATED LITERATURE

This chapter presents the literature and studies related to the study. Most of the studies cited and discussed here were mostly found in books, journals, and theses. Some were taken from online articles. The discussion will be divided into the following sections: mathematics achievement; variables related to mathematics achievement. A summary will conclude the chapter, highlighting important points and connecting the previous studies to the present one.

Achievement in mathematics

Mathematics achievement has been a subject of numerous studies. In fact, achievement in math has always been included in some of the largest assessment studies conducted worldwide: the TIMSS, or the Trends in International Mathematics and Science Study (TIMSS and PIRLS, 2016), and the PISA, or the Programme for International Student Assessment (OECD, 2016).

TIMSS, a study that focuses on achievements in science and mathematics of fourth grade and eighth grade students, started in 1995 and takes place every four years (Gurney-Read, 2016). The latest study, TIMSS 2015, involved more than 600,000 students from all over the world (TIMSS and PIRLS, 2016).

Through the years, TIMSS has found a trend: East Asian countries lead the world in mathematics achievement. TIMSS 2015 revealed that the top five countries emerging with the highest achievement scores in mathematics were Singapore, Hong Kong, Korea, Taiwan, and Japan (Gurney-Read, 2016), which is exactly the same combination of countries that made it to the top five in TIMSS 2011 mathematics results (TIMSS and PIRLS, 2012).

First conducted in the year 2000, PISA is a global survey conducted every three years aimed at testing the knowledge and skills of 15-year-old students in science, mathematics, and reading. Aside from these three main subjects, the study also assesses collaborative problem solving and financial literacy. In terms of scope hence, this study covers a broader area than the TIMSS. In the latest study, PISA 2015, East Asian countries were again on the top spots. Singapore, Hong Kong, Macao, Taiwan, Japan, and South Korea were among the countries that obtained the highest scores in mathematics (OECD, 2016).

While the Philippines was not a participant in TIMSS 2015, PISA 2015, or TIMSS 2011, the country had its records of low mathematics achievement in the previous years of its participation. One thing is consistent with the results: the country scored below international average, and more importantly, it ranked as one of the countries with lowest mathematics achievement in the world. In TIMSS 2003 for instance, the Philippines scored 358 in grade IV mathematics, while the international average was 495. This left the country in 23rd position out of 25 participating countries. In HS II mathematics (roughly equivalent to grade 8 in other countries), the Philippines obtained a score of 378, which was again below the international

average score of 466. This placed the country in the 34th position among 38 participating countries (Department of Education, 2010).

The NAT or the National Achievement Test, though not as reliable source of information as the international studies above, also gives frustrating achievement figures. Apparently, these reports reflect that the quality of basic education in the country is bad, and that many students do not have mastery of basic competencies (Department of Education, 2010).

This deficiency on the basics is a problem not only here in the Philippines. Though on a degree much less than our country's deficiency, TIMSS (TIMSS and PIRLS, 2016) and PISA results (OECD, 2016) have often pointed out that American students perform only on the average level, with many students in other countries outdoing them in mathematics.

Some Philippine studies conducted among college students also report that mathematics achievement is low. Andaya (2014), who assessed elementary education students on Fundamental Math and Contemporary Math, revealed that students' performances on both subjects were poor. Another study by Patena and Dinglasan (2013) assessed college students on Algebra and Trigonometry. Results showed that the students did poorly, not surpassing the required criteria of the subjects.

On the whole, all of these achievement results, whether from a global study or national reports, say something about the ubiquity of deficiency or low achievement in mathematics.

Variables related to mathematics achievement

Many studies from different institutions and countries have shown that certain variables are related to academic achievement in general. Specifically, when it comes to mathematics, studies have often identified previous achievements and certain attitudes as variables related to or predicting math achievement.

Prior achievement variables

As might be expected, the student's previous achievements are clues on how the student would perform and achieve in the present, which is why most higher educational institutions factor previous achievement records of college applicants into the admission process. The University of the Philippines, for example, has the UPCAT or the UP College Admission Test to screen its incoming college freshmen. The deciding final score is called the UPG or the university predicted grade, which combines the student's score in the UPCAT and the weighted average of the student's grades in the first three years in high school (UP Office of Admissions, 2014). Harvard, Princeton, Yale, and many other prestigious universities and colleges in the United States look at incoming college freshmen's Scholastic Aptitude Test (SAT) scores or the American College Testing (ACT) scores, among other requirements, to decide on whether they will be accepted or not (Espenshade & Chung, 2010).

These educational data of students – pre-college achievement scores such as high school grades or entrance examination scores – are considered for a reason. Studies have shown that achievements in the past could predict future academic achievements. Harvard, for instance, has found that SAT Subject Tests scores and high school GPA are the best predictors of college grades (Cohen, as cited in Espenshade and Chung, 2010). These results matter especially when it comes to college admission. Universities care to select the best students because accepting under-qualified students would mean a misuse of resources, and not being able to recruit the candidates with the best potentials weakens a discipline in the long run (De Winter & Dodou, 2011).

There are evidence saying that academic achievements in the past continue to have its influence on the present academic achievement, whether it is in situations not in college or not in the context of mathematics education. But when it comes to mathematics achievement, studies have shown using different measures of achievement that, on average, previous achievements of students are related to their present performance. According to Matthews and Farmer (2008), prior achievement in mathematics varies strongly with the present performance.

Studies on college subject-specific achievements such as achievements in Algebra, Statistics, and Calculus, also point to previous achievements as determinants or significant predictors of students' current performance and achievement in these subjects. In the study of Dupuis, Medhanie, Harwell, Lebeau, Monson and Post (2012), they found that students with

greater prior achievement took more difficult statistics courses and earned higher grades in those courses. In the study of Islam and Al-Ghassani (2015) in Oman, high school math score and over-all high school score were found to be significant predictors of subsequent performance in college calculus course. In general, they see that good secondary school achievements, as suggested by the findings of Capellari et al. (2009), are significantly associated with college mathematics grades. Results of the study conducted by Tesema (2014) in Ethiopia also show similar results: the high school GPA and the university entrance exam scores significantly predict first year college GPA in general. In the United States (Syverson as cited in Espenshade and Chung 2010), both the SAT and ACT data of students are counted in freshman admission process for the reason that they predict how well students will perform in their early years in college.

Several Philippine studies on achievement also showed how some previous-achievement variables were related to the present student achievement. Porter (1996) as cited in De Jesus (2001) studied the usefulness of the entrance requirements of UP High School regarding prediction of academic success of incoming high school students. The research aimed to find the relationship between the entrance requirements and the academic achievement of the students in their first two years in high school. The entrance requirements were elementary average grade, interview, and entrance examination. Results of this study showed that the performance of students in entrance requirements was directly related to students' academic achievement.

Tuason (1998) as cited in De Jesus (2001) studied the predictive validity of entrance test and grade 6 general average among the second year high school students of Don Bosco Technical College Mandaluyong during the school year 1990-1991. The study aimed to find out whether the two previously mentioned variables would be able to predict the first year high school cumulative grade point average or GPA. Analysis revealed a positive relationship between the pairs of variables and showed that Grade 6 general average was a better predictor of the first year high school performance.

De Jesus (2001) herself studied secondary school student achievement. She found in her study of Xavier School high school students that the students' performance in high school entrance test mathematics portion when they were still applying as freshmen is related to their later performance in the school when they got admitted, as measured by the CEM Math Achievement Test, which was given annually to their students of all year levels.

There have also been studies on achievement conducted in Philippine colleges. Ramos (as cited in De Jesus, 2001) investigated the factors that could be associated with mathematics achievement of college freshmen of Central Luzon State University. In this study, math achievement was measured by the final grade in College Algebra. The variables taken into consideration in the study were National College Entrance Examination or NCEE rating, sex, age, parents' educational achievements, and family income. The study found that among these variables, it was NCEE rating to which mathematics achievement was strongly related. All the rest of the variables were not significantly related to mathematics achievement.

In another college-related study, De Jesus (2001) cited the study conducted by Tan in Central Mindanao College. That study revealed that the college admission test score was a good predictor of achievement in Algebra. This was stated after having found that the admission test score and achievement in Algebra yielded a correlation coefficient of 0.50, which was tested significant at 0.001 level. Aside from college admission test, other factors such as High School GPA, NCEE total score, and NCEE mathematical ability score were considered significantly related to achievement in Algebra.

English achievement and mathematics achievement

There have been studies linking mathematics and English achievements, saying that English proficiency dictates English language learner's performances on mathematics assessments (Henry, Nistor, & Baltes, 2014).

Hasan and Khan (2015) of India studied the relationship between academic achievement test in English and Mathematics of secondary school students in relation to gender differences. Results found that there was low positive correlation between English and Mathematics achievement of male students and that there was moderate positive correlation between English and Mathematics achievement of female students.

In Malaysia, Rambely, Ahmad, Majid, and Jaaman (2013) conducted a study entitled "The relationship of English proficiency and mathematics achievement". Results of this study

showed that good mastering of English is needed to nurture and understand mathematics subjects and achieve excellent results. Also, the study found that low English proficiency resulted in students experiencing shortage in mathematics learning and obtaining a lower grade in mathematics subjects.

Science achievement and mathematics achievement

Helfgott (2006), as cited in Oyedeji (2011), noted that the close relation between mathematics and physics goes as far back as the time of Euclid and Archimedes in the third century before the Common Era. According to the author the relationship has been especially strong since the 17th century when Galileo established the scientific method, wherein mathematics plays a crucial role. Furthermore, it was reported that the connection between mathematics and chemistry started in the 19th century.

In the article "On the relationship between math and science achievement in the U.S.", Li, Shavelson, Kupermintz, and Ruiz-Primo (2002) found using data provided by TIMSS (Trend in Math and Science Study) that there were consistently high correlations between girls' and boys' math and science scores.

Wang (2005) examined the relation between mathematics and science achievement of 8th grade students using the students' scores in the TIMSS and the TIMSS-R and found moderate correlation coefficients. Kurumeh, Igyu, and Mohammed (2013) investigated the correlation between mathematics achievement and each of the science subjects, biology,

chemistry, and physics. Using Pearson product moment correlation and t-test, they found that there existed a significant relationship between mathematics and each of the science subjects mentioned at 0.05 level of significance. Their study re-emphasized the importance of mathematics to science and how mathematics achievement can be used to predict students' science achievement.

Oyedeji (2011) investigated the predictive effects of the math skills on the students' achievement in science in the article "Mathematics Skills as Predictors of Science Achievement in Junior Secondary Schools". The study involved 500 students who were randomly selected from ten junior secondary schools in Benin Metropolis in Nigeria. Results of this study showed that there were significant correlations between the mathematics skills of students and their science achievement. The study also revealed that all the six mathematics skills (computation skill, algebra skill, geometry skill, mensuration skill, interpretation of graphs and tables, everyday statistics) have direct effects on the science achievement in junior secondary school.

Motivation variables

According to National Council of Teachers of Mathematics (2013), affect is an important factor in teaching and learning mathematics. Usually when we talk with teachers or students about mathematics, the teachers more often discuss student enthusiasm (or apathy), and the students talk about classes that are interesting (or boring). In fact, NCTM puts considerable emphasis on affective issues in its publication of Curriculum and Evaluation

Standards for School Mathematics. In this publication, two of the major goals of the Standards deal with helping students understand the value of mathematics and with developing student confidence.

In mathematics education, feelings and moods like anxiety, confidence, frustration, and satisfaction are all used to describe responses to mathematical tasks. Frequently these feelings are discussed in the literature as attitudes (NCTM, 2013).

There have been many reviews of the literature related to affective factors and mathematics education, and they have generally focused on attitudes toward mathematics (NCTM, 2013).

According to Krapp et al. as cited in Pintrich and Schunk (2002), researchers have conceptualized interest as a personality trait or a personal characteristic that is usually assumed to be directed toward some specific activity or topic (say a sport, science, music, dance, computers, etc.). Interest, according to Santrock (2008), is conceptualized as more specific than intrinsic motivation and is positively linked to learning.

Interest is one of the usual factors under attitudes toward mathematics. Kpolovie and colleagues (2014) investigated the role of interest in learning and other attitudes towards school, and their investigation revealed overwhelming preponderance of data-based evidence that student's interest in learning and attitude towards school jointly and separately predict

academic performance. This applies specifically to mathematics learning and achievement. Interest in mathematics, according to Heinze, Reiss, and Augsburg (2005), could be regarded a predictor for mathematics achievement. Some studies also showed that there were sex differences in favor of boys in mathematics achievement and interest. It was also found out that high achievers expressed more interest than low achievers (PsycINFO, 2001).

According to Martos (2005), the relationship between interest and students' achievement cannot be disputed: there is a significant evidence showing that highly motivated students perform better than students who are poorly motivated. He cited Schiefele, Kurpp and Wintaler, who contended that interest in mathematics and motivation are two important variables in explaining differences in math achievement.

Though similar results emerged from the aforementioned studies, some study still obtained a different result. A study in Germany involving 602 students in high school attempted to investigate the relationships between academic interest and achievement in mathematics. The study concluded that interest had no significant effect on learning, but did affect course selection. Supporting this contradiction, data from the Second International Mathematics Study indicate that Japanese students had a greater dislike for mathematics than students in other countries, even though Japanese achievement was very high.

According to Saritas and Akdemir (2009), mathematics education requires highly motivated students because this subject requires reasoning, making interpretations, and

solving problems, mathematical issues, and concepts. They said that the challenge of mathematical learning today, therefore, is that it requires disciplined study, concentration, and motivation.

In a study of elementary-school-aged children, Broussard and Garrison as cited in Saritas and Akdemir (2009) examined the relationship between classroom motivation and academic achievement. They found that motivation was related to higher math grades.

Instrinsic motivation is a predictor of mathematics achievement. This was one of the findings of the study conducted by Sartawi et al. (2012) using fifth graders as sample in the United Arab Emirates. On the contrary, in a study of Canadian elementary pupils (grades 1 to 4), it was found out that intrinsic motivation did not predict achievement at any time.

Weiner, as cited in Maidinsah, Embong, and Wahab (2014), postulated that the following are the causal factors which students use to describe their successes and failures: ability, effort, task difficulty, luck. Subsequent researches, however, identified other attributions such as other people (teachers, students), mood, fatigue, illness, personality, and even personal appearance. Weiner also classified attribution according to the following dimensions (a) internal or external, (b) stable or unstable, and (c) controllable or uncontrollable.

Using results from Third International Mathematics and Science Study (TIMSS), House (2006) found in his study of elementary school students in Japan and United States that

students who attributed success in mathematics to controllable factors such as hard work showed higher mathematics test scores whereas those who attributed it to external factors such as luck tended to get lower test scores.

Cao and Bishop (2001) compared Chinese and Australians in terms of attribution of success and failure and found that Chinese students view environment and effort as important factors of success in mathematics, while students from Australia consider environment and task as important factor. When it comes to failure, students in China attributed their failure in mathematics to lack of effort more than to other factors, while students in Australia, attribute their failure in mathematics to task difficulty more than to any other factors.

Synthesis

The studies discussed in this section ranged from very old to recent, and explored different levels of students, here in the country and abroad. Although some measurements have changed in the recent years (for example, there is no NCEE anymore), these studies stand as evidence of the importance placed by researchers on investigating academic achievement and the variables or factors that are related to it or could possibly affect it.

In most of these past studies, achievement was usually measured by grades that the students obtained in a subject at the end of the school year or a semester (e.g. College Algebra final grade). The present study is similar to the previous studies in the sense that it is going to find if certain relationships exist between selected variables and mathematics achievement.

However, the present study will differ from the previous ones in terms of the scope of mathematics achievement and how it will be measured. The achievement to be measured in the present study will span a little wider subject matter as basic mathematics includes several pre-college mathematics (basic algebra, basic geometry etc.), and unlike what most previous studies did - using final grades obtained by the students in a specific subject at the end of a semester or a year to represent achievement - achievement in this study will be gauged using the scores obtained in the researcher-made test in basic mathematics. Also, the present study will take on a different setting and a different sample. Many previous achievement and motivation variables will be brought together in a single study, whereas in the past studies they were usually treated separately.

Chapter III

METHODOLOGY

This chapter presents the research design, participants of the study and research locale, sampling procedure, research instruments, data collection procedures, and the tools and methods used for data analysis.

Research Design

This study used descriptive-correlational design. Descriptive research seeks answers to questions by analyzing past events or already existing conditions. This design does not need manipulation of variables or arranging specific conditions; it only looks at what is or was already there, and analyzes relationships among variables involved. Studies that use this research design provide numeric descriptions of some characteristics of a population by studying a sample of that population, and determine whether some factors are associated with certain outcomes or conditions (Bueno, 2016; Best and Kahn, 1993).

Since some of the research questions of this study called for determining relations between variables, the statistical work involved correlational analyses. According to Bueno (2016), when a descriptive research uses correlational analyses, it may be referred to more specifically as correlational research.

In this study, the main variable quantified through survey was mathematics achievement. Many other variables, most of them making up the respondents' profile, were also given numeric descriptions. Most of these variables were correlated among themselves and with the achievement in basic mathematics.

Research Locale, Sampling, and Participants

This study involved a total of 92 college students from several 4-year or 5-year bachelor's degree programs of two main collegiate institutions in Infanta, Quezon, which will be labelled College A and College B.

College A is a private college offering the following bachelor's degree programs: Bachelor of Elementary Education and Bachelor of Science in Business Administration, while College B is a satellite campus of a state university offering the following bachelor's degree programs: Bachelor of Science in Engineering, Bachelor of Secondary Education majoring in mathematics, and Bachelor of Secondary Education majoring in Technology and Livelihood Education (TLE).

Initially, all the college freshmen of College A and College B were included in the data-gathering process. A total of 277 students (207 from College A and 70 from College B) took the achievement test and answered the motivation variables inventories. This sample size was then reduced to 92 students (68 from College A and 24 from College B). All the other students with several missing archival data were consequently removed from the selection. The 92 respondents, with complete data needed for the study, emerged as the final

composition of the sample. This final sample, hence, was also derived with randomness since the researcher did not predetermine who would be selected in the final sample.

Of the total sample, 74% came from College A and 26% came from College B; 63% were female and 37% were male; and majority of the respondents (51%) were in the age range of 18 to 19. Also, the respondents came from almost all parts of northern Quezon. Most of the college freshmen included in the sample were from the municipality of Infanta (51%), where the two chosen schools (College A and College B) were located. Some 17% were from the town of Real and small percentages of respondents came from the municipalities of General Nakar, Polillo, Panukulan, Burdeos, and Patnanungan. Only the town of Jomalig had no representation. There was, however, one member of the sample, who was a current student in one of the schools, but did not originate from northern Quezon. Figure 3.2 below shows the geographic map of northern Quezon.

Figure 3.1. Geographic map of northern Quezon.

source: http://www.quezon.gov.ph/homepage/?info=municipalities

Research Instruments

The following instruments were used in this study.

(1) achievement test in mathematics

The test consisted of 50 multiple choice questions, which were based on a constructed table of specifications found in Appendix A. The questions came from various topics in the areas of mathematics shown in Table 3.5.

Table 3.1

Content of the Achievement Test

Areas of basic mathematics	Number of items	Percent
Elementary Algebra	13	26
Intermediate Algebra	12	24
Geometry	13	26
Advanced Algebra, Trigonometry, and Statistics	12	24
Total	**50**	**100**

Aside from telling the respondents explicitly during the test administration, the researcher stated in the instructions of the test that their scores would be used only in data analysis and that no part of their identity would ever be hinted or revealed.

The examination used a criterion-referenced scoring system. That is, a respondent's score is assessed against a scale rather than compared with other respondents' score through ranking.

The number of correct answers obtained by a respondent (or the raw score) represents his or her basic math achievement score. With this scoring system, the maximum possible score is 50, while the minimum possible score is zero. The passing score is set at 25 correct answers or 50% of the totality. Such cut-off score was based on common practice. To interpret the scores in the basic math achievement test, the following score classification was used.

40 to 50 --- very good to outstanding

35 to 39 --- good

30 to 34 --- moderately good

25 to 29 --- average or just passing

20 to 24 --- poor

0 to 19 --- very poor

Validation

The constructed basic mathematics achievement test originally consisted of 70 questions, all of which were based on a table of specifications checked by the research advisor. The test was also shown to some colleagues in the math education department for content checking and proofreading. The test was then administered in a single section consisting of 34 college freshmen not involved in the final sample. Item analysis was done to obtain indices of difficulty and discrimination. Of the 70 questions, eight were outright eliminated for having not only very low index of difficulty but also for having negative index

of discrimination. Of the remaining 62 questions, the fifty questions with the more acceptable indices of difficulty and discrimination were taken in. These items obtained an index of difficulty of at least 0.20 and at most 0.80, and index of discrimination of at least 0.25. The final form of the achievement test was then re-administered to another similar group of 30 students to determine the reliability of the test. The scores from the test were correlated to current grades (class standing) obtained by the students in their current mathematics class. Computation yielded a correlation coefficient of 0.698, which was a moderately high correlation tested significant at 0.05 level. The final copy of the achievement test is attached in Appendix B.

(2) survey questionnaires/motivation variables inventories

A questionnaire was constructed to measure interest in mathematics, beliefs in the usefulness of mathematics, and attribution of success and failure in mathematics. The constructed questionnaire had four sections, each corresponding to an attitudinal variable to be measured. It also called for other basic information of a respondent such as name, gender, address, and so on. There were clear instructions, which included statements assuring the respondents that all of their responses would be kept anonymous, and each respondent's identity would be protected in the entire research process.

Interest in mathematics and beliefs on the usefulness of math

The first part of the motivation inventories made use of a 4-point Likert type questionnaire, which was for the assessment of the first three variables: interest in

mathematics, beliefs in the usefulness of mathematics, and achievement motivation. There were 10 statements in each section consisting of equal number of positive and negative statements. Some of these statements were taken and then modified from across different studies, while some were thought up and worded by the researcher.

Some examples of statements included in the inventory of interest in mathematics were “Mathematics is my most favorite subject in school” (a positive statement), and “Solving math problems is not an interesting activity for me” (a negative statement). Some examples of statements included in the inventory of beliefs in the usefulness of math were “People use mathematics every day” (a positive statement) and “Many mathematics lessons are useless” (a negative statement).

Respondents were to express their agreement or disagreement to these opinions by choosing a response among the four options: SA – strongly disagree, A – agree, D – disagree, and SD – strongly disagree. All the statements comprising the inventory used to assess each of the three variables are shown in Appendix A.

To obtain scores from this instrument, the following value assignment was used for positive statements:

Strongly agree = 4

Agree = 3

Disagree = 2

Strongly disagree = 1

For negative statements, the order of this value assignment was reversed.

Each total score that a respondent obtained for interest in math, beliefs on the usefulness of math ranged from 10 (the lowest possible) to 40 (the highest possible). The score for a particular variable simply resulted from adding up all the numerical values of a respondent's response in all the ten statements measuring that variable. The following six-level qualification was used to interpret the scores.

36 to 40 --- very high value of the variable measured

31 to 35 --- high value of the variable measured

26 to 30 --- moderately high value of the variable measured

21 to 25 --- moderately low value of the variable measured

16 to 20 --- low value of the variable measured

10 to 15 --- very low value of the variable measured

In the analysis of the response per statement, the over-all score of the respondents for a specific statement was obtained by getting the mean of their response. Hence, the scores ranged from 1.0 to 4.0. The following scale was used to interpret the per-statement mean scores of the respondents.

3.6 to 4.0 --- very high amount of agreement

3.1 to 3.5 --- high amount of agreement

2.6 to 3.0 --- moderate amount of agreement

2.1 to 2.5 --- moderate amount of disagreement

1.6 to 2.0 --- high amount of disagreement

1.0 to 1.5 --- very high amount of disagreement

Attribution of success and failure

In this section of the questionnaire, respondents were presented a set of possible reasons for succeeding in mathematics, and another set of reasons for failing in mathematics. In each of the two situations, respondents were asked to choose from several options as to which among them is their most important reason, second most important reason, and so on.

For attribution of success and failure in mathematics, the respondents' answers are not numerical but categorical. In the analysis of this variable, focus was given to the responses given to each of the first questions. These responses were then classified into whether they are internal or external type of attribution.

Some sample items for the inventory of attribution of success in mathematics were "What is your first reason for obtaining a high grade in mathematics?" Some possible response options were "My ability – I'm really good at math" (an intrinsic attribution) and "The teacher teaches very well" (an extrinsic attribution). Some sample items for the inventory of attribution of failure in mathematics were "What is your first reason for failing an exam in mathematics?" Some possible response options were "I'm just not good enough in math" (an intrinsic attribution) and "The exams were always difficult" (an extrinsic motivation). The whole content of this part of the questionnaire is shown in Appendix C.

Validation

The initially constructed survey questionnaire, as well as a 10-item criteria checklist used to assess the questionnaire, was checked by a research advisor before their duplicates were given to experts for their examination of the research instrument. The checklist used can be found in Appendix D. The experts who examined the instrument were two mathematics educators from Philippine Normal University, one mathematics educator and one research expert from Southern Luzon State University, and one mathematics educator, researcher and administrator from University of the Philippines Diliman. Their comments and suggestions on the specific statements included in the questionnaire were all considered in its revision. Specific suggestions addressed included minor rewording of some statements to be more exact. Other suggestions were removal of some statements from the list (for example, remove "Learning mathematics makes our thinking sharper" because it is similar to another statement already in the list, or remove "Mathematics is an important subject to learn" because other statements can provide better information regarding beliefs in the usefulness of math.) Because some variable contained more statements than the others and there were more positive statements than negative statements, other suggestions that were addressed were making the number of statements constant (that is, ten) across all variables measured and equalizing the number of positive and negative statements in each variable.

Aside from the comments and suggestions, the experts were asked to rate the questionnaire based on the given criteria checklist. On a scale of 1 to 4, 4 being the most acceptable, the whole questionnaire received an acceptability measure of 3.72.

The questionnaires' content was also tested for internal consistency to determine whether the instrument used was reliable. To do this, all the respondents' answers to the interest inventory and beliefs in the usefulness of math were analyzed using SPSS scale reliability function. The Cronbach's alpha values obtained for the two inventories were 0.801 and 0.645, respectively. Such values indicate that the statements comprising the inventories are measuring the same attribute, suggesting that the instrument is reliable.

Other research tools

Aside from the researcher-made instruments, the researcher referred to student records kept by registrar's offices to gather other information that make up the respondents' profile such as high school over-all average and subject-specific grades. Upon request of these records, the school and the office heads were informed through writing and orally that these requested data would be used purely for research purposes and that no identity of any student would ever be revealed in the entire research process.

Data Collection Procedure

After the instruments had been validated and emerged in their final forms, they were employed to acquire the needed data from the target sample. To ensure that all the data gathering procedures would produce correct data, respondents were asked to answer the instruments honestly and independently. To achieve this, they were carefully guarded the entire time they were completing the surveys, while being reminded to give their answers

based only on what they know or what are true to them. They were directly instructed to avoid copying answers from other respondents or giving false information.

The data gathering steps were divided into several stages.

1. **Motivation Variables Evaluation**

   This part was the first step done among all the data-gathering procedures. When the survey questionnaires had been distributed to the respondents, they were instructed carefully and given 10-15 minutes to complete the survey.

2. **Test administration**

   Giving the achievement test to the respondents was done immediately after the respondents were done with the motivation variables questionnaire. The respondents were given 60 to 75 minutes to complete the test without the use of any electronic calculating devices.

3. **Acquiring copies of student records**

   This part of the data-gathering process was done last and took up the longest time to complete – about one and a half months. Letters of permission were sent to the school heads and registrar, informing the school of the research undertaking. Upon approval, the college freshmen's data were retrieved from the registrar's office records through the help of the school's authorized personnel. The specific student data that were collected from the records were: student's over-all grades in first year, second year, up to fourth year; and final grades in math, science, and English from first year to fourth year.

The entire data collection process was performed with utmost care for the participants and for every other person in the research site. It was ensured that all the data-gathering activities would not interfere with the class schedules and other academic activities of all the participants and other people in the immediate environment.

Data Analysis Procedure

When all the needed data were completely collected, they were subjected to organization and analysis. The following statistical tools were used.

1. **Tables and charts**

   Tables and charts were used to present the statistics or summaries of the answers to each research question in a clearer and easier-to-grasp way.

2. **Descriptive statistics**

   To summarize the respondents' profile using numeric descriptions, the following descriptive statistics were used.

   a. **Frequency count and percent**

      Frequency count and percent were used frequently in distribution tables summarizing the results that would answer the first research question, which was about the profiling of the respondents in terms of many variables under investigation in the study.

b. Measures of central tendency

Mean, median, and mode are used to summarize a set of numerical data by getting a single value that serves as the center of the distribution. Students' achievement scores in basic mathematics were summarized using these statistics.

c. Measures of dispersion

Measures of dispersion are used to describe the distribution of the students' achievement scores in terms of how scattered or how concentrated they are around the center of the distribution. Of the several measures of dispersion, the standard deviation was the one used to describe the scores in the basic mathematics achievement.

d. Maximum and minimum values

The extreme values found in the distribution of basic mathematics achievement scores and some other quantitative variables were also identified to easily recognize the upper and lower bounds of the range of the respondents' data.

3. Formulas for determining relations between variables

a. Pearson r

The Pearson r formula – and the accompanying test of significance – was employed in obtaining correlation coefficients between variables that were both in the interval or ratio level. Correlation analysis was used to answer all the last three research questions.

The correlation coefficients were interpreted using the interpretation offered in Blay (2007):

.80 to .99 --- high correlation

.60 to .79 --- moderately high correlation

.40 to .59 --- moderate correlation

.20 to .39 --- low correlation

.01 to .19 --- negligible correlation

b. Chi-square test of independence

Because attribution of success and failure is nominal or categorical variable, its relation with all the other variables under investigation was determined by using the Chi-square test of independence.

c. **Multiple regression analysis**

Multiple regression analysis was employed to determine if the high school achievement variables and motivation variables, taken together, predicted the college freshmen's achievement in basic mathematics.

All data analysis in this study was facilitated by the use of Microsoft Excel and IBM SPSS Statistics.

CHAPTER IV

PRESENTATION, ANALYSIS, AND INTERPRETATION OF DATA

This chapter presents the results and the corresponding discussions. The presentation of the gathered data and the accompanying analysis and interpretation is based on the order of the research problems raised in the first chapter.

Problem 1. What is the profile of the students in terms of the following variables?

Basic Mathematics Achievement

Results on the current achievement in basic mathematics are presented and discussed below.

Table 4.1

Distribution of the Respondents' Scores in Basic Mathematics Achievement Test

Raw Score	Frequency	Percent	Interpretation
35-39	2	2.17	good
30-34	7	7.61	moderate
25-29	8	8.70	average
20-24	11	11.96	poor
15-19	30	32.61	very poor
10-14	34	36.96	very poor
Total	**92**	**100**	

Table 4.1 shows the frequency distribution of the raw scores received by the students in the 50-item basic math examination. It can be easily noticed through the frequencies that, as a whole, the respondents performed badly in the basic mathematics examination. Thirty-four students (37%) showed extremely low performance, their scores being in the lowest

interval, 10 to 14 correct answers. Only 2% of the students received scores that are in the highest interval, 35 to 39, and no student was able to score beyond that. The bulk of the respondents are visibly at the lowest intervals, scores in which are interpreted very poor. Also, a notable pattern emerged from the scores: the number of respondents diminishes as the interval goes up. Overall, only 17 out of the 92 respondents (18%) passed the basic math examination.

Table 4.2

Summary of Descriptive Statistics of the Achievement Test Scores

Statistic	Value
Mean	18.02
Median	17
Mode	14
Standard Deviation	6.58
Maximum Value	36
Minimum Value	10
Skewness	.99
Kurtosis	.31

Table 4.2 gives further details on the basic math examination results. The highest score obtained in the examination was only 36 correct answers out of 50 questions, while the lowest score was a highly unsatisfactory 10. The raw scores of the respondents yielded a mean of 18.02 and a standard deviation of 6.58, which means that the scores are mostly low and a little dispersed as a whole. Considering that the respondents were college students, the average 18.02 or 36% correct answers is a tell-tale indication of a highly insufficient

achievement among the college freshmen. The skewness value of the raw scores is 0.99, and it says that the distribution is a little skewed to the right, which supports the fact that the majority of the respondents scored lower than the mean.

The foregoing discussion points to a central idea: the inadequacy of achievement or performance in mathematics. The majority of college freshmen's performance in the basics of mathematics was below par. These results, however, were somewhat expected, given the common situation encountered in practice – having students that are extremely poor performing in class. Some previous Philippine studies found similar results, backing up this continuing trend of bad performance in basic mathematics among college students. Studies such as those conducted by Andaya (2014), and Patena and Dinglasan (2013) both showed that the sets of college students they investigated performed really low in mathematics. And these kinds of findings were consistent even though the kinds of mathematics tested in the studies were not exactly the same in coverage.

Though the very poor performance of the college freshmen in basic mathematics was somehow predictable, these results stand as evidences of the continuing prevalence of deficiency in mathematics even among the beginning college students. The results suggest that the college freshmen did not learn much of the mathematics competencies prescribed in the secondary school. Now their having been accepted as college freshmen, especially in mathematics-related programs, suggests that student admission standards in the colleges could not select the qualified students. All in all, the basic math achievement data in this study could

be used to re-emphasize how much more room there is for the improvement of mathematics education in Northern Quezon.

Though this is a tiny-scale evaluation of math achievement relative to those like TIMSS or PISA, the emerging picture from the basic achievement results is somehow reflective of the country's general status in mathematics achievement. The Philippines was always either a non-participant or at the bottom of world rankings of mathematics achievements.

International studies such as TIMSS and PISA continually conduct evaluative researches on mathematics achievement because the results produce useful information on how each participant country fares relative to the global norm and suggest the current condition of a nation's mathematics education. Likewise, obtaining current findings on the basic math achievement level of college freshmen in Northern Quezon updates information that will serve to remind that there is still much to troubleshoot in our mathematics education in the locality.

High School Achievement Variables

The high school records of the respondents, which were considered the previous-achievement variables in this study, are presented and discussed as follows.

Table 4.3

Summary of Respondent's High School Grades

Variable	Mean	SD	Verbal Interpretation
High school overall average grade	83.99	2.92	Satisfactory
High school overall mathematics average grade	82.96	3.53	Satisfactory
High school overall science average grade	83.44	3.18	Satisfactory
High school overall English average grade	83.49	3.25	Satisfactory
Fourth year high school overall average grade	84.93	3.29	Satisfactory
Fourth year high school math final grade	83.45	4.06	Satisfactory
Fourth year high school science final grade	84.40	3.79	Satisfactory
Fourth year high school English final grade	84.22	4.16	Satisfactory

The high school data of the respondents, as shown in Table 4.3, consisted of overall averages in math, science, and English; final grades in fourth year math, science, and English; and overall average in fourth year and in the whole four years of high school. The first thing that can easily be noticed in the table above is that the numbers form a homogeneous data set. All these high school data converge to values within 82 to 85; the highest is the fourth year overall average and the lowest is the overall mathematics average. In the Department of Education grading system, these values are given the impression, satisfactory. However, considering that grading in the secondary school is notably generous, figures cannot be that reflective of the students' actual performance. In light of this, the satisfactory level might actually translate to being low. Therefore, most of the respondents had only ordinary performance during high school. This kind of high school data might be attributed to the respondents' components being students here in Northern Quezon. Most of the time, students who performed better academically in high school went to the city for college, leaving most

of the average students in the local collegiate institutions. The distribution of the respondents' over-all high school averages can be seen in Table 4.4.

Table 4.4

Respondents' Over-all High School Averages

Range	Verbal Rating	Frequency	Percent
90 -100	outstanding	2	2.17
85-89	very satisfactory	29	31.52
80-84	satisfactory	53	57.61
75-79	fair	8	8.70
Total		**92**	**100**

Of the 92 respondents, only two had overall high school average of at least 90, which is the cut-off value for an outstanding grade in the Department of Education scale. Eight respondents' overall averages belonged in the interval 75-79, which are grades considered to be really low and close to failure. The large chunk of the respondents was in the middle intervals, from which it can be deduced that the majority of the participating college freshmen were average students when they were in high school and only a few were on the both extremes.

The distribution of students' high school performance in mathematics is shown in Table 4.5.

Table 4.5

Distribution of the Respondents' Over-all Mathematics Averages in High School

Range	Verbal Rating	Frequency	Percent
90 -100	outstanding	6	6.52
85-89	very satisfactory	15	16.30
80-84	satisfactory	54	58.70
75-79	fair	17	18.48
Total		**92**	**100**

Like the overall high school average, the concentration of the overall math average is on the interval 80 to 84, which contained 58.70% of the respondents. It is easy to see from the figures that the participating college freshmen did not do that well in high school mathematics. Seventeen respondents were at the lowest category, each obtaining an average within the interval 75-79. Especially in the local high schools, a grade belonging in this interval is almost a fail. But teachers are not allowed to fail students so most passing grades are a product of much consideration and adjustment.

Despite the evident concentration of the respondents in the lower grade intervals, the sample got to include a few with outstanding mathematics grades. Six college freshmen obtained an average of at least 90 in their four years of mathematics subjects in high school. Perhaps some of them were honors students during that time.

Motivation Variables

The results and discussion for all the motivation variables under investigation in this study are presented below.

Table 4.6

Respondents' Average Scores on the Inventories of Interest in Mathematics and Beliefs in the Usefulness of Mathematics

Attitudinal Variable	Average Score	Interpretation
Interest in mathematics	28.84	Moderately high level
Beliefs in the usefulness of mathematics	32.34	High level

The average scores of the respondents in the two motivation variables namely interest in mathematics and beliefs in the usefulness of math are given in Table 4.6. Each inventory used in the measurement of each of the above variables used a Likert-type scale, assigning the numbers 4, 3, 2, and 1 to each response in the inventory. Using the scale, the maximum possible score for each variable is 40, which is obtained when all 10 statements are given the value 4. That is when all positive statements are strongly agreed to and when all the negative statements are strongly disagreed to. The lowest score possible is 10, which is obtained when all the statements are given the value 1. That is when all positive statements are strongly disagreed to and when all the negative statements are strongly agreed to.

From the table, it can be seen that beliefs in the usefulness of mathematics obtained a higher average score across respondents than interest in mathematics. Beliefs obtained a score above 30, which means that the respondents as a whole have highly positive beliefs in the

usefulness of mathematics. The score being above 30 may be thought of as the majority of respondents answering strongly agree to positive statements and strongly disagree to negative statements. Interest in mathematics, on the other hand, scored a little lower than 30. This means that as a whole, unlike in the degree of the previous variable, respondents are only moderately interested in mathematics.

The statements comprising the inventory for interest in mathematics, with the corresponding weighted mean and verbal interpretation, can be seen in the following table.

Table 4.7

Respondents' Average Score per Statement in the Inventory of Interest in Mathematics

Statement	Weighted Mean	Interpretation
1. I enjoy learning mathematics.	2.96	Moderate amount of agreement
2. I wish that I don't have any more math subjects to take.	2.04	Moderate amount of disagreement
3. I learn many interesting ideas in mathematics.	2.97	Moderate amount of agreement
4. Mathematics is a boring subject for me.	1.86	High amount of disagreement
5. I would still want to study math even if it is not required.	2.75	Moderate amount of agreement
6. I do not like school work that involves numbers.	1.85	High amount of disagreement
7. Mathematics is my most favorite subject in school.	2.41	Moderate amount of disagreement
8. Solving math problems is not an interesting activity for me.	2.04	Moderate amount of disagreement
9. I usually feel excited to attend a math class.	2.68	Moderate amount of agreement
10. I hate math.	1.90	High amount of disagreement

It would be helpful to note that the odd-numbered statements are positive, while the even-numbered statements are negative.

The two rightmost columns of the table show that the positive statements obviously did not get much agreement from the respondents, as all positive statements each averaged below 3.0, which is the exact numeric figure for agree. Results less than 3.0 quickly suggest that there were many respondents who indicated a disagree or a strongly disagree response. It is quite notable that among the positive statements, one received an overall moderate amount of disagreement (scoring only 2.41) from the respondents: statement number 7, "Mathematics is my most favorite subject in school." This clearly suggests that mathematics is not the most favorite school subject of the majority of the participating college freshmen. This might be attributed to the fact that most of the 92 respondents were majoring in other subjects, not mathematics or engineering. Also, students of math-related courses such as mathematics education or engineering are the most likely to prefer mathematics over other subjects, and the random sample of this study got to include only a few of these kinds of students.

Nonetheless, since all the rest of the positive statements each obtained an overall moderate amount of agreement, still more respondents leaned toward the agreeing side than the disagreeing side. The statement "I enjoy learning mathematics" received the most strongly agree responses (17 respondents) among all the positive statements in the inventory. But there were 18 respondents who were not in agreement to such statement. The statement "I learn many interesting ideas in mathematics" got the highest weighted mean (2.97) among the positive statements, though such value was just almost the same as the results of the other

positive statements. The result in the fifth statement indicates that 61 respondents out of 92 would still want to study math subjects even if they were not required. If such responses were honest and a product of accurate understanding of the statement, then they are quite good indicators of positive interest in mathematics among the respondents. It is not hard to understand that interest can be seen when individuals engage in a particular subject or activity even when there is no requirement or element of coercion. In the last positive statement "I usually feel excited to attend a math class", more than 50% were on the agreeing side; however, it is worth noting that still 33 respondents expressed disagreement.

Though the positive statements obtained overall results that still lean on the agree side, the fact that there are still many respondents who disagreed or strongly disagreed to the positive statements is not hard to believe at all because in teaching practice, many students actually voice out –even directly to their teachers – their dislike for mathematics or their weakness in it.

The negative statements obtained better results in terms of the interest in math measurement. It can be seen from the table that all of the even-numbered statements each obtained either a moderate amount or a high amount of disagreement. Since disagreement to negative statements is the analogue of agreement to positive statements, the results for the negative statements suggest positive interest in mathematics.

Among the negative statements, the statements “Mathematics is a boring subject for me”, “I do not like school work that involves numbers”, and “I hate math” each received a high amount of disagreement from the respondents. On the other hand, the statements “I wish that I don’t have any more math subjects to take” and “Solving math problems is not an interesting activity for me” each received only a moderate amount of disagreement. The disagreements indicated by the respondents for these statements mean that although other students hate or find mathematics boring, majority still believes otherwise.

On the whole, most of the positive statements in the interest inventory were agreed to, and most of the negative statements were disagreed to, suggesting an overall positive interest in mathematics among the respondents. But the interest level is only moderately high, as evidenced by the overall score of 28.84 out of 40 (found in Table 4.6).

These results are a little contradictory to the results found in other articles and studies. Most results found or indicated lack of interest in mathematics of students. Not much has been said about Filipino students, but students abroad have been reported to have a declining interest in mathematics. American students (Khazan, 2012), as well as Australian students (University of Western Sydney, 2017), were reported to lack interest in mathematics. This lack of interest in the subject was said to be a cause of their bad performance in mathematics and of the little percentage of students who pursue STEM-related courses and careers. Even students who are generally proficient in mathematics like the Japanese students reported being uninterested in mathematics (OECD, 2012). Similarly, in a study conducted by Grootenboer and Marshman (2016), they remarked that most students finish school still disliking mathematics for the reason that it is boring and hard.

It is therefore quite contradictory that the respondents of this study showed bad performance in the basic mathematics achievement test, yet most of them manifested positive interest in mathematics. This might be attributed to one kind of limitation that can be encountered in a survey study like this one. Even when respondents had been informed very well that their answers would not affect their performance or grades, the presence of social desirability bias among respondents could still not be totally eliminated.

Table 4.8

Respondents' Beliefs in the Usefulness of Mathematics

Statement	Weighted Mean	Interpretation
1. People use mathematics every day.	3.64	Very high amount of agreement
2. We do not need mathematics to learn other subjects.	1.84	High amount of disagreement
3. I will need mathematics for my future work.	3.30	High amount of agreement
4. Many mathematics lessons are useless.	1.93	High amount of disagreement
5. Mathematics is useful in improving the technology of our country.	3.27	High amount of agreement
6. Taking a math subject is a waste of time for me.	1.71	High amount of disagreement
7. Many mathematics lessons have important applications in real life.	3.32	High amount of agreement
8. It is not important for me to do well in math.	1.98	High amount of disagreement
9. I think that math improves our mental capabilities.	3.27	High amount of agreement
10. I do not see math subjects as important part of the curriculum.	1.75	High amount of disagreement

Table 4.8 shows the breakdown of responses in the assessment of the respondents' beliefs in the usefulness of mathematics. Compared with the per-statement results obtained in the inventory of interest in mathematics, per-statement results of the inventory of beliefs in the usefulness of math indicate more positive overall responses among the respondents. It can be seen on the right-most column of the table that all positive statements in the inventory received a very high amount or a high amount of agreement, and all the negative statements got a straight high amount of disagreement. It would be easy to read from these data that the beliefs in the usefulness obtained a higher, more positive measurement among the college freshmen, compared to the measurement obtained for the variable, interest in mathematics.

Clearer insight on the respondents' beliefs regarding the usefulness of mathematics can be gained by running through the distribution of responses in the specific statements included in the inventory. It can be seen from the table above that the statement "People use mathematics everyday" got the highest degree of agreement among the positive statements. There were 95% of the respondents who agreed or strongly agreed to this statement, and the percentage of respondents who actually strongly agreed was 71%, which was the highest across all statements in the inventory. This result indicates that most students surveyed, regardless of their achievement in mathematics, believe that mathematics is used every day. Some 86% of the college freshmen agreed or strongly agreed that they will need mathematics for their work. This still large percentage might be attributed to the fact that people are usually aware that various jobs, even those that are not directly mathematics-related, still employ

basic math skills such as arithmetic. Some 92% of the respondents believe that mathematics is useful in improving the technology of the country. This means that a huge chunk of the respondents think that the modernity of today's technology is somehow governed by being knowledgeable and skillful in mathematics. The largest percentage of respondents (96%) agreed or strongly agreed that many mathematics lessons have important real-life applications. This result is rather surprising because in practice most students are often heard complaining that they study many topics without known uses in real life. Also a large percentage (93%) of the respondents believes that math improves people's mental capabilities. This might be attributed to the general perception that since mathematics is not easy, the mind that works on it becomes sharper.

Some 87% of the respondents disagreed or strongly disagreed with the statement "We do not need mathematics to learn other subjects." This would imply their belief that mathematics is needed to be able to study and learn in other disciplines. Some 78% of the respondents do not believe that mathematics lessons are useless, which means that they still perceive mathematics lessons to be helpful. However, it is worth noting that 20 college freshmen in the sample believe so. Approximately nine of every ten respondents do not consider taking a math subject a waste of time, which is a good result in favor of mathematics subjects. This means that taking math subjects is still a worthwhile activity, something worth spending time for. Some 88% of the respondents disagreed or strongly disagreed with the statement "It is not important for me to do well in math." This means that the majority of the sampled college freshmen still value their performance in math classes. It is also noteworthy

that a large percentage of the respondents (88%) disagreed and strongly disagreed with the statement “I don’t see math subjects as important parts of the curriculum,” which suggests that they see mathematics as an important subject in the school curriculum.

The high percentage of disagreements with all the negative statements in the inventory shows consistency with the high percentage of agreements with the positive statements. This is why the average score for the beliefs on the usefulness of mathematics – being a high score of 32.34 out of 40 –is justified.

Though this present study obtained more positive results across respondents, results of some studies are similar. A study conducted by Kislenko, Grevholm, and Lepik (n.d.) revealed that Grade 9 students averaged 3.96 out of 5 while first year students got an average of 3.62 in their beliefs in the usefulness of mathematics. Both figures mean that the averages lie between neutral and agree but are closer to agree. The study concluded that though students generally perceive mathematics as boring, they consider it really useful nonetheless. However, the results of the present study are contrary to the findings of Grootenboer and Marshman (2016) saying that most students find mathematics useless.

Table 4.9

Respondents' Most Important Reasons for Success in Mathematics

The most important reason	Frequency	Percent	Attribution Type
1. It's my ability – I'm really good at math.	6	6.52	Internal
2. I studied hard for it.	51	55.43	Internal
3. The exams/tasks were easy.	1	1.09	External
4. The teacher taught really well.	28	30.43	External
5. The teacher was kind and helpful.	2	2.17	External
6. I was just lucky.	3	3.26	External
7. Other reasons	1	1.09	External
Total	**92**	**100**	

The results on the assessment of respondents' attribution of success in mathematics are shown in Table 4.10. The table shows the breakdown of the responses in regard to the respondents' most important reason they think of when they experience success in mathematics such as getting a high score in an examination or a good final grade in the subject. It can be easily spotted from the table which reasons stood out over the others. The reason, "I studied hard for it" was chosen as their most important reason by the largest percentage of the respondents – around 55 %. This reflects that the majority of the college freshmen attribute being successful in mathematics to making efforts in studying the subject. Some 30% of the respondents indicated "The teacher taught really well" as their most important reason for succeeding in mathematics, making it the second most popular attribution. Since teachers' teaching well ranks second as a reason for mathematics success of students, this provides insight on how the students place value on the teachers as a cause for their achieving in school. Far below the first two attributions lies the third in rank: the

student's mathematics ability. Only around 7% of the respondents placed the greatest importance on the reason, "It's my ability – I'm really good at math." This might be a sign of modesty among the respondents but it is also an indication that only a few could be confident enough of their mathematical ability to assert that it is the reason for their success in mathematics. The other attributions listed in the inventory each received very small frequencies compared to the top three attributions. Some 1% of the respondents attributed success in mathematics to the ease of the exams or other tasks, 2% to the teacher's being kind and helpful, and 3% to luck.

From this distribution of responses, the college freshmen seemed to attribute success in mathematics first to their effort, second to their teacher, and third to their math ability. It can be said from these results that the most common attribution is an internal, controllable factor; their second most common attribution is an external, uncontrollable factor; and the third is an internal, uncontrollable factor.

Table 4.10

Respondents' Most Important Reasons for Failure in Mathematics

The most important reason	Frequency	Percent	Attribution Type
1. I am just not good enough at mathematics.	24	26.09	Internal
2. I just did not study hard.	38	41.30	Internal
3. The exams/tasks were always difficult.	13	14.13	External
4. The teacher did not teach well.	10	10.87	External
5. I was not feeling well.	6	6.52	Internal
6. I was unlucky.	0	0	External
7. Other reasons.	1	1.09	External
Total	**92**	**100**	

The respondents' most important attributions of their failure in mathematics are shown in Table 4.11. Evident from the table, the most frequent answer was "I just did not study hard", which was given by 41% of the respondents. From this result, it is easy to deduce that majority of the respondents believed that their failure in mathematics was just the result of their lack of effort to study the subject. The second most frequent answer was "I am just not good enough at mathematics, which was given by 26 % of the respondents. This means that the second most common attribution for failure in mathematics is the lack of talent or skill in mathematics. The third reason most frequently picked by respondents was "The exams/tasks were always so difficult." This reason is somehow expected to be one of the common choices because in practice it is the consensus among students to say that the things they do in math classes are difficult. It can be noticed that when it came to failure in mathematics, the first attribution was still to effort or the lack thereof. But the second and third reasons changed: the second reason now pointed to ability or the lack thereof, and the third task difficulty.

On the whole, in terms of the three motivation variables, the college freshmen in this study can be described as individuals whose interest in mathematics is moderately high, and whose beliefs regarding usefulness in mathematics is highly positive. They generally attribute their success in mathematics to their effort in studying for the subject, and their failure to the lack or absence of such effort – which means that the nature of their attribution of both success and failure in mathematics is internal.

Problem 2. Are the high school achievement variables related to current achievement in basic mathematics?

All the previous-achievement variables considered in this study were each correlated with the current achievement in basic mathematics using Pearson r. Microsoft Excel was employed to facilitate computations. The resulting correlation coefficients were tested for significance at $\alpha = .05$ level. Results are summarized in the table below.

Table 4.11

Correlations between High School Achievement Variables and Basic Math Achievement

	Previous-Achievement Variables							
	HS overall average	HS overall math average	HS overall science average	HS overall English average	Fourth year HS overall average	Fourth year HS math final grade	Fourth year HS science final grade	Fourth year HS English final grade
Basic Math Achievement	.46*	.49*	.44*	.45*	.50*	.49*	.43*	.42*

Note. *$p < .05$

Table 4.11 shows all the coefficients of correlation resulting from correlating each previous-achievement variable with basic mathematics achievement. First thing that can be noticed from the display of the values is that all of the correlation coefficients obtained were positive. Also, all values fall within the range .42 to .50, which are all moderate correlation values. When the correlations were tested for significance, all of the p-values obtained were lower than .05, indicating that the correlations imply significant relationships at .05 level.

Among the previous-achievement variables considered in this problem, fourth year high school overall average obtained the highest correlation coefficient with basic math achievement, with r = .50. It was followed closely by high school overall math average and fourth year math final grade, both having r = .49. High school overall average ranked third with r = .46. On the other end, the variable that obtained the smallest correlation coefficient with basic math achievement was fourth year high school English final grade.

This overall result – previous-achievement variables having significant moderate positive relationships with basic math achievement – means that an increase or decrease in the values of the previous-achievement variables corresponds in some degree to an increase or decrease, respectively, in the values of the basic math achievement of the college freshmen. In light of this, it can be said that these previous-achievement variables could be of help in predicting the current achievement level of the students. In this sense, the result can be helpful in upgrading mathematics education in the community by improving the method by which colleges select students especially those getting into mathematics-related programs. Many universities reputed to be providing high quality education – here and abroad – do not enforce high standards of student selection just for nothing. They believe that recruiting the fittest students into programs helps in maintaining that quality and in strengthening the discipline. Harvard University for example (cited in Espenshade and Chung, 2010), found that some pre-college scores such as the Scholastic Aptitude (SAT) subject tests and high school grade point average (GPA) predict performance in college; and as a result, uses some high school data to select the students they think are appropriate or acceptable into their college programs.

The results in this section conform, to some extent, to the findings of some studies in the past. Matthews and Farmer (2008) found that prior achievements in mathematics are related with present mathematics performance. More specifically, according to Capellari et al. (2009), high school achievements are significantly related with college math grades or achievements. This is the reason why the best universities in the country not only consider the performance in entrance examinations as the basis for student admission, but also the student's previous scholastic records.

The results point to some mathematics education problems persisting in the local educational community today. A large number of high school students graduate every year and enter college with very little preparation in mathematics. This poses difficulty to the incoming college freshmen, especially those that get into a mathematics-related major; students tend to grapple with beginning college subjects such as the Basic Math or the General Math, which is the gateway to the understanding of the more complicated mathematics they take as they go up the ladder. The lack or even absence of students' mathematics preparation in high school also poses threats to the quality of the mathematics-related programs that will accommodate them in college. The wide gap between what the high school graduates know and what they are supposed to already know surely produces more teaching difficulty, which will usually be shouldered by the teaching faculty in college. This now poses a problem to the tertiary institutions because the strength or quality of college programs depend so much upon the quality of student selection.

The results of this study will help to remind everyone that there are solutions to some continuing educational problems if addressed properly. First, prior achievements predict success in college to some extent, and therefore it would be paramount that preparatory education in high school be sufficient before going to college. There are several ways that mathematics education in high school might be improved. These have been sorted out as common views of some school administrators and teachers alike. First, if the educational system could do away with the so-called mass promotion, the quality of education might be helped to improve. Rephrasing what a college administrator remarked, mass promotion keeps both the students and teachers from working hard. Students know that no matter how bad they do or behave in school, they will still pass and graduate. Likewise, teachers know that at the end of the year, their goal is to make adjustments on the grades of the failing students to make them pass, making them not interested in the accurate assessment of student learning. Mass promotion, according to another college administrator, stems from the schools' motivation to receive certain performance-based incentives, which rely on the number of students passed and promoted. As a result, this motivation causes the high school educators to shift their focus away from comprehensive teaching and accurate evaluation of students' progress to just aiming for the performance incentives. It probably goes without saying that if a system such as this continues, the quality of teaching school subjects, including mathematics, is surely jeopardized. On the other hand, retooling the current educational system and implementing a stricter one that disciplines students to behave properly and to work hard to pass a subject, would most likely produce better high school graduates.

Many people currently in the teaching profession are also of the consensus to mention the following as other means by which mathematics teaching in high school might be improved. Some suggestions are to make teaching hours for a math class longer since it is one of the core subjects in high school, and to provide more time for drills to master a lesson. Because completeness is one element of sufficiency of teaching, another suggestion is to make wise use of the whole year to cover completely the prescribed math topics for that particular year so that no topics and competencies are missed. Another suggestion is to diagnose the students with possible deficiency in the basics of mathematics (fractions and signed numbers, for example) and reteach these topics if need be, so that errors would not be carried over to the next level mathematics. And still another suggestion is to try to make examples and explanations in math classes more concrete and related to real life. One suggestion refers to improving teaching in general: (1) to reduce class size to 25 to 30 per classroom to improve class concentration and student progress monitoring, and (2) to teach actively the contents of learning materials and stop the practice of teachers copying on the board what is in the book only for the students to spend so much time copying into their notebooks. Such classroom activity has been widely used in secondary schools of Northern Quezon area and does not help in advancing the knowledge and skills of students.

Another mathematics education problem in the community is having so many students in college that are accepted and placed in any program without reference to their capability as beginning tertiary students. The results point to the relationship between prior achievement (high school grades) and their current math achievement. This implies the importance of

schools' having some policy on student admission into college programs with emphasis on student placement in math-related programs. If properly implemented, this policy could make college programs stronger, compared to the plain "accept everyone" method of student selection. This policy might be done by having all incoming college freshmen undergo an entrance examination which truly tests general potential and ability, and is not just a formality. And for students who intend to enter a math-related program, an additional math diagnostic or aptitude test might be administered. For better measurement, these examinations should be well-crafted and thought out by the admission committee. The results of these examinations, together with high school averages in math, science, and English, might be a better basis for admission. This method is definitely not new, but materializing this idea in Northern Quezon would lead to a better fashion of selecting and/or placing students (say, take the top n students after ranking all the examinees based on their overall scores, or refer this particular student to another program because his or her score in math is too low).

This is not to say that colleges in Northern Quezon must change over so easily to the standards of the big universities and colleges. Mindlessly applying standards used in well-established educational institutions, being a far cry from the local standards, might lead to schools having no student selected at all. However, the results of the study could help remind and suggest that there is room for improvement in the way things are done in the locality and that the quality of mathematics education can be enhanced if college programs would be able to take in the students who have the potential to perform well and are likely to study hard and finish the program.

There are many unpleasant consequences that may arise by lack of attention to the importance of sufficiency of math background in high school and by the very loose fashion of student screening in colleges in the local area. Many students who have finished a bachelor's degree in a mathematics-related major resulted in taking licensure examinations multiple times, and thus wasting effort, money, and time in the process. Other graduates even end up unemployed and not able to practice their line of profession.

This problem might be addressed by strengthening two things in school systems: improving the screening of students into math-related college programs – as discussed above – and improving the teaching of mathematics in college and implementing stricter competency-based assessment of mathematics performance. This would imply that a student gets to finish subjects, end eventually the whole program, with sufficient background that enables passing employment-related examinations and performing basic tasks on the job. Experience has shown for a long time that loosely passing students in mathematics subjects leads to graduating without actually acquiring the basic math skills needed to be ready for the real world.

Problem 3. Are motivation variables related to the current achievement in basic mathematics?

To help answer this research question, a table of correlation is shown below. The table includes only the first two of the three motivation variables: interest in math and beliefs in the usefulness of math. The way these variables were scored made these variables fall under the interval type; the results for the third variable, the attributions of success and failure in mathematics, are in another table since these variables are of the nominal type. The

hypotheses tested here, just like in the previous problem, were tested at $\alpha = .05$ level of significance.

Table 4.12

Correlations between Two Motivation Variables and Basic Math Achievement

	Motivation Variables	
	Interest in math	Beliefs on the usefulness of math
Basic Math Achievement	.34*	.16
Note. *p<.05,		

It can be seen from the table that the correlation coefficients between the two motivation variables and basic mathematics achievement are all positive, but the values are all small. Between interest in mathematics and basic math achievement, the correlation coefficient was .34, with a p-value less than .05. This means that the correlation indicates a low but significant relationship between interest in math and basic math achievement. The correlation coefficient obtained between beliefs in the usefulness of mathematics and basic math achievement was .16 with p-value of .123. Aside from the correlation coefficient being a really small value, the p-value of .123 indicates that the correlation coefficient is not significant at .05 level.

The results above show that only interest in mathematics had some relation with achievement in basic mathematics. From the results of the previous problems, it was the measurement of interest in mathematics of college freshmen that obtained a lower score. Yet, it was the variable that obtained the higher and significant (though still low) correlation with basic mathematics achievement between the two motivation variables. This means that difference in interest levels in mathematics might determine some difference in basic mathematics achievement. To be specific, since the correlation coefficient was positive, a higher interest level might – to some extent – determine a higher performance or achievement in mathematics.

There were studies that investigated the role of interest in learning and how interest in subjects like mathematics was related to performance and achievement. Kpolovie et al. (2014) for example, found in their study that interest in learning and academic performance are positively related and that the former predicts the latter. This result conforms to what Santrock (2008) wrote regarding interest. He stated that interest is positively linked to learning. The study of Heinze, Reiss, and Augsburg (2005) also indicated that interest in mathematics could be regarded as a predictor of achievement in mathematics.

The results of this section showed that interest in mathematics emerged as the one positively related to basic mathematics achievement, and that the rest of the attitudinal variables had no significant relationship to such an achievement.

The use of these results in mathematics education might be applied in formulating strategies to promote mathematics classes to students by making it a more enjoyable subject. This can be done by math teachers and instructors through additional efforts in their teaching

to consciously infuse interest into their class activities. This might be achieved, for example, by engaging students in active discussions, providing ample examples and exercises that give individual students chances to answer themselves, and by using teaching materials that hold students' attention. And because math is a highly visual subject, it is important to emphasize the importance of large enough, vivid board writing, as this alone can already spark student interest during math classes.

Problem 4. Do high school achievement variables and motivation variables predict achievement in basic mathematics?

To answer this question, multiple linear regression was performed on the variables using IBM SPSS 23. Results are shown in the following tables.

Table 4.13 Multiple Regression Output

Table 4.13a

Model Summary

Model	R	R square	Adjusted R Square	Std. Error of the Estimate
	.580	.336	.235	5.75569

Table 4.13b

ANOVA

Model		Sum of Squares	Df	Mean Square	F	p-value
1	Regression	1324.844	12	110.404	3.333	.001[b]
	Residual	2617.112	79	33.128		
	Total	3941.957	91			

Table 4.13c

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	p-value
1	(Constant)	-59.177	18.840		-3.141	.002
	interest in math	.264	.155	.198	1.704	.092
	belief in usefulness of math	-.070	.173	-.042	-.406	.686
	overall high school average	-2.248	1.338	-.998	-1.679	.097
	overall math average	.679	.559	.364	1.215	.228
	overall science average	.534	.756	.258	.706	.482
	overall English average	1.089	.699	.537	1.559	.123
	fourth year average	1.501	.783	.749	1.917	.059
	fourth year math average	.169	.361	.104	.470	.640
	fourth year science average	-.427	.414	-.246	-1.031	.306
	fourth year English average	-.428	.431	-.271	-.994	.323
	attribution of success in math	.5151	1.276	.041	.432	.667
	attribution of failure in math	-1.074	1.492	-.071	-.719	.474

Multiple regression analyses were conducted to examine if the high school achievement variables and motivation variables predict basic math achievement. Correlation among the independent variables was also conducted to determine how these variables are related to each other pairwise.

Table 4.13 presents the summary of information obtained from IBM SPSS output. As can be seen the multiple regression model with all high school achievement and motivation variables as predictors produced $R^2 = .336, F(12,79) = 3.333, p < .05$. The coefficient of determination R^2 being .336 means that close to 34% of the variation in basic mathematics achievement is explained by high school achievement and motivation variables put together. The significance of F in the ANOVA table shows that the p-value obtained is less than .05, suggesting that the regression model is valid.

However, data in the coefficients table show that all of the coefficients obtained are not significant (all p-values exceed .05), which means that all of the high school achievement and motivation variables are not significant predictors of basic mathematics achievement. Because R value is not large enough, R^2 becomes understandably a much smaller number, which makes the set of independent variables weak in its ability to predict the dependent variable. When the independent variables (the high school achievements and motivation) are taken individually and paired with the dependent variable (the basic math achievement), the bivariate correlation analysis shows that some pairs are actually positively and significantly related. This is because in pairwise correlation, no other variable comes into play. On the other hand, in the multiple regression model, all the other variables come in the picture. The interaction of the independent variables have some pulling effects on each other, and so taken together, the high school achievement and motivation variables appear to be only slightly predicting the basic math achievement of the college freshmen.

The result of the bivariate correlation analysis among the independent variables can be seen in Table 4.14.

Table 4.14

Correlations between the Independent Variables

	interest in math	belief in usefulness of math	overall high school average	overall math average	overall science average	overall English average	fourth year average	fourth year math average	fourth year science average	fourth year English average	attribution of success in math	attribution of failure in math
interest in math												
belief in usefulness of math	.348											
overall high school average	.345	.367										
overall math average	.440	.318	.908									
overall science average	.297	.314	.947	**.851**								
overall English average	.218	.303	.923	**.828**	**.860**							
fourth year average	.337	.326	.886	.797	.850	.832						
fourth year math average	.383	.308	.788	.845	.757	.709	.841					
fourth year science average	.341	.220	.761	.717	.818	.717	.863	**.772**				
fourth year English average	.191	.283	.793	.707	.732	.862	.883	**.736**	**.719**			
attribution of success in math	-.115	-.021	.040	.005	.058	.083	-.006	-.007	-.029	.012		
attribution of failure in math	.091	.027	.193	.290	.184	.163	.201	.283	.216	.192	-.039	

Table 4.14 displays all the Pearson r values between each pair of previous-achievement variables. First, it is remarkable that all these correlation coefficients are positive

and indicate at least moderately high correlation: .71 is the lowest and .95 is the highest. And since the p-values obtained for all cases are less than .05, another thing worth pointing out is that all these correlations are significant at 5% significance level. Some of these correlation coefficients show really high correlation; however, the outcomes are not very surprising because they are predictable: many of these variables are not mutually exclusive (for example, over all high school math average and fourth year mathematics final grade). Nonetheless, correlation coefficients between some non-overlapping variables are noteworthy. These numbers are highlighted in the table.

The correlation obtained between high school mathematics average and high school science average was high, r = .85. Between high school mathematics average and high school English average, there was also a high correlation, r = 0.83. And between high school science average and high school English average, the correlation was even higher, r = .86. Among the fourth year final grades in mathematics, science, and English, the correlations were moderately high. Between fourth year math final grade and fourth year science final grade, r = .77. Between fourth year math final grade and fourth year English final grade, r = .74. And between fourth year science final grade and fourth year English final grade, r = .72. Again, all these correlation coefficients were tested to be significant at .05 level.

The results shown above indicate that the performances in high school mathematics, science, and English seem to go hand in hand. Because the correlations are all positive and at

least moderately high in degree, this means that, for example, students with good grades in math are likely to have good grades also in Science and English. Those that have bad grades in one of the three subjects tend also to have bad grades in the other two.

These results conform to what other studies found regarding the relationships among mathematics, science, and English. Several studies have pointed out the link between performance in English and performance in mathematics. According to Henry, Nistor, and Baltes (2014), proficiency in English determines a student's performance on mathematics assessments. This might be accounted for by the fact that mastery of English is needed to understand mathematics and achieve better results (Rambely et al., n.d.). This must be especially true in the Philippines because mathematics is taught and learned in English. In India, another non-native English speaking country, Hasan and Khan (2015) found that there was low positive to moderate positive correlation between English and mathematics achievement of students. In the case of the relationship between math and science performances, other studies found even closer link between the two. Oyedeji (2011) wrote, for example, that the relationship between science and math has been strong since the time of Euclid, Archimedes, and Galileo. This is true because math plays an important role in the scientific method in all of the sciences. International studies on mathematics and science achievements support this relationship. Li, Shavelson, Kupermintz, and Ruiz-Primo (2002), as well as Wang (2005), studied past achievement data of TIMSS. In these studies, they found that there were consistent and moderate to high correlations between mathematics scores and science scores. In the former study, they even revealed that the correlation coefficient

obtained between math scores and science scores was .74. Though the high school math and science grades treated in the present study are not as reliable as the TIMSS scores in terms of achievement measurement, it is still interesting to note that the correlation coefficients obtained between math grades and science grades of the respondents (.77 for fourth year grades and .85 for overall high school grades) were not that far from .74. Another study, conducted by Kurumeh, Igyu, and Mohammed (2013) found that there was significant positive relationship between performance in math and performance in each of the sciences: biology, chemistry, and physics. The study stressed the importance of mathematics to science and emphasized that achievement in mathematics can be used to predict achievement in science.

The results shown above suggest that there is a positive link between performance in mathematics and performances in English and science. Its implication to mathematics education is that grades in English and science, which are usually considered equally important school subjects, may be considered predictors of grades in mathematics.

Also, English subjects are very much connected to math and science subjects in the Philippine curriculum because these two subjects are taught in English and their learning materials are all written in English. Because of this, students who have good grounding in English and are skilled in reading comprehension are most likely to have an advantage in understanding definitions, rules, and problems in both mathematics and science. Conversely,

exposure to mathematics and science lessons gives additional language practice since reading in these subjects are all in English.

As such, the results imply the importance of strengthening English and science teaching to support learning and performance in Mathematics. It is suggested that English teaching should give more attention to enhancing students' skill in reading with comprehension. This can be done by incorporating a lot of reading practice in English classes. In a similar manner, since science concepts are mostly understood and learned by reading books and articles, it is suggested that English comprehension practice be also consciously integrated in science classes. This can be done by providing exercises and assignments for critical reading and to not just rely on memorization.

If students are equipped with English skills, one barrier to understanding is removed, and students would most likely lessen their difficulty in dealing with English-dependent subjects such as mathematics and science.

Like the correlations obtained between previous-achievement variables, the correlations obtained between the three attitudinal variables are all positive and significant, as indicated by the p-values being all less than .05. Though the correlations are significant, the small correlation coefficients displayed in the table show low or weak degrees of relationship.

Interest in mathematics and beliefs in the usefulness of mathematics obtained a low positive correlation, r = .35. Between interest in math and achievement motivation, r = 0.33. Beliefs in the usefulness of math and achievement motivation are moderately related, r = .49. The results mean that the level of interest in mathematics can be predicted –though in a little extent only – by the level of being positive of their beliefs regarding mathematics, and vice versa. The same is true for interest in math and achievement motivation. The correlation coefficient between beliefs in the usefulness of math and achievement motivation was found to be higher, indicating a moderate positive relationship. This means that in terms of predictability, the link between these two variables is a little stronger. A change in the level of being positive of the respondents' beliefs regarding mathematics corresponds lightly to a same-direction change in their level of achievement motivation, and vice versa.

These results show that being internal or external of attribution of success in mathematics is not related to any of the other three attitudinal variables namely: interest in math, beliefs on the usefulness of math, and achievement motivation. The same is true for attribution of failure in mathematics; its being internal or external is not related to the other three variables.

This means that the respondents' levels of interest in mathematics, beliefs in the usefulness of math, and achievement motivation do not differ with respect to whether the respondents' type of attribution of success or failure in mathematics is internal or external in

nature. Conversely, the respondents' attribution being internal or external does not seem to change or be affected by their levels of interest in math, beliefs in the usefulness of math, and achievement motivation.

Chapter V

SUMMARY, FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

This chapter presents the summary of the study, its findings, the conclusions, and the recommendations.

Summary of the Study

This study sought to evaluate a sample of college freshmen in northern Quezon in terms of the following variables: (1) basic mathematics achievement [BMA], (2) high school achievement variables such as selected high school subjects' grades, and (3) motivation variables such as interest in mathematics, beliefs in the usefulness of mathematics, and attributions of success and failure in mathematics. The study also aimed at determining or verifying relations existing between high school achievement variables (previous achievements) and basic math achievement (present achievement), as well as between selected motivation variables and basic math achievement. Addition to the study was producing a regression model that explains if the independent variables could predict the dependent variable. A total of 92 respondents participated in the study. They came from the two main tertiary institutions of Northern Quezon, which are labelled College A and College B in this study and are both located in Infanta, Quezon. The instruments used to acquire data were 50-item self-constructed basic mathematics examination and inventories of the three motivation variables, all of which underwent validation procedures. Statistics such as percentages, arithmetic mean and standard deviation were used to provide descriptions of the

respondents in terms of all the variables involved in the study. In the analysis of variable relationships, Pearson r and Chi-square were used. All computations were facilitated by Microsoft Excel and IBM SPSS Statistics.

Summary of Findings

This study found the following:

1. The profile of the respondents shows that

    1.1 Basic Mathematics Achievement.

    The college freshmen obtained very poor performance or achievement level in basic mathematics.

    1.2 High School Achievement Variables

    In terms of high school grades, the college freshmen performed at the satisfactory level as per Department of Education standard.

    1.3 Motivation Variables

    The college freshmen showed a moderately high level of interest in mathematics and a high level of beliefs in mathematics. Their attribution of success in mathematics is mostly effort, and their attribution of failure in mathematics is mostly the lack of effort.

2. All the high school achievement variables were positively and moderately related to basic mathematics achievement.

3. There was a low positive relation between interest in math and basic mathematics achievement. The other two variables, beliefs in the usefulness of math and attributions of success and failure in math were not related to basic mathematics achievement.

4. As the regression model showed, all the high school achievement variables and motivation variables put together explains only a small amount of variation in basic mathematics achievement of college freshmen. Also the model showed that each of the dependent variables seems to be a non-significant predictor of basic mathematics achievement.

Conclusion

This study arrived at the following conclusion.

1. The overall picture that emerges from this study is that the college freshmen in northern Quezon is still deficient in basic mathematics, which reflects that the quality of education in the area is still wanting. This may mean that the college freshmen were not taught enough or did not learn enough of the basic math competencies prior to entering college. Hence the poor math performance of college freshmen is an indication that there is still much room for improvement in high school teaching or in the standard of student admission in the local colleges.

2. Another picture emerging from this study is that several high school achievement variables – that is, the high school final grades in selected subjects – somehow can predict the college freshmen's performance in basic mathematics. And so it would be

important that colleges in northern Quezon really look at applicants' high school records, especially in mathematics, when determining placement of students in math-related programs. Not paying attention to this matter could actually lead to the obvious wastage of many resources including time.

3. Since the study saw that interest in mathematics predicts basic math achievement to some extent, this may mean that getting the students more interested in mathematics could somehow have positive impact in their math achievement. On the other hand, beliefs in the usefulness of math and attribution of success and failure in math are not seen to be influencing differences in student's achievement in basic mathematics.

4. When all the high school achievement and motivation variables are taken into consideration, the basic mathematics achievement of a college freshman can only be predicted slightly. This means that there might be some other combination of factors – within or outside the set of the variables used in this study – that could better explain the differences in college freshmen's achievement in basic mathematics.

Recommendations

Based on the findings and conclusions of this study, the following are recommended.

1. In light of the poor basic mathematics achievement results of college freshmen, it is recommended that high school mathematics teaching be improved by making sure that all

topics in the prescribed curriculum are covered completely and in depth. This is to address the apparent wide gap between high school mathematics and the beginning college mathematics courses.

2. The administrators of tertiary institutions in northern Quezon , especially the ones concerned with screening incoming college students into mathematics-related programs such as engineering, mathematics education, or business administration, may consider looking at more data, aside from the usual fourth year high school overall average found in their card and entrance examination scores. They may also factor into the admission criteria the student's high school overall average, and HS overall average in math, in case fourth year math final grade is not enough information. HS overall average in science and HS overall average in English may also be looked at for better selectivity of students into college programs. Also, it is recommended for colleges in northern Quezon to set higher standard of screening for students who intend to major in engineering or other mathematics-related programs such as mathematics education and business administration. This may be done by including a mathematics aptitude test –besides the usual general entrance examination – in the requirements for entering college freshmen.

3. Both high school math teachers and college math instructors could make additional means by which interest might be infused in their mathematics classes to improve students' general interest in mathematics. This may be done by incorporating in class the importance of mathematics in daily life and by making math classes include more real-life applications.

4. Because this study has verified the existence of a high relationship among grades in high school math, science, and English, it supports why tertiary educational institutions usually partly consider these previous-achievement data in determining whether students have the potential to perform well in college. It is then recommended for colleges in northern Quezon area to always look at these subjects when deciding student admission similar to the way it is practiced by universities and bigger colleges. It is also then recommended that math, science, and English teaching be strengthened and given more focus.

5. It is also recommended that high school mathematics teaching be reinforced by implementing rules on the completeness and thoroughness of teaching of topics throughout the year.

6. Researchers who wish to study an area similar to this may explore more variables such as the college entrance examination scores in future studies, and probably recommend a more effective exam instrument to determine students who are more likely to do well and be fit to study mathematics-related degrees.

7. Future researchers may also want to do in-depth exploration of the practice of mass promotion in most public schools and how such practice produces impact in the student achievement in secondary schools and in the educational standard in general.

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APPENDIX A

BASIC MATHEMATICS ACHIEVEMENT TEST
Table of Specifications

Area	Topics	Level						Number of items
		knowledge	comprehension	application	analysis	synthesis	evaluation	
ELEMENTARY ALGEBRA	Whole number operations			Item no. 3				1
	Signed number and integer operations		Item no. 7					1
	Fractions		Item no. 8	Item no. 9				2
	Decimals		Item no. 10					1
	Percents			Item no. 1				1
	Ratio				Item no. 6			1
	Roots		Item no. 2					1
	Greatest common factor and least common multiple		Item no. 4					1
	Conversion of measurements				Item no. 5			1
	Algebraic expressions		Item no. 11					1
	Operations on polynomials		Item nos.12,13					2
TOTAL								**(13) 25%**

Area	Topics	Level						Number of items
		knowledge	comprehension	application	analysis	synthesis	evaluation	
INTERMEDIATE ALGEBRA	Rules on exponents		Item nos.14 , 15					2
	Special products and factoring		Item no.16					1
	First degree equations and inequalities in one variable				Item nos.17 , 20			2
	Systems of linear equations and inequalities in two variables				Item no.21			1
	Quadratic equations in one variable				Item no.18			1
	Rational algebraic expressions				Item no.23			1
	Variation				Item no.22			1
	Radicals		Item no. 24		Item no.19			2
	Sequences and series		Item no. 25					1
TOTAL								**(12) 25%**

Area	Topics	Level						Number of items
		knowledge	comprehension	application	analysis	synthesis	evaluation	
GEOMETRY	Points, lines, and planes	Item no. 39						1
	Angle measurement and types of angles and angle pairs				Item no. 38			1
	Parallel lines and perpendicular lines				Item no.40			1
	Perimeter of polygon		Item no. 32					1
	Area of polygon				Item no. 36			1
	Area and circumference of circles		Item no.34					1
	Volume and surface area of common solids		Item no. 37					1
	Properties of different types of quadrilaterals		Item no. 41					1
	Congruence of triangles		Item no. 42					1
	Segments of a circle	Item no. 33						1
	Plane coordinate geometry: point plotting, slopes, equations of lines	Item no. 30	Item no. 31		Item no. 35			3
TOTAL								**(13) 25%**

Area	Topics	Level						Number of items
		knowledge	comprehension	application	analysis	synthesis	evaluation	
ADVANCED ALGEBRA	Definition of function		Item no. 26					1
	Linear functions		Item no. 28					1
	Quadratic functions		Item no. 27					1
	Higher-degree polynomial functions							
	Exponential functions and Logarithmic functions		Item no. 29					1
TOTAL								**8.33%**
BASIC TRIGONOMETRY	Trigonometric functions of special angles				Item no.47			1
	Solutions of triangles				Item no.49			1
	Basic trigonometric identities	Item no. 48	Item no. 50					2
TOTAL								**8.33%**
BASIC STATISTICS	Computing averages: mean, median, mode		Item nos. 43,46		Item no.45			3
	Reading graphs tables				Item no.44			1
TOTAL								**8.33%**

Total number of items: 50

APPENDIX B

Achievement Test Final Form and Answer Key

BASIC MATHEMATICS ACHIEVEMENT TEST

Time allotment: 1 hour

NAME OF STUDENT: _____
Course and Year: _____
High School graduated from: _____

To the Examinee:

This is a 50-item examination on mathematics topics covered in your first four years in high school. Please answer this examination with your honest knowledge and effort, without calculator or any other electronic computing devices. The score that you will obtain from this examination will be collected and used by the researcher for his thesis data analysis. It will be assured that your performance data from this examination will be held confidential and will not in any way affect your actual grade or status in school.

Your participation will be really helpful to the accomplishment of this study.

1. How much is 15% of 12,000 pesos?

   a. 180 pesos b. 1,800 pesos c. 1,900 pesos d. 2,000 pesos

2. What is the result if the cube root of 27 is added to the square root of 64?

   a. 17 b. 13 c. 11 d. 7

3. To hold a party, a group of students needed an amount of 8,981 pesos. If there were 28 students, and each student had to contribute equally for that amount, how much did each student spend?

   a. 320.25 pesos b. 320.50 pesos c. 320.75 pesos d. 321.75 pesos

4. What is the greatest common factor of 72 and 45?

   a. 12 b. 9 c. 8 d. 3

5. If 1 inch is equal to 2.54 cm, then how many centimeters are there in 6 feet?

   a. 30.48 cm b. 182.88 cm c. 190.4 cm d. 210 cm

6. The ratio of males to females in a class is 3:5. How many males are there if there are 48 students in the class?

   a. 16 b. 18 c. 24 d. 30

7. $-6 + 2 - (-3) =$

   a. -7 b. -1 c. 1 d. 7

8. Which set of fractions is arranged from lowest value to highest value?

   a. $\frac{3}{5}, \frac{3}{4}, \frac{1}{2}$ b. $\frac{3}{4}, \frac{3}{5}, \frac{1}{2}$ c. $\frac{1}{2}, \frac{3}{4}, \frac{3}{5}$ d. $\frac{1}{2}, \frac{3}{5}, \frac{3}{4}$

9. Rosa bought $2\frac{1}{4}$ kilos of fish sold at 180 pesos per kilo from a supermarket. If she paid 500-peso bill, how much change did she receive?

   a. 85 pesos b. 95 pesos c. 105 pesos d. 110 pesos

10. $(2.4 \div 6) + (0.2 \times 8) =$

    a. 0.20 b. 0.56 c. 1.64 d. 2

11. What is the value of the expression $a^2 - 2b + 3c$ if $a = 3$ and $b = -4$ and $c = 5$?

a. 16 b. 18 c. 25 d. 32

12. What is the simplest form of the expression $3x - (x - 2y - 4) + (9y + 6)$?

a. $3x + 11y + 2$ b. $2x - 11y + 2$ c. $4x + 7y + 10$ d. $2x + 11y + 10$

13. Multiply: (2b – 1)(3b + 4)?

a. $6b^2 + 5b - 4$ b. $6b^2 - 5b - 4$ c. $6b^2 - 5b + 4$ d. $6b^2 + 5b + 4$

14. Get the product: $a^3b \cdot a^2b$

a. a^5b b. a^5b^2 c. a^6b^2 d. a^5b^3

15. Which is the simplest form of 3^{-2}?

a. $-\frac{2}{3}$ b. $-\frac{1}{9}$ c. $\frac{1}{3}$ d. $\frac{1}{9}$

16. Factor: $x^2 - 17x - 60$

a. $(x - 30)(x + 2)$
b. $(x + 3)(x - 20)$
c. $(x + 20)(x - 3)$
d. $(x - 12)(x - 5)$

17. Solve for x: $8x - 7 + 2x = 6 + 5x + 2$

a. x = 5 b. x = 4 c. x = 3 d. x = $\frac{1}{5}$

18. What are the solutions of $x^2 + 3x = 4$?

a. $x = 1, 4$ b. $x = -1, 4$ c. $x = -4, -1$ d. $x = -4, 1$

19. What is the simplest form of $\sqrt{24x^2y^3}$?

a. $4y\sqrt{6xy}$ b. $2xy\sqrt{6xy}$ c. $4xy\sqrt{6y}$ d. $2xy\sqrt{6y}$

20. Solve: $3x + 5 > x + 1$

a. $x > 4$ b. $x < 4$ c. $x < -2$ d. $x > -2$

21. If you solve the system $\begin{matrix} x+y=10 \\ x-y=6 \end{matrix}$, what is the value of y?

a. 2 b. 4 c. 6 d. 8

22. Y varies directly as X. When X = 4, the value of Y = 12. If the value of Y is 45, what is the value of X?

a. 9 b. 15 c. 37 d. 135

23. What is the sum of $\frac{2}{x+1}$ and $\frac{3}{x-2}$?

a. $\frac{5}{2x-1}$ b. $\frac{5x-1}{x^2-x-2}$ c. $\frac{5x-1}{x^2+x-2}$ d. $\frac{5x+1}{x^2-x-2}$

24. 8 raised to 2/3 is equal to _____.

a. 2 b. 4 c. 8 d. 16

25. In the arithmetic sequence 1, 4, 7, 10, 13,…, what is the 15^{th} term?

a. 46 b. 43 c. 42 d. 41

26. Which set of order pairs is a function?

a. {(2, 3), (2, 4), (3, 4), (4, 3)}
b. {(2, 3), (3, 4), (3, 5), (4, 2)}
c. {(2, 3), (3, 4), (4, 5), (4, 6)}
d. {(2, 3), (3, 4), (4, 4), (5, 2)}

27. Describe the graph of the function, $f(x) = -2x^2 + 3x - 1$.

a. It is a line with positive slope.
b. It is a parabola opening upward.
c. It is a line with negative slope.
d. It is a parabola opening downward.

28. The points (2, 1) and (4, 7) are on a given line. What is the slope of the line?

a. 3 b. 2 c. -2 d. -3

29. What is the value of $\log_2 8$

a. -4 b. 2 c. 3 d. 4

30. In the Cartesian coordinate plane, the point (4, -3) is in what quadrant?

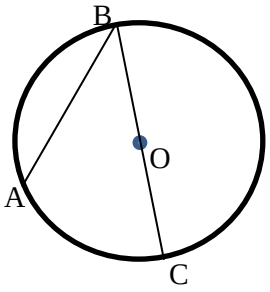
a. Quadrant I b. Quadrant II c. Quadrant III d. Quadrant IV

31. What is the equation of the line with slope 4 and passing through the point (1, 2)?

a. $y = 4x - 2$ b. $y = 4x - 4$ c. $y = 4x - 6$ d. $y = 4x + 2$

32. The length of a rectangle is 7 cm, and its width is 5 cm. What is its perimeter?

a. 6 cm b. 12 cm c. 24 cm d. 35 cm



33. In the figure above, segment AB is a _____.

a. diameter b. radius c. chord d. secant

34. If the diameter of a circle is 8 feet, how many square feet is its area?

a. 6.28 b. 12.56 c. 25.12 d. 50.24

35. What is the y-intercept of $2x - 3y = 6$?

a. -2 b. 2 c. 3 d. 6

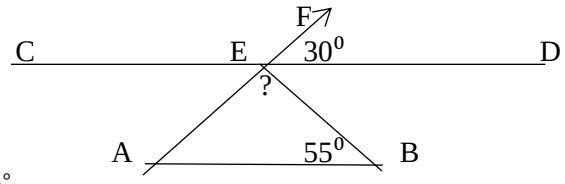
36. If the perimeter of a square is 36 cm, what is its area?

a. 81 cm^2 b. 64 cm^2 c. 49 cm^2 d. 36 cm^2

37. The length of a box is 8 feet and its width is 6 feet. What is the volume of the box if its height is 4 feet?

a. 18 cubic feet b. 56 cubic feet c. 182 cubic feet d. 192 cubic feet

38. In the figure below, $\overline{AB}$ is parallel to $\overline{CD}$. If m$\angle FED = 30^0$ and m$\angle$EBA = 55^0, what is m$\angle$AEB?

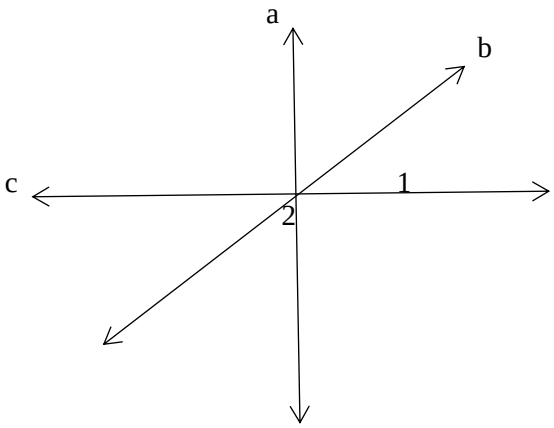


a. 30° b. 55° c. 95° d. 150°

39. Which of the following objects illustrate the concept of plane?

a. a dot b. surface of a board c. edge of a table d. a string

40. In the figure, lines c, b and a are coplanar and they intersect at the same point. If m$\angle$1 = 35^0 and line c is perpendicular to line a, what kind of pair of angles are $\angle$1 and $\angle$2?



a. linear pair
b. complementary angles
c. vertical angles
d. supplementary angles

41. Which statement is true?

a. All rectangles are squares.
b. All parallelograms are rectangles.
c. All rhombuses are squares.
d. All squares are rectangles.

42. Two triangles are said to be congruent if

a. all corresponding interior angles are congruent.
b. all corresponding sides have equal lengths.
c. all corresponding sides are proportional.
d. they have the same perimeter.

43. What is the mean of 81, 89, 93, 85, 92?

a. 87 b. 87.5 c. 88 d. 88.5

(figure taken from Google images)

44. Please refer to the bar graph above. Which statement is NOT true?

a. The number of visitors increased by 20000 from 1995 to 1996.
b. The number of visitors in 1996 is higher than the number of visitors in 1999.
c. The number of visitors decreased by 10000 from 1997 to 1998.
d. The number of visitors decreased by 20000 from 1998 to 1999.

45. Ann's average in 3 quizzes is 90. If two of her scores are 85 and 94, what is her third score?

a. 92 b. 91 c. 89 d. 88

46. What is the mode of the scores below?
2, 9, 3, 3, 8, 2, 4, 2, 7, 8

a. 2 b. 3 c. 4.8 d. 8

47. What is the cosine value of 90°?

a. -1 b. 0 c. ½ d. 1

48. The expression $\tan\theta$ is equal to

a. $\frac{\sin\theta}{\cos\theta}$ b. $\frac{\cos\theta}{\sin\theta}$ c. $\sec^2\theta$ d. $\sin\theta + \cos\theta$

49. On level ground, an observer notices that the angle of elevation of the top of the building is 45°. If the observer is 18 meters from the base of the building, how high is the building?

a. 14 m b. 16 m c. 18 m d. 20 m

50. $1 - \sin^2 x$ is equal to which expression?

a. $\cos^2 x$ b. $\sin^2 x$ c. $\tan^2 x$ d. $\cos x$

Achievement Test Key to Correction

1. B
2. C
3. C
4. B
5. B
6. B
7. B
8. D
9. B
10. D
11. D
12. D
13. A
14. B
15. D
16. B
17. C
18. D
19. D
20. D
21. A
22. B
23. B
24. B
25. B
26. D
27. D
28. A
29. C
30. D
31. A
32. C
33. C
34. D
35. A
36. A
37. D
38. C
39. B
40. B
41. D
42. B
43. C
44. D
45. B
46. A
47. B
48. A
49. C
50. A

APPENDIX C

SURVEY QUESTIONNAIRE

RESPONDENT'S BASIC DATA
Please supply the following information.
Name: _____
Course: _____
Age: _____
Gender: _____
Permanent address: _____
Complete name of High School graduated from: _____

Dear Respondent:

The next page presents statements, which are all opinions regarding **interest in mathematics**, **beliefs on the usefulness of math**, and **motivation for achievement.** You are requested to indicate the degree of applicability of each statement to you by putting a check (√) under the code that corresponds to your answer.

SA – strongly agree
A – agree
D – disagree
SD – strongly disagree

The third page is an inventory of your **attribution of success and failure in math**. Kindly supply the information needed there as asked in the instructions.

Throughout this questionnaire, please answer only based on what is true to yourself. All the information that will be obtained from this questionnaire will be used solely for my study entitled "antecedents of college freshmen's achievement in basic mathematics."

It is assured that all respondents will remain anonymous in the entire research process, and no part of anyone's identity will be revealed in research reports. Also, whatever the outcome, these responses will not affect the respondent's grade or status in school.

By completing this questionnaire, you are participating in an effort to improve our knowledge and awareness on mathematics education.

VARIABLE: INTEREST IN MATHEMATICS

Statement	SA	A	D	SD
1. I enjoy learning mathematics.				
2. I wish that I don't have any more math subjects to take.				
3. I learn many interesting ideas in mathematics.				
4. Mathematics is a boring subject for me.				
5. I would still want to study math even if it is not required.				
6. I do not like any schoolwork that involves numbers.				
7. Mathematics is my most favorite subject in school.				
8. Solving math problems is not an interesting activity for me.				
9. I usually feel excited to attend a math class.				
10. I hate math.				

VARIABLE: BELIEFS ON THE USEFULNESS OF MATH

Statement	SA	A	D	SD
1. People use mathematics everyday.				
2. We do not need mathematics to learn other subjects.				
3. I will need mathematics for my future work.				
4. Many mathematics lessons are useless.				
5. Mathematics is useful in improving the technology of our country.				
6. Taking a math subject is a waste of time for me.				
7. Many mathematics lessons have important applications in real life.				
8. It is not important for me to do well in math.				
9. I think that math improves our mental capabilities.				
10. I don't see math subjects as important parts of the school curriculum.				

VARIABLE: MOTIVATION FOR ACHIEVEMENT

Statement	SA	A	D	SD
1. I consider myself a hardworking student.				
2. I usually feel lazy about studying.				
3. I aim to finish my studies as soon as possible.				
4. I do not feel the need to perform well in class.				
5. I do all my school work seriously.				
6. I am contented with just a passing score in an examination.				
7. I do not want to be left behind in class.				
8. I don't really care if I fail in school.				
9. I am determined to achieve my goals despite difficulties.				
10. I do study only because that is what my parents want.				

VARIABLE: ATTRIBUTION OF SUCCESS AND FAILURE IN MATHEMATICS

I. When you pass a mathematics test or get a high grade, you might think of the following as the reasons for your success.

Possible reasons:

A. It's my ability – I'm really good at math.
B. I studied hard for it.
C. The exams/tasks were easy so it's just easy to pass or get a high grade.
D. The teacher teaches really well.
E. The teacher was kind and helpful.
F. I was just lucky.
G. Other reasons (please specify):

1. Which reason is the most applicable to you? _____

2. Which reason is the second most applicable to you? _____

3. Which reason is the third most applicable to you? _____

II. When you fail an exam or get a failing grade in mathematics, you might think of the following reasons for your failure.

Possible reasons:

A. I am just not good enough at mathematics.
B. I just did not study hard.
C. The exams were always so difficult.
D. The teacher did not teach well.
E. I was not feeling well.
F. I was unlucky.
G. Other reasons (please specify):

1. Which reason is the most applicable to you? _____

2. Which reason is the second most applicable to you? _____

3. Which reason is the third most applicable to you? _____

THANK YOU SO MUCH FOR YOUR TIME AND COOPERATION.

APPENDIX D

Letters to Validators

Sep 06, 2016

Myla Esperanza, M.A.
Instructor of Mathematics
Philippine Normal University
Taft Avenue, Manila

Dear Ma'am:

I am Alexis Villaflor, an ED 600 student at Philippine Normal University and currently conducting a study entitled **Antecedents of College Freshmen's Achievement in Basic Mathematics.**

One of the instruments that I will be using to gather my data is a set of survey questionnaires that I constructed. These questionnaires are inventories of the following variables: interest in math, beliefs on the usefulness of math, motivation for achievement, and attributions of success and failure in math.

In light with this, I am submitting a copy of these instruments to you for your comments and suggestions.

I am hoping for your favorable response.

Alexis C. Villaflor
M.A. Education – Mathematics

Sep 06, 2016

Dr. Jose Maria Balmaceda, Ph.D.
Dean
College of Science
UP Diliman

Dear Sir:

I am Alexis Villaflor, an ED 600 student at Philippine Normal University and currently conducting a study entitled **Antecedents of College Freshmen's Achievement in Basic Mathematics.**

One of the instruments that I will be using to gather my data is a set of survey questionnaires that I constructed. These questionnaires are inventories of the following variables: interest in math, beliefs on the usefulness of math, motivation for achievement, and attributions of success and failure in math.

In light with this, I am submitting a copy of these instruments to you for your comments and suggestions.

I am hoping for your favorable response.

Alexis C. Villaflor
M.A. Education – Mathematics

Sep 06, 2016

Violeto N. Coronacion, Ph.D.
Campus Director
Southern Luzon State University – Infanta
Tongohin, Infanta, Quezon

Dear Sir:

I am Alexis Villaflor, an ED 600 student at Philippine Normal University and currently conducting a study entitled **Antecedents of College Freshmen's Achievement in Basic Mathematics.**

One of the instruments that I will be using to gather my data is a set of survey questionnaires that I constructed. These questionnaires are inventories of the following variables: interest in math, beliefs on the usefulness of math, motivation for achievement, and attributions of success and failure in math.

In light with this, I am submitting a copy of these instruments to you for your comments and suggestions.

I am hoping for your favorable response.

Alexis C. Villaflor
M.A. Education – Mathematics

Sep 06, 2016

Mrs. Jan Marie P. Lubuguin, M.A.
Mathematics Instructor/Research Coordinator
Southern Luzon State University – Infanta
Tongohin, Infanta, Quezon

Dear Ma'am:

I am Alexis Villaflor, an ED 600 student at Philippine Normal University and currently conducting a study entitled **Antecedents of College Freshmen's Achievement in Basic Mathematics.**

One of the instruments that I will be using to gather my data is a set of survey questionnaires that I constructed. These questionnaires are inventories of the following variables: interest in math, beliefs on the usefulness of math, motivation for achievement, and attributions of success and failure in math.

In light with this, I am submitting a copy of these instruments to you for your comments and suggestions.

I am hoping for your favorable response.

Alexis C. Villaflor
M.A. Education – Mathematics

APPENDIX E

Checklist for Evaluating a Survey Questionnaire

To the evaluator:
Please rate the given survey questionnaire based on the following criteria. Kindly put a check inside the box under the level with which you rate the given criterion.

Criterion	Highly satisfied	satisfied	Needs improve-ment	Not satisfied at all
1. It deals with a significant topic - one that respondent will recognize as important enough.				
2. It seeks only the information which cannot be obtained from other sources such as school reports or census data.				
3. Each question deals with a single idea.				
4. Each question is worded as simply and clearly as possible.				
5. The statements are comprehensive enough to measure the variable intended to measure.				
6. The questions are objective, with no leading suggestions as to the responses desired.				
7. The questions provide an opportunity for easy, accurate, and unambiguous responses.				
8. It is attractive in appearance, neatly arranged, and clearly printed.				
9. The length can be comfortably answered by respondents. That is, it is as short as possible.				
10. Directions are clear and complete.				

APPENDIX F

SURVEY QUESTIONNAIRE CONTENT VALIDATION

Dear Validator:

This self –constructed questionnaire will be used as one of the tools to collect da for my study entitled ***Antecedents of College Freshmen's Achievement in Basic Mathematics.*** This instrument will attempt to measure the following variables: interest in mathematics, beliefs on the usefulness of math, motivation for math, and attribution of success and failure. Some of the statements were taken from questionnaires made by other researchers and used in other studies, while most were thought up and worded by the researcher.

To ensure that each questionnaire item really measures the variable intended to measure, I am humbly asking for your help to examine the content of each section of this questionnaire. Kindly indicate your judgment of each statement, and please add comments/suggestions where applicable. Your expertise and experience will be of great help in making this questionnaire better.

VARIABLE: INTEREST IN MATHEMATICS

Statement	**appropriate**	**Needs to be revised**	**Removed / not appropriate at all**	**Comments & Suggestions**
1. I enjoy learning mathematics.				
2. I wish I don't have to study mathematics.				
3. Mathematics is a boring subject for me.				
4. I learn many interesting things in mathematics.				
5. I like studying mathematics.				
6. I do not like any schoolwork that involves numbers.				
7. I like solving mathematics problems.				
8. I am excited to attend a mathematics class.				
9. Mathematics is my most favorite subject.				
10. I don't care about mathematics.				

Please add more items that you consider to be appropriate for this section.

VARIABLE: BELIEFS IN THE USEFULNESS OF MATH

Statement	**appropriate**	**Needs to be revised**	**Removed / not appropriate at all**	**Comments & Suggestions**
1. Mathematics is an important subject.				
2. We used the mathematics every day.				
3. We need mathematics to learn other subject.				
4. Being good at mathematics will help me do my future job well				
5. Mathematics is useful in improving the technology in our country.				
6. Many mathematics lessons are useful.				
7. Learning mathematics makes our thinking sharper.				
8. Many mathematics lessons have important practical application.				
9. Mathematics makes people financially wiser.				
10. Doing math improves our mental capabilities.				

Please add more items that you consider to be appropriate for this section.

VARIABLE: MOTIVATION FOR ACHIEVEMENT

Statement	**appropriate**	**Needs to be revised**	**Removed / not appropriate at all**	**Comments & Suggestions**
1. I consider myself a hard working student.				
2. I do not feel the need to perform well in class.				
3. I do no to be left behind in class.				
4. The thought of getting a high grades motivates me to study hard.				
5. I do not care whether I will be successful someday or not.				
6. I am afraid to fail in school.				
7. I the type who does my schoolwork seriously.				
8. I do extra effort to get high grades.				
9. I usually feel lazy doing schoolwork.				
10. I do my studies only because that is my parent want.				
11. I study hard because I want to graduate with honors or award.				
12. I do not care if I fail in school.				
13. In general, I enjoy studying and learning.				
Please add more items that you consider to be appropriate for this section.				

VARIABLE: ATTRIBUTION OF SUCCESS AND FAILURE IN MATHEMATICS

I. When you pass a mathematics test or get a high grade, you might think of the following as the reasons for your success.

Possible reasons:

A. It's my ability – I'm really good at math.
B. I studied hard for it.
C. The exams/tasks were easy so it's just easy to pass or get a high grade.
D. The teacher teaches really well.
E. The teacher was kind and helful.
F. I was just lucky.
G. Other reasons(please specify):

1. Which reason is the most applicable to you?_____
2. Which reason is the second most applicable to you?_____
3. Which reason is the third most applicable to you?_____

II. When you fail an exam or getting a failing grade in mathematics, you might think of the following reasons for your failure.

Possible reasons:

A. I am just not good enough at mathematics.
B. I just did not study hard.
C. The exams were always difficult.
D. The teacher did not teach well.
E. The teacher was crazy.
F. I was unlucky.
G. Other reasons(please specify):

1. Which reason is the most applicable to you?_____
2. Which reason is the second most applicable to you?_____
3. Which reason is the third most applicable to you?_____

.....

NAME AND SIGNATURE OF VALIDATOR

APPENDIX G

Validation of Questionnaires/Inventories
Summary of Ratings

Validator	Score given
Dr. Violeto N. Coronacion (SLSU)	3.6
Jan Marie P. Lubuguin, M.A. (SLSU)	4.0
Myla Esperanza – Detecio, M.A. (PNU)	4.0
Dr. Roberto Diaz (PNU)	3.7
Dr. Jose Maria P. Balmaceda (UP Diliman)	3.3
AVERAGE	**3.72**

Note: The validator evaluated the questionnaires using a 10-item criteria checklist using a 4-point scale:

4 – criterion highly satisfied
3 – criterion satisfied
2 – needs improvement to satisfy the criterion
1 – criterion not satisfied at all

The minimum acceptable average is 3.0.

APPENDIX H

Letters of Permission

December 8, 2016

Mr. Roy P. Villaflor
President
Northern Quezon College, Inc.
Infanta, Quezon

Dr. Angelita Bugnalen
Academic Dean
Northern Quezon College, Inc.
Infanta, Quezon

Dear Sir/Ma'am:

I am Alexis C. Villaflor, a student in the Master of Arts in Mathematics Education program at PNU. I am currently conducting a study entitled "Antecedents of College Freshmen's Achievement in Basic Mathematics." The results of this study would have implications on the improvement of teaching mathematics and the quality of student selection.

In light with this, I am humbly asking for your permission to allow me to administer my research instruments: mathematics achievement test and attitude inventories among the selected students in your institution.

All the information acquired in the whole data-gathering process will be protected and kept confidential, and no one's identity will be revealed or hinted in any way in all research reports.

I am hoping for your favorable response.

Thank you.

Alexis C. Villaflor

Approved:

Mr. Roy P. Villaflor

Dr. Angelita Bugnalen

November 7, 2016

Dr. Violeto N. Coronacion
Campus Director
Sothern Luzon State University – Infanta Campus
Infanta, Quezon

Dear Sir:

I am Alexis C. Villaflor, a student in the Master of Arts in Mathematics Education program at PNU. I am currently conducting a study entitled "Antecedents of College Freshmen's Achievement in Basic Mathematics." The results of this study would have implications on the improvement of teaching mathematics and the quality of student selection.

In light with this, I am humbly asking for your permission to allow me to administer my research instruments: mathematics achievement test and attitude inventories among the selected students in your institution.

All the information acquired in the whole data-gathering process will be protected and kept confidential, and no one's identity will be revealed or hinted in any way in all research reports.

I am hoping for your favorable response.

Thank you.

Alexis C. Villaflor

Approved:

Dr. Violeto N. Coronacion
December 1, 2016

Mr. Roy Villaflor
President
Northern, Quezon College, Inc.

Dr. Angelita Bugnalen
Academic Dean
Northern Quezon College, Inc.

Madeleine Rosales – Combalicer
Registrar
Northern Quezon College Inc.

Dear Ma'am/Sir:

My name is Alexis Villaflor, a former instructor and student here at NQCI. I am currently doing my study entitled *Antecedents of College Freshmen's Achievement in Basic Mathematics* – the terminal requirement in my MA program at PNU. This study is basically an evaluation study of the mathematics achievement of college students in northern Quezon area. It also explores possible relationships existing between various previous-achievement variables, some attitudinal variables, and current mathematics performance and achievement.

To be able to answer the specific research questions/problems of this study, one of the research tools that I need would be the high school data of first year students, which are in the documents that they submitted to your office prior to enrollment. The specific data that I would need from these records are the following:

1st year high school overall average
2nd year high school overall average
3rd year high school overall average
4th year high school overall average

1st year high school final grade in math
1st year high school final grade in science
1st year high school final grade in English

2nd year high school final grade in math
2nd year high school final grade in science
2nd year high school final grade in English

3rd year high school final grade in math
3rd year high school final grade in science
3rd year high school final grade in English
4th year high school final grade in math
4th year high school final grade in science
4th year high school final grade in English

Please allow me to have a copy of these specific student data. It will be assured that all these information will be used only for achieving the goals of this study and nothing else. All students' identities will be protected in the entire research process.

I am hoping for your positive response.

Sincerely,

ALEXIS C. VILLAFLOR
Student Researcher

APPENDIX I
CONSENT FORM

I, _____, being selected as a respondent in this study entitled Antecedents of College Freshmen's Achievement in Basic Mathematics hereby consent to participate.

I understand that:

I am chosen as a respondent by random selection.

I may not directly benefit from taking part in this research, but I am participating in an endeavor that can help develop additional knowledge regarding mathematics education.

I will be able to give my participation in this research by completing a set of survey questionnaires and by answering an achievement test in basic mathematics.

Participating in this research will not in any way affect my grades or status in school.

All the information gained from this study will just be used for analysis and arriving at some conclusions. In this process, I am ensured that my name or any part of my identity will not be revealed in the final research report, and all my individual information will remain anonymous.

I am from free to withdraw from participation in this study.

Participant's signature: _____ Date: _____

I certify that I have explained the purpose of research to the participant and consider that he or she understands what is involved and consents to participate.

_____

Researcher
M.A. Math Education student
Philippine Normal University

APPENDIX J

THESIS DATA

BM Ach	**Int**	**B use**	**m ach**	**attr S**	**attr F**	HS Ov	math Ov	sci Ov	eng Ov	IV-ave	math4	sci4	eng4
25	27	34	23	B.	B.	83.50	81.25	81.50	80.25	83.00	77	77.00	76.00
10	27	36	32	B.	A.	84.39	82.88	84.69	82.44	84.55	83.5	82.75	84.75
10	22	29	30	A.	E.	77.06	76.61	77.08	76.16	79.99	79.33	80.52	77.55
28	38	40	26	G.	C.	88.26	90.05	87.36	87.80	89.08	91.02	89.94	88.11
13	24	30	29	D.	B.	82.39	80.19	82.09	81.75	82.63	82.98	82.37	80.28
16	30	32	27	B.	B.	78.66	77.74	77.66	78.10	79.61	78.8	77.80	78.84
10	32	38	36	B.	B.	86.74	85.20	87.69	84.99	88.15	86.32	87.75	85.81
18	33	34	37	B.	B.	84.24	83.63	82.74	83.14	85.70	81.13	82.34	86.96
13	33	32	28	B.	B.	84.12	83.45	84.00	82.84	85.28	82.16	87.69	84.72
14	30	33	31	B.	B.	83.99	83.92	82.47	83.08	86.81	84.86	85.75	83.73
11	23	35	25	F.	A.	83.86	79.12	82.37	86.31	84.99	82.658	82.32	88.86
18	32	35	33	D.	E.	80.92	80.66	80.43	78.81	82.18	84.23	81.10	78.69
16	32	32	32	B.	B.	82.30	83.74	81.34	82.09	77.71	78.76	78.25	76.35
21	34	33	29	D.	B.	87.19	87.03	87.45	86.49	87.20	85.58	88.62	87.15
18	27	32	27	D.	D.	85.26	83.92	85.25	85.28	86.19	85.17	85.20	86.60
25	35	37	33	B.	C.	88.02	90.15	88.10	87.73	89.44	88.6	87.77	90.61
11	31	37	31	B.	C.	84.74	83.67	82.78	84.82	85.70	82.43	85.82	86.59
12	28	29	26	D.	B.	83.96	82.58	84.22	82.26	83.39	80.77	84.28	83.38
17	33	21	29	B.	B.	78.88	78.19	78.56	78.50	79.48	78.1	80.25	79.72
14	24	32	29	D.	B.	83.05	79.06	83.31	81.88	83.95	83.5	83.00	81.50
16	30	31	29	D.	B.	81.72	79.56	80.42	82.02	83.09	79.07	81.33	83.06
23	30	30	29	B.	B.	84.00	82.63	83.56	83.38	86.55	84.75	87.25	87.50
17	26	28	24	A.	C.	83.62	82.55	85.25	81.52	83.33	81.85	86.96	82.33
15	35	36	33	A.	A.	84.96	83.64	83.13	82.70	85.40	83.04	85.37	83.32
26	30	36	31	B.	B.	86.52	86.15	86.14	86.47	88.69	86.6	88.00	89.85
12	37	35	35	B.	C.	85.63	85.41	84.16	84.51	84.51	86.03	85.02	83.50
22	35	32	36	A.	A.	83.53	82.44	82.94	82.56	86.70	88.75	85.25	84.50
10	25	25	29	B.	C.	83.81	83.23	83.55	85.60	85.51	83.32	84.68	85.99
34	35	33	29	B.	B.	85.88	85.68	86.01	84.85	89.38	89.54	92.35	88.19
21	37	37	33	B.	C.	87.58	86.87	87.22	85.88	88.39	89.2	86.41	88.23
22	28	30	29	B.	C.	87.96	86.86	87.24	86.49	88.27	88.49	85.27	87.35
11	20	33	29	F.	C.	78.04	77.64	77.52	76.73	76.89	75.23	77.50	75.19
18	30	22	25	F.	A.	83.46	82.98	83.34	81.63	84.47	83.69	84.81	84.35
17	26	35	28	B.	B.	81.61	79.71	80.20	81.65	83.36	82.63	81.78	81.85
26	24	30	31	D.	A.	85.14	83.76	82.98	85.41	85.09	86.343	81.71	86.88
10	27	28	28	B.	B.	80.60	82.64	79.00	81.68	80.09	80.1	80.53	79.75
12	24	23	25	C.	D.	83.26	83.50	80.99	83.22	83.27	82.83	82.39	81.43

30	38	37	30	D.	A.	83.33	83.27	83.32	82.60	83.70	86.138	86.02	81.56
14	23	33	32	B.	A.	84.85	82.20	85.83	82.22	86.47	84.6	86.70	83.83
14	31	30	35	D.	A.	82.72	81.15	84.03	81.53	84.86	84.73	86.23	82.17
14	28	27	26	B.	B.	83.41	82.25	83.42	82.44	85.96	84.21	84.57	87.78
12	28	34	37	B.	B.	82.86	81.27	81.59	83.73	87.25	84.83	86.81	87.12
23	34	37	32	B.	B.	89.12	87.53	88.48	88.54	89.97	86.95	88.39	91.00
15	33	37	30	D.	A.	84.82	82.91	83.89	84.62	84.61	83.21	83.35	83.50
18	27	34	27	D.	D.	82.62	79.68	79.71	82.36	83.61	78.6	80.16	86.42
23	24	35	32	D.	B.	86.02	83.29	86.34	86.41	86.98	82.82	85.62	88.60
16	27	35	40	B.	A.	85.79	84.25	83.74	86.51	82.60	80.25	78.76	84.41
17	32	35	30	B.	B.	81.95	81.86	82.66	79.76	80.28	79.98	80.20	76.87
19	27	35	29	B.	D.	84.09	83.05	84.07	83.37	86.67	85.56	88.43	86.07
36	26	27	27	E.	B.	91.18	92.31	92.06	91.00	91.25	91	91.75	90.00
11	30	33	37	B.	B.	78.95	77.00	79.36	77.74	79.39	77.41	82.06	76.56
13	22	26	31	D.	E.	82.53	80.44	83.07	84.41	84.91	80.45	81.99	86.96
17	28	36	33	B.	A.	80.41	78.88	80.38	79.06	80.60	79.5	82.50	77.50
15	40	37	40	B.	B.	85.08	83.89	83.27	83.02	86.82	87.05	84.56	85.34
15	21	32	29	D.	B.	85.29	83.64	86.34	86.96	84.28	81.5	87.03	83.32
10	25	39	31	D.	B.	81.72	80.98	81.63	81.00	79.50	80.71	76.87	77.67
15	27	24	24	E.	B.	76.81	76.56	76.94	76.06	76.90	75	79.75	75.75
13	27	34	26	A.	A.	84.57	84.55	83.25	84.12	86.44	84.22	83.97	87.43
28	32	35	32	B.	B.	88.32	87.45	86.76	89.94	89.22	88.76	90.25	90.16
21	24	30	24	B.	A.	83.72	80.38	83.22	83.84	85.55	82.24	82.51	86.96
26	32	32	33	B.	B.	91.07	90.94	92.66	91.09	92.08	94.355	96.31	90.42
30	32	30	30	D.	E.	82.67	82.50	80.48	82.78	83.29	80.84	81.99	82.91
19	38	32	31	B.	B.	87.34	87.68	85.70	88.33	87.21	85.59	88.30	86.50
34	31	35	32	B.	C.	88.58	88.07	87.75	89.08	92.10	92.25	90.75	93.00
17	33	37	32	D.	A.	85.84	84.92	86.90	86.62	87.93	83.13	87.27	89.29
14	24	31	30	B.	D.	84.63	83.14	84.52	84.76	83.48	82.54	83.72	84.56
31	38	38	36	D.	G.	87.56	93.69	86.86	87.44	90.45	97.75	89.35	92.75
13	25	33	32	D.	A.	84.45	80.50	84.00	81.75	85.82	84	86.00	82.00
31	33	33	31	B.	B.	79.64	75.25	78.50	79.25	81.81	76	80.00	81.00
25	28	35	33	B.	B.	86.95	87.29	85.38	85.57	87.24	85.71	84.05	87.77
17	27	31	29	E.	A.	82.61	81.40	81.64	82.61	82.20	80.98	80.62	83.81
20	28	34	40	B.	A.	87.62	86.51	86.33	87.10	88.08	84.88	86.35	88.00
18	27	27	27	B.	A.	82.43	79.47	81.67	83.12	82.85	79.52	81.04	82.95
11	30	31	31	D.	B.	87.09	83.78	86.56	83.37	86.08	82.5	84.63	82.01
20	25	32	32	B.	D.	81.15	81.79	81.78	78.64	84.02	83.6	85.79	80.75
35	29	35	28	E.	B.	87.36	84.83	88.58	89.74	87.81	81	88.20	86.70
18	23	29	24	B.	B.	80.31	79.59	77.82	81.89	82.29	83.36	77.69	84.75
14	27	35	31	D.	A.	85.63	84.19	82.94	86.66	85.75	83.75	86.12	86.50

14	26	25	24	B.	C.	82.55	80.80	83.03	84.60	86.45	81.76	89.78	86.30
17	30	37	30	B.	B.	82.31	81.64	80.63	82.36	83.87	82.188	83.96	82.43
10	20	33	30	B.	A.	80.91	78.64	80.27	81.13	82.29	79.55	84.06	82.25
31	29	27	28	B.	C.	82.91	82.47	82.82	81.23	85.17	85.03	85.26	80.20
10	27	25	29	B.	B.	82.49	80.66	81.32	81.57	81.33	80.08	81.35	79.02
19	21	33	31	D.	A.	84.73	82.17	85.91	85.74	85.68	83.17	85.39	87.21
12	33	37	29	D.	D.	85.06	82.70	85.74	84.82	86.74	84	86.87	87.76
20	31	38	36	B.	D.	86.76	85.28	85.99	86.53	88.22	85.48	87.01	88.40
19	30	31	28	D.	D.	88.58	90.69	87.28	86.30	89.48	91.13	87.71	87.02
16	39	31	32	D.	E.	82.20	80.75	81.25	79.75	86.60	79	84.00	79.00
14	16	29	29	D.	A.	81.71	80.49	79.61	82.18	84.15	81.66	81.82	84.95
13	22	30	27	B.	B.	77.81	77.13	77.25	76.75	78.05	76.5	75.00	77.00
16	19	34	34	B.	A.	84.22	82.66	83.83	83.53	86.57	84.96	86.93	85.18
13	32	28	27	B.	C.	83.64	83.44	83.29	82.48	82.53	82.93	81.76	79.52

APPENDIX K

AUTHOR'S CURRICULUM VITAE

Name: Alexis Coronacion Villaflor
Address: Infanta, Quezon

Previous Education:
Kindergarten: Good Shepherd Preschool - Batican
Elementary: Tongohin Elementary School
High School: Infanta National High School
College: UP Diliman (degree: BS Mathematics (2006))

Work Experience:
UP Manila – math instructor , 2007 to 2010
Northern Quezon College – math instructor, 2010 to 2012
Southern Luzon State University – math instructor, 2012 to 2018
ACTS Computer College – part-time senior high school math teacher, 2017 to 2018

Distinction:
1st Placer, Licensure Examination for Teachers (March 2012)
DOST Scholarship recipient (2002)
high school class salutatorian (2002)
elementary class salutatorian (1998)

Interests:
English language, Japanese language, writing essays and short narratives, biking, swimming, American television series (especially medical drama and crime investigative drama)