October 2014

Student Attribute Correlates of Academic Achievement in High School Chemistry between Grade 9 & 10 Students

Angela Francisca B. Veloso

Philippine Normal University

Student Attribute Correlates of Academic Achievement in High School Chemistry between Grade 9 & 10 Students

A Thesis Presented to the

College of Graduate Studies and

Teacher Education Research

Philippine Normal University

Taft Avenue, Manila

In Partial Fulfillment of the Requirement for

Master of Arts in Science Education

with Specialization in Chemistry

ANGELA FRANCISCA B. VELOSO

October 2014

APPROVAL SHEET

In partial fulfillment of the requirements for the degree Master of Arts in Science Education with specialization in Chemistry, this thesis titled **STUDENT ATTRIBUTE CORRELATES OF ACADEMIC ACHIEVEMENT IN HIGH SCHOOL CHEMISTRY BETWEEN GRADE 9 & 10 STUDENTS** prepared and submitted by **MS. ANGELA FRANCISCA B. VELOSO**, who is hereby recommended for approval and acceptance.

VIC MARIE I. CAMACHO
Adviser

VIRGIL DUAD, Ed.D
Adviser

Approved in partial fulfillment of the requirements for the degree Master of Arts in Science Education with specialization in Chemistry by the Oral Examination Committee.

ZENAIDA Q. REYES, Ph.D
Chairperson

RUEL A. AVILLA
Member

FIDELA Q. ARAÑES
Member

REBECCA C. NUEVA ESPAÑA, Ph.D
Member

Accepted as partial fulfillment of the requirements for the degree Master of Arts in Science Education with specialization in Chemistry.

Date: _____

ZENAIDA Q. REYES, Ph.D
Dean
College of Graduate Studies and
Teacher Education Research

ACKNOWLEDGMENT

The researcher hereby extends her acknowledgment to the following individuals who unselfishly extended their untiring support, help, and guidance for the realization of this work:

Valeriano C. Veloso Jr. and **Escolastica B. Veloso,** her parents, for their spiritual and financial support. They never gave up encouraging the researcher to complete her thesis especially during the times she felt like giving up.

Rafael and Sheila Bajamundi, her relatives, for their spiritual and financial support.

Prof. Vic Marie I. Camacho and **Dr. Virgil D. Duad**, her thesis advisers, for their patience, encouragement, understanding and generous assistance in the different phases of the study.

Dr. Zenaida Q. Reyes, Prof. Ruel A. Avilla, Prof. Fidela Q. Arañes, and Dr. Rebecca C. Nueva España, the chairman and members of the Committee on Oral Defense, for sharing optimism, confidence and advancement of new knowledge in the field she wish to excel.

Prof. Ramer V. Oxiño, for his kind-hearted and unconditional help in editing and in the completion of this paper. And the researcher would also like to thank him for his encouragement to strive for more, go beyond limitations, and not let negativity hinder progress.

Prof. Maria Lourdes Santiago-Agustin, for allowing the researcher to conduct her study at the Institute of Teaching and Learning, Philippine Normal University.

Larry F. Tengco, for despite the hard times with the researcher, he did not give up nor leave her behind. Their "puyat" and cramming modes were finally over and the study was at last completed.

Arvin Kristopher A. Razon, best friend and buddy of the researcher, for the strength and for believing that, with perseverance, she could do great things and accomplish her dreams. The researcher reminisces her fond memories with him—the times when they together dreamed. She feels blessed for these dreams are now a reality.

Aura Kriz Abella and **Cristina Reyes**, her colleagues, for the support, laughter and prayers especially to the times when they have kept her sanity throughout this study

Third and Fourth year students at PNU-ITL, for their cooperation and support.

Most of all, to God Almighty, for all the blessings he showered upon the researcher not only during the duration of the study but throughout her life.

ABSTRACT

Name	**ANGELA FRANCISCA B. VELOSO**
Title of Thesis	**STUDENT ATTRIBUTE CORRELATES OF ACADEMIC ACHIEVEMENT IN HIGH SCHOOL CHEMISTRY BETWEEN GRADE 9 & 10 STUDENTS**
Key Concepts	Attitude toward chemistry, mathematics anxiety, learning style, achievement test in chemistry
Degree	**MASTER OF ARTS IN SCIENCE EDUCATION**
Specialization	**CHEMISTRY**
Advisers	**VIC MARIE I. CAMACHO** **DR. VIRGIL DUAD**

This study examined three student attributes namely; level of mathematics anxiety, learning style, and attitude toward Chemistry that generated information on their effect on student achievement in Chemistry.

The study employed the causal-comparative descriptive research method. Instruments used included an achievement test to measure performance involving mathematical concepts in Chemistry, level of mathematics anxiety scale to measure anxiety levels, attitude toward Chemistry scale, and learning style reference. A total of 108 Grade 9 and 10 students from the Institute of Teaching and Learning (ITL) at the Philippine Normal University were involved as respondents. The result of the study revealed that the respondents taken as a whole, performed fairly in the achievement test in Chemistry particularly in the multiple choice and poorly in the open-ended part of the achievement test. Their anxiety in mathematics was positively correlated with their performance in Chemistry involving mathematics.

The respondents, taken separately by grade level showed that grade 9 performed better than grade 10 in multiple choice and open ended tests. Both groups have favourable attitude toward chemistry. Grade 9 has less anxiety level than grade 10 respondents.

The study recommends that teachers should employ an effective approach on how to lessen the students' level of anxiety in mathematics for them to improve their performance in Chemistry. Further, the study recommends teachers to find best ways to get their students interested in Chemistry topics which involve mathematics.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter One

The Problem and Its Background

Introduction

Basic mathematical skills are important in everyday life, yet many students feel anxious when they are faced with the prospect of solving mathematical problems. Students recall having traumatic experience involving mathematics, such as being ridiculed by their classmates if they did not solve a problem correctly or belittled by the teacher.

More than just memorizing formulas and concepts, Mathematics requires high-ordered thinking skills such as analytical reasoning, problem solving, and critical thinking because mathematics are abstract and spiral in nature. Similarly, learning Chemistry is also a challenge because students are not only introduced to science concepts but also required to apply skills in mathematics. Students tend to have a negative attitude toward learning Chemistry, as both require similar skills and a thorough understanding of problems that they have to solve. Mathematical anxiety, characterized by feelings of tension, apprehension, and fear about performing math, hinders the students' progress and competence in learning and understanding the concepts of mathematics, more so when mathematics skills are needed in learning Chemistry concepts. In effect, students' uneasiness of the discipline affects how they take the examination, their attitude toward the subject, and their behavior in the classroom, hindering their capacity to learn not only courses in Mathematics but also scientific in disciplines like Chemistry.

Mathematics is used as the language of science especially Chemistry. Mathematics difficulty is associated with disinterest in learning chemistry, understanding, and solving problems. Student's fear in mathematics affects their ability to endure and perceive concepts encountered in studying chemistry. It has been observed that so many students fear chemistry and such fear is characterized by mass disenchantment among the students toward the subject. The relationship of the student's mathematics anxiety and their attitude toward chemistry greatly affects their performance in the subject.

The increasing learners' individual interest has led to the shifting of traditional to progressive mode of education, showing a new paradigm as a student-centered learning. The individuals' interaction process is very important to determine their method of learning that is most effective to take place in terms of their learning styles (Zywno, 2002). The study of Ikitde and Edet (2013) indicated that students' attention is being focused on how they can meet challenges in an increased diversity inside the classroom. It is their interest how they demonstrate mastery in the completion of a subject that depends on their way in absorbing the lessons and the teaching methods. Pashler, McDaniel, Rohrer and Bjork (2008) conclude that learning styles can have little evidence with the students' learning style on how they match instructions to produce superior learning.

Students' attitude can be influenced by their achievement which gives an important role in selecting their professional carriers. According to Bennet, Lubben, and Hogarth (2003), students' understanding of science ideas is helpful in science education. These science ideas are referred to the student's views in developing science as the result of experiences in different environments in the field of Science education.

Restrepo and Villaveces (2012) noted that Mathematics and Chemistry are closely related. The close relationship was evidently observed in the emerging subdiscipline known as mathematical chemistry.

Mathematics has an essential use in chemistry. Basic knowledge of mathematics can be used in chemistry to deal with concepts and theories. Mathematical skills are extremely necessary to explore chemistry in its most important concept using some basic mathematics skills and with these calculations, chemistry itself will be extremely difficult (Shodor, 2008).

This study sought to determine and correlate the students' mathematics anxiety, students' learning style, and attitude toward chemistry to their achievement in chemistry.

Conceptual Framework

In 1986, Bandura proposed the Social Learning Theory. In this theory, a person's choice of behavior, how much effort to expend, and for how long an effort is sustained despite obstacles and adverse experiences (demonstrating persistence) are governed by his/her perception of self-efficacy. A person will have lower performance (efficacy) expectations if he/she believes that he/she is not able to succeed due to personal inadequacies rather than due to the particular situation he/she finds himself/herself to be in. Self-efficacy expectations are independent of performance and are a better predictor of behavior than the actual capability of the person. Bandura's theory presents the cognitive orientation and basis for introducing a lot of variables to a person's special attention to the concept of 'self' served. Bandura's concept of "self-efficacy" received special attention due to its outstanding role in learning and its influence to peoples' behavior through their judgment of their own capabilities.

Bandura (1989) defines efficacy beliefs as the product of a complex process of self-persuasion that relies on cognitive processing of diverse sources of efficacy information. These sources of efficacy information include performance mastery, watching others to see how a person's capabilities measure up, verbal persuasion, and other social influences from others that indicate a person's capabilities.

If students judge that they do not have the confidence to be successful, they would avoid potentially threatening situations and activities by adopting defensive behaviors such as avoidance even if they are not anxious at that particular moment. This defensive behavior, according to Bandura, is maintained because it is successful in reducing anxiety-causing events like enrolling in mathematics courses. This avoidant behavior is difficult to eliminate even if the threat no longer exists. Thus, the student's defensive behaviors may have become so successful in avoiding mathematics courses that, over time, his/her level of mathematics anxiety may have been greatly reduced or even eliminated because the threat of taking future mathematics courses has been eliminated. Since the student's mathematics anxiety has been reduced, the mathematics avoidance behavior is reinforced.

Students who were mathematics anxious in elementary and or middle school may not be mathematics anxious in high school if they were successful in avoiding mathematics courses they viewed as potentially threatening in middle/junior and high school. These students who no longer suffer from mathematics anxiety because they are no longer taking threatening mathematics courses may not remember being mathematics anxious. Although it appears on the surface that these students may be successful in the lessening or elimination of mathematics anxiety, they

actually may be limiting their career options by avoiding challenging mathematics courses. They may be unaware that their present course and career choices are based on avoiding certain courses and career paths in the past.

Many learners have already experienced mathematics anxiety in schools consequently. Although the reaction appeared to be similar to test anxiety in general, they found that mathematics anxiety is a potential factor prose. They have labeled it 'number anxiety' which is often assumed to be a high level of anxiety impairs performance. A moderate amount of anxiety may actually facilitate performance. Beyond a certain degree, however, anxiety hinders performance particularly in the case of higher mental activities and conceptual process. Psychological literature provides a number of conceptualizations of mathematics anxiety. Richardson and Suinn (1972) have defined mathematics anxiety in terms of its (debilitating) effect on mathematical performance. They have observed that the feeling of tension and anxiety interfere with manipulation and solving the mathematical problems in academic situations and a wide variety in ordinary life. Feelings that involve tension and anxiety that interfere with manipulating of numbers and solving mathematical problems. Many students who suffer from mathematics anxiety tend to have little confidence in their mathematical abilities and tend to take the minimum numbers of required mathematics courses, which greatly limits their career choice options.

Vygotsky (1962) believes that children's knowledge of the social community, which is learnt from either technical or psychological cultural tools can affect their thinking. A child can be taught of this from other people via language. Therefore, he suggests that language is the most important tool for gaining this social knowledge. He provides a very influential theory which is a

meaningful social context in the development of learning. The emphasis of cultural knowledge was something unseen in Piaget's theory. He stresses the importance of looking at each child as an individual who learns distinctively. Consequently, the knowledge and skills that are worthwhile learning vary with the individual.

The overall goal of education according to Vygotsky is to generate and lead development which is the result of social learning through internalization of culture and social relationships which by means of influencing one another in a positive outlook this can improve a students' attitude towards learning the subject.

Reported consequences of anxiety toward mathematics include the avoidance of mathematics and decline in achievements relating to mathematics. Although the reaction appears to be similar to test anxiety in general, it was found that mathematics anxiety is a potential factor. It has been labelled 'number anxiety' which is often assumed to be a high level of anxiety that impairs performance.

A distinction must be made between the different levels of anxiety. A moderate amount of anxiety may actually facilitate performance. Beyond a certain degree, however, anxiety hinders performance particularly in the case of higher mental activities and conceptual process. Scarpello (2005) observed that many students who suffer from math anxiety have little confidence in their ability to do mathematics and tend to take the minimum numbers of required mathematics courses, thus limiting their career choice options greatly.

Studies relating to students' attitudes toward chemistry and mathematical ability and their performance in Chemistry classes at the secondary level revealed that participants preferred

Mathematics to Chemistry, as they found the former more important and useful than the latter. Research suggests that students do not have satisfactory academic achievement if they have negative attitudes toward the field, as it is in science and mathematics. For instance, Sorge, Newsom, and Hagerty (2000) note that Hispanic students dislike Science and Mathematics and this attitude represents a significant predictor of success.

Further research studies revealed that individuals' learning styles influence their school or academic achievement. Collinson (2000) compared the learning styles and the school achievement of 110 elementary school students. Snyder (2000) found similar results for high school students. Students' perceptions of their own academic achievement differed with different learning styles. Snyder (2000) used high school students' Grade Point Average (GPA) and Metropolitan Achievement Test (MAT-7) scores to explain the relationship between GPA scores and tactile/kinaesthetic learning style, between MAT-7 scores and visual learning style.

Students learn differently from one another and it has been determined that brain structure influences language structure acquisition. It has also been shown that different hemispheres of the brain contain different perceptions avenues. Some researchers claim that several types of cells present in some brains and not present in others are responsible for the different patterns of perception among individuals. VAK or Visual, Audio and Kinaesthetic is a commonly and simplest learning style reference that can be used to students to plan the teaching strategies that a teacher is going to use. Some students are visual learners, while others are auditory or kinesthetic learners. Visual learners learn visually by means of charts, graphs, and pictures. Auditory learners learn by listening to lectures and reading. Kinesthetic learners learn by doing. Students can prefer

one, two, or three learning styles. Because of these different learning styles, it is important for teachers to incorporate in their curriculum activities related to each of these learning styles so that all students are able to succeed in their classes. While all of the senses are used to take in information, each one seems to have preferences in how he/she learns best. Cuaresma (2008) suggests that in order to help all students learn, teachers need to teach to as many of these preferences as possible.

Based on the concepts presented above, clearly, mathematics anxiety, attitude toward chemistry, and learning style are factors to be considered in the determination of achievement in Chemistry. Since mathematics anxiety has been proven to affect students' performance in mathematics, the same may be possible in Chemistry as some topics also involve mathematical applications. Individual learning style may affect students' performance in Chemistry regarding how certain topics are presented especially in terms of concepts involving mathematical operations. In terms of attitude toward Chemistry, performance may be affected by the students' initial outlook toward the subject.

Students sometimes do not see Chemistry as an enjoyable and easy subject but as a boring and hard subject—an attitude that may hinder their actual performance. Some misconceptions were expected to arise due to their level of mathematical anxiety, learning style, and attitude toward chemistry.

Figure 1 shows the conceptual framework of the study.

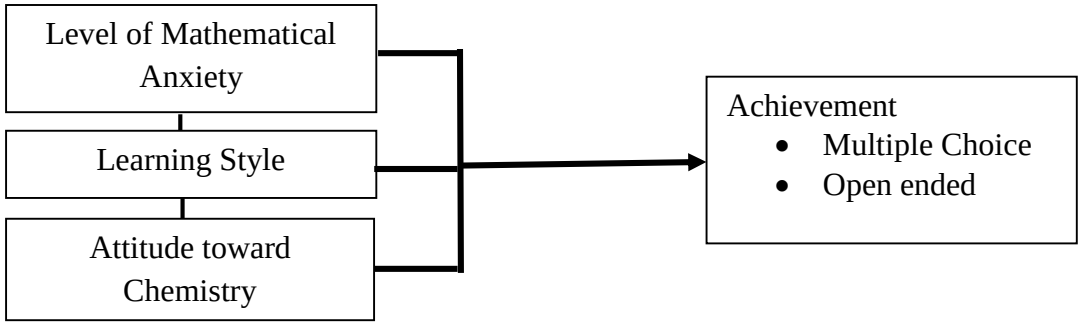


Figure 1. Conceptual Framework of the Study

The study tested the three student attributes namely, level of mathematical anxiety, learning style and attitude toward chemistry to correlation the students academic achievement. This test was done by administering a series of tests to measure the level of mathematical anxiety, learning style and attitude toward chemistry.

The variables of the study were concentrated on the achievement test of the respondents determined by direct measurement using the concepts in Mathematics Skill Test in General Chemistry which has two components, multiple choice and open ended questions for Achievement Test. The data obtained from the three student attribute were then correlated to the data obtained from the achievement test.

Statement of the Problem

The main focus of this study was to investigate the correlation between the mathematics anxiety, learning style, and attitude toward Chemistry and performance in Chemistry among the selected students at the institute of Teaching and Learning at the Philippine Normal University.

Specifically, the following questions were raised in this study;

1. What is the profile of the respondents in terms of the following variables?
    a. Mathematics anxiety
    b. Learning style
    c. Attitude toward chemistry
    d. Achievement in chemistry
        d.1 Multiple choice test
        d.2 Open ended test
2. Are there significant differences in the Chemistry achievement of respondents when they are categorized according to the following variables:
    2.1 mathematics anxiety
    2.2 attitude towards chemistry
    2.3 learning style
3. Is there a significant difference between the scores of grades 9 and 10 in terms of multiple choice, open ended, anxiety and attitude?
4. Which among the independent variables serves as the best predictor of chemistry achievement?

Significance of the Study

This study may provide future Chemistry educators data on profiling students based on their mathematics skills and attitudes to better support chemistry learning.

Educators. This study hopes to provide empirical data why students lose interest when they hear or encounter the word "math" and fear solving mathematical problems. Since educators must focus on the subject taught and on the improvement of their teaching methodologies, this study could help by understanding learning needs, could provide remedial classes should the need arises educators to find alternative pedagogical approaches that motivate their students to enjoy the subject in the long run.. This would also help teachers in determining manifestations of mathematics anxiety among their students.

Students. This study may serve as their guide to improve and develop their mathematical ability by reducing or overcoming mathematics anxiety for a better understanding and learning of the subject. It is also hoped that the students may know themselves deeply and develop a positive attitude toward any mathematics subject, which could also affect their performance in chemistry.

School administrators. This study may serve as their reference for the development of a more refined set of guidelines to address the students' mathematics anxiety and to cater the students' learning styles and attitude toward chemistry.

PNU-ITL. This study may provide information on the chemistry problems of the students, which may serve as basis in conducting remedial classes and in improving the quality of instruction at the center in general.

Scope and Delimitation and Limitation of the Study

This study focused on the correlation of the three student attribute namely; students' level of anxiety, learning style, and attitude toward chemistry to the achievement of the 108 Grades 9 and 10 students at the Institute of Teaching and Learning at the Philippine Normal University school year 2013-2014.

This study also leaned on the information gathered through the use of four (4) questionnaires on students' level of anxiety that were administered to the respondents, learning style and attitude on the topics of chemistry that deals in mathematical skills.

The respondents were purposively selected and were required to submit Parent's Consent form before they were given the questionnaires.

The study utilized ANOVA and correlation ratio for statistical treatment of data.

Definition of terms

The following terms are hereby defined to facilitate better understanding of the study:

Academic Achievement. This refers to the scores gained on the achievement test.

Attitude. This refers to students' views something or tends to behave toward it, done on a personal evaluative way.

Learning Style. This refers to three factors, visual, audio and kinaesthetic facilitate learning for an individual in a given situation.

Mathematics Anxiety. This refers to students' feelings of isolated, helpless in such a way of being small, insignificant, tension and stress in solving chemistry problems which involve mathematical skills that interferes with the construction of science knowledge, the development of mathematical skills and abilities, and the use of math knowledge, skills, and abilities in life and in academic situations.

Multiple Choice Achievement Test. This refers to a set of questionnaire composed of 30 items multiple choice questions on chemistry concepts involving mathematical operations.

Open ended Achievement Test. This refers to a set of questionnaire composed of four item problem solving composed of chemistry questions involving mathematical operations that requires students to answer using their knowledge.

Student Attributes. This refers to three variables namely; mathematics anxiety, learning style and attitude toward chemistry in relation to multiple choice and open ended achievement test.

Chapter Two

Review of Related Literature and Studies

This chapter presents a brief review of the related literature and studies from books, journals, periodicals, and internet that are related to the problem at hand. They are cited to add insights into the present research.

Anxiety

Kelly (1955) defined anxiety as the recognition that the events with which one is confronted lie outside the range of convenience of one's construct system. A person can experience outside range wherein when a person's incompatibility constructs can no longer be tolerated and the person's construction system breaks down. Horney (1950) defined anxiety as a feeling of being isolated and helpless in such a way of being small, insignificant, and helpless. Basic anxiety is not a neurosis, but "it is the nutritive soil out of which a definite neurosis may develop anytime. This is constant and unrelenting, needing no particular stimulus such as taking a test in school or giving a speech according to Horney (1937). Sullivan (1953b) refers anxiety as energy transformation such as tensions. Tensions that are transformed into actions, either overt or covert are what he refers as energy transformation. This somewhat awkward term simply refers to our behaviors that are aimed at satisfying needs and reducing anxiety- the two great tensions. Not all energy transformations are obvious, overt actions; many take the form of emotions, thoughts, or covert behaviors that can be hidden from other people.

Students' Difficulty in Mathematics

The problem of difficulties in mathematics has been analyzed under many aspects by the National Education Boards and by the researchers in Sciences of Education and Mathematics Education all over the world.

To overcome the problem it is necessary to relate failure with affect. According with McLeod's (1992) framework he assume a multidimensional description of the affective domain, consisting of interdepending constructs, such as emotions, attitudes, beliefs and values (Evans et al., 2004).

Considering the discomfort in mathematics as an attitude with three components: emotional response, beliefs on the subject, and behaviour towards the subject (Di Martino & Zan, 2001 and 2003). Discomfort is revealed through uneasiness, annoyance, and pain or fear. Students' attitude towards mathematics from their lectures, homeworks, or school tests shows a ground on discomfort. If a student does not overcome the causes of discomfort, the risks to become alienated from mathematics and then to fail in it and to abandon school.

Students having difficulties in arithmetic that originate and develop in the primary school, if they are not diagnosed and cured in the secondary school they become obstacles to the access to communication through the mathematical language and therefore they become more and more difficult to eliminate (Kieran, 1990 and 1992). The lack of the semantic control (Arcavi, 1994), due to the increase in formal complexity, is also responsible for the arising of discomfort in mathematics (Silver & Kenney, 1997).

Too often, teachers do not give importance to the difficulties met by students in the

use of the algebraic language and with some of its functional aspects such as the use of words as: "variable, unknown, undetermined, parameter" (Marchini, 2002), (Marchini & Kaslova, 2003). According to Rinaldi,et al., (2006), mathematical failure always follows mathematical discomfort. Classifying discomfort in mathematics as an endogenous variable of school drop-out. In other words, getting over the discomfort in mathematics becomes a decisive factor in order to avoid drop-out.

Mathematics Anxiety

Mathematics anxiety is more than a dislike or frustration in dealing with math-related problems. Richardson and Suinn (1972) define mathematics anxiety as a feeling of tension and anxiety that interfere with the manipulation of mathematical problems in varied situations in ordinary as well as academic life. In Miller's (1981) study, it was concluded that mathematics anxiety is directly related to perceptions of one's own mathematical skill into other subject areas. Smith (1997) characterizes math anxiety in a number of ways, including: (a) uneasiness when asked to perform mathematically; (b) avoidance of math classes; (c) feelings of physical illness, faintness, dread or panic; (d) inability to perform on a test; and (e) utilization of tutoring sessions that provide very little success. Ma (2003) also defines mathematics anxiety as a sense of discomfort observed while working on mathematical problems and is associated with fear and apprehension to specific mathematics related situations.

Experiencing Mathematics Anxiety

Many people experience mathematics anxiety in different ways. Jain and Dowson (2009) identified the psychological indicators of mathematics anxiety as feelings of tension, fear and

apprehension, low self-confidence, a negative mindset toward mathematics learning, feeling of being threatened, failure to reach potential, and a temporary reduction in working memory. Malinski, Ross, Pannells and McJunkin (2006) articulate that mathematics anxiety is exhibited physiologically by sweaty palms, feeling of nausea, difficulty with breathing, and, for some people, heart palpitations. Additionally, they assert that it interferes with calculating and solving of mathematical problems in academic, private, and social environments. Within a classroom or school environment, it is most often associated with children undertaking learning in mathematics, however it is not restricted to children. Some teachers have reported nervousness and lack of confidence when confronted with teaching aspects of mathematics. As noted earlier, it is a common occurrence in work and everyday life. Hopko (2003) also notes that mathematics anxiety is often seen when people avoid situations and even careers that require the use of even basic mathematical skills.

Jain & Dowson (2009) found out that many research projects have already investigated and tried to understand the causes of mathematical anxiety with the intention to improve attitudinal and cognitive aspects of mathematics learning. According to Baloglu & Kocak (2006), sources of mathematics anxiety are varied, interrelated, and also inconsistent in their effects. For example, some studies have noted an influence of gender while others have failed to substantiate this influence. Other researches like Furner & Berman (2003) have reported that age is also a factor in school student perceptions of mathematical anxiety. One such possible cause of mathematics anxiety— teacher behavior— differs between elementary and high school levels. However, causes of mathematical anxiety may be broadly categorized as attributes of the children, the family, the teacher and instruction, and the nature of mathematics itself.

Relationship between Mathematics Anxiety and Achievement

Whyte (2009) considers mathematics anxiety as a fear or phobia that produces 'a negative response to specific learning or doing mathematical activities that interfere with performance. Miller and Bischel (2004) describe math anxiety in a closer examination that reveals two general forms of anxiety: trait and state. Trait anxiety is the vulnerability to stress that an individual brings to a situation, while state anxiety refers to the actual situational stress experienced that is specific to personally stressful or fearful circumstances. Mathematics anxiety can affect individuals in varying ways, inducing a cognitive, affective, or physical reaction. According to Freiberg (2005), a cognitive reaction may involve negative self-talk, 'blanking out,' and avoidance; an affective reaction may be characterized by distrust of ability, fear of looking stupid, and loss of self-esteem; and a physical reaction may be evidenced by perspiring, a boost in one's heart rate, tenseness, or nausea.

Lee (2009) observed that New Zealand students fare well in mathematics anxiety stakes in that relatively high math achievement scores and positive math self-concept and self-efficacy scores are matched by relatively low levels of mathematics anxiety. On the other hand, Lee (2009) argues that academic-motivation constructions such as mathematics self-concept, self-efficacy, and mathematics are inevitably related to the societal and eductional environment, the negative impact of mathematics anxiety on both of the students' short-term learning and long-term relation with mathematics, and for prospective teachers within the educational system, remains significant.

There is no accurate measure of the number of students within the classrooms that experiences mathematics anxiety. Jennison and Beswick's noted in a recent survey (2009) of 40

Year 8 boys in Australia that eight students recorded high ratings on mathematics anxiety measures. Conservatively estimating the level as 10 percent means that there are several students in each of the classes experiencing extreme levels of discomfort with mathematics learning. Middleton & Jansen (2011) explain that not many negative experiences are needed for students to begin a pattern of mathematics avoidance that lingers for the rest of their lives. To redress this pattern of avoidance and the pervasive attitudes toward mathematics that can frighten and debilitate, mathematics anxiety as another layer within the diversity of students should be given attention.

Ballado (2014) found out that there is a significant negative correlation between anxiety and achievement but in his study, the female respondents showed a significant difference of mathematics anxiety level from the male. This could mean that academic achievement may be affected by the kind of disposition a student has towards mathematics. Whether the anxiety caused the achievement or the achievement caused the anxiety, there is a dire need for mathematics teachers to exhaust all efforts to make mathematics learning a pleasurable experience for students.

Learning Style

Children follow their own unique way in learning and processing information. They learn material in different ways. Some learn by oral repetition, some by writing it out, and others through practical work. Individuals thus differ in the way they learn.

Learning style can be described as a set of factors, behaviors, and attitudes that facilitate learning for an individual in a given situation. It is the ability of learners to perceive and process

information in learning situations. Learning styles can be defined, classified, and identified in many different ways. Generally, they are overall patterns that provide direction to learning and teaching.

Learning styles influence how students learn, how a teacher teaches, and how the two interact. Each person is born with certain tendencies toward particular styles, but these biological or inherited characteristics are influenced by culture, personal experiences, maturity level, and development.

Learning style can be considered as a 'contextual' variable or construct because what the learner brings to the learning experiences is a part of the content as well as the important features of the learner's experience. Each learner has his/her very own distinct and preferred consistent ways of perceptions, organization, and retention.

Many psychologists have developed different indexes of learning styles such as Felder-Silverman model, Neil Fleming's VARK/VAK model, Memletic styles, David Kolb's model, Peter Honey and Alan Mumford's model, Anthony Gregorc's model, and many others.

The Felder design model is an instructional design model based on learning style consideration. According to Felder (1996, 1993), this model shows the classification of students along the following dimensions: (a) sensing/intuitive learners (b) visual/verbal learners (c) inductive/deductive learners (d) active/reflective learners (e) sequential/global learners.

The Memletics system is focused around the thought that everyone adapts in an unexpected way, and that people do best when they can concentrate on their own favored learning style rather than being confined to a style decided by another person. The learning styles included in the Memletics system are the visual or those who learn most easily from pictures and symbols, the

verbal or those who learn best through verbal explanation, the logical or reasoning their way through problems as their preferred way of learning, and the physical or known as the "hands-on approach."

Kolb's (1984) experiential learning theory comprises a four-stage learning cycle where a learner will experience every one of the four phases of the cycle in changing degrees: experiencing, reflecting, thinking, and acting. On the other hand, at the most essential level, a learner will show an inclination or quality in one of the stages.

The favored learning stage decides a learner's learning style characterized in Kolb's Learning Style Inventory. Kolb's hypothesis draws on the inceptions of experiential learning from the works of Dewey, Lewin, and Piaget prominent 20th century researches (Kolb 1984) and creates an all-encompassing model of the learning procedure and a multi-linear model of adult advancement (Kolb & Kolb, 2005).

Peter Honey and Alan Mumford learning style was based on the work of Kolb. They recognize four different learning styles or preferences: activist, theorist; pragmatist and reflector. These are the learning approaches that people commonly incline. Honey and Mumford (1982) suggest that every learner should comprehend his/her learning style and seek out opportunities to learn using that style.

Among the many learning style references, VAK theory is the most widely recognized by teachers particularly by those who advocate accelerated learning techniques. VAK or visual, audio and kinesthetic looks into the three broad learning styles that should be facilitated within the classroom.

It is rare to find all three of these approaches to learning incorporated into a class in a typical classroom situation. While it may seem impossible to do this, it can be done through thoughtful planning and preparation. It does force teachers to conceptualize the class differently with a focus on the variety of ways in which students learn. The various inventories on learning styles allow teachers to gain insight into which areas they can further develop and which areas are already well developed.

Relationship between Learning Style and Achievement

Learning styles are characteristic ways of perceiving and processing information. Considering the importance of learning styles, educational organizations have assessed the learning styles of students and tailored instruction to fit student learning styles. In a comprehensive review of learning style literature, Pashler, McDaniel, Rohrer, and Bjork (2008) found out in their study that little evidence in matching instruction with learning styles produces superior learning.

However, there are researches that indicate that learning styles can influence student academic performance. In addition, teachers and administrators are able to improve the quality of instruction in their schools when they are aware of the learning styles of their students. For example, Bart and Bhatti (2013), suggest that current undergraduate teaching tends not to accommodate students of diverse learning styles. A prominent finding in this study is that undergraduate students taking classes in sociology who have the Converger or Kinesthetic learning style had a higher mean GPA than comparable students with the other learning styles. Many undergraduate courses may be employing instructional methods that favor and better fit the Converger learning style.

As a result, many students with non-Converger learning styles such as the Dominant Assimilator learning style many not be performing as well as Converger students. This state of affairs is unacceptable. To cope with this situation, courses and programs in the university should be designed with a consideration of multiple student learning styles. Accommodation of the learning styles of students will likely facilitate student learning. According to the Pashler et al. (2008), there is continued merit in investigating the interaction of instructional methods and learning styles with the goal of improving the academic achievement of all students including undergraduate students. Carbonel (2013) study implies that the study habits of the students in College Algebra have great impact to their performance in the said subject. Students are then described to be more on visual and auditory form of learning as compared to the tactile.

Attitude

The concept of attitudes has changed over the years (see Allport, 1954, for an early review). The initial definitions were broad and encompassed cognitive, affective, motivational, and behavioral components. For example, Allport (1935) defined an attitude as a mental and neural state of readiness, organized through experience, exerting a directive and dynamic influence upon the individual's response to all objects and situations with which it is related. A decade later, Krech and Crutchfield (1948) wrote that an attitude can be defined as an enduring organization of motivational, emotional, perceptual, and cognitive processes with respect to some aspect of the individual's world. These definitions emphasized the enduring nature of attitudes and their close relationship to individuals' behavior. Some sociologists and psychologists like Fuson (1942) and

Campbell (1950) even defined attitudes simply in terms of the probability that a person will show a specified behavior in a specified situation.

In subsequent decades, the attitude concept lost much of its breadth and was largely reduced to its evaluative component. In the words of Daryl Bem (1970) that attitudes are likes and dislikes. Similarly, Eagly and Chaiken (1993), defined attitudes as a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavour.

Jung (1921/1971) defined an attitude as a predisposition to act or react in a characteristic direction. He insisted that each person has both an introverted and an extroverted attitude, although one may be conscious while the other is unconscious. Like other opposing forces in analytical psychology, introversion and extroversion serve in a compensatory relationship to one another and can be illustrated by the yang and the yin motif. According to Jung, attitude can be shown into two; introversion and extroversion. Introversion is the turning inward of psychic energy with an orientation toward the subject while in contrast, extroversion is the attitude distinguished by the turning outward of psychic energy so that a person is oriented toward the objective and away from the subjective. Attitude were describe into four functions- sensing, thinking, feeling intuiting. Sensing tells people that something exists, this function receives physical stimuli and transmits them to perceptual consciousness; thinking enables them to recognize its meaning that produces a chain of activities, logical intellectual activity; feeling tells them its value or worth, describes the process of evaluating an idea or event; and intuition allows them to know about it without knowing how they know, it involves perception beyond the workings of consciousness.

Attitude in Chemistry

Teachers can improve students' motivation simply by smiling, giving extra help on an assignment, or commending a student on a job well done. While these actions are great motivators, the best motivation lies in a teacher's personality toward their students. A student is motivated to learn new skills if they understand their potential value, yielding efforts in getting good grades and good performance output. Motivation is distinguished between two types according to the Self-Determination Theory based on the goals and different reason that is given rise to action. Intrinsic motivation refers to doing something that is enjoyable or interesting to the learner while extrinsic motivation to doing something that leads to a separable outcome.

Intrinsic motivation has developed as a vital phenomena for instructors—a regular wellspring of learning and accomplishment that can be efficiently catalyzed or undermined by parents and educators (Ryan & Stiller, 1991). Since intrinsic motivation results in quality learning and inventiveness, it is particularly important to detail the variables and forces that incite or undermine it. Intrinsic motivation is characterized as the doing of an action for its characteristic satisfactions instead of for some divisible result. At the point when intrinsically motivated a individual is moved to represent the fun or test involved as opposed to due to outside prods, pressure, or prizes. The phenomenon of intrinsic motivation was initially recognized inside exploratory investigations of animal conduct, where it was found that numerous organisms take part in exploratory fun loving, and interest-driven practices even without reinforcement or prize. Extrinsic motivation is a development that relates at whatever point an action is carried out so as to accomplish some distinguishable results. Extrinsic motivation hence contrasts with intrinsic motivation, which refers to doing an action basically for the enjoyment in the activity itself, instead

of its instrumental worth. On the other hand, not at all like a few points that view extrinsically motivated behavior as invariantly nonautonomous. SDT recommends that extrinsic motivation can vary significantly in the degree to which it is independent. Escalona (2005) correlated the attitude towards chemistry among the students in the sophomore college and it seems that it greatly influence their performance in chemistry. The students' positive attitude towards chemistry may have nourished their capabilities in performing different chemistry activities.

Relationship between Attitude toward Chemistry and Achievement

Tinio (2009) conducted a study which measured academic achievement by administering a test called the Academic Engagement Scale for Grade School Students (AES-GS) to 250 sixth and seventh graders in the Philippines. The test consisted of 102 questions, with three categories: behavioral engagement, emotional engagement, and cognitive engagement. The students answered questions using a Likert scale with options ranging from always to never (Tinio, 2009). Based on the results, she concluded that, all three subscales (behavioral, emotional, and cognitive) are necessary to measure academic engagement. It is thus essential to construct such a scale because it could be an avenue to improve the education of a student. It would also help teachers determine what aspects a student is not able to respond well.

Normally, levels of academic achievement are based on cognitive abilities. Tinio's study however, took into account behavioral and emotional as well. All three levels are equally important to implement in a classroom, but schools often focus on the cognitive aspect because of standardized tests or other requirements that must be met. While cognitive, behavioral, and

emotional engagement should be present to increase academic engagement. Tinio did not study the motivation factor and its effect on academic success.

In his study, Coleman (2009) investigated the relationship among parental involvement, student motivation, and academic achievement of fifth graders. Coleman found out that student motivation and academic achievement had a positive correlation; therefore, if a student is motivated to do well in school, then he/she would be more likely to make an effort and therefore achieve higher scores. This statement is supported by Ellis (2010) in the textbook "Teaching and Learning Elementary Social Studies" when he wrote: "A student's most powerful motivation to learn a school subject comes from his or her prior success in that subject."

Clearly, these researchers noted that the aspects of motivation and academic achievement are reciprocal. The more one increases, the more the other increases; therefore, students who are successful and motivated will continue to be, whereas students

who do not succeed are less likely to become motivated to succeed. Further, they point out that motivation is a crucial factor in promoting students' academic success and should be implemented in classrooms to increase test scores, which in turn motivate students further.

In a study, Singh, Granville, and Sandra Dika (2002), compared the effect of attitude, motivation, and academic engagement on academic performance among eighth graders in the areas of mathematics and science. They used 25 percent of the National Education Longitudinal Study's student sample from 1988 and analyzed two motivation factors—one academic engagement factor and one attitude factor. In all cases, their predictions were correct finding that the study of the total effects revealed the important influences of academic time, attitude, and motivation on achievement. The researchers stressed that of primary importance is the evidence of the strong

effects of motivation, positive attitude, and engagement in academic work for success in mathematics and science. Further, in their study, they found that it is important for students to be actively engaged in their learning for success. They also determined that motivation has a significant impact on academic achievement. Burris, Heubert, and Levin (2004) stated that motivation affects attitudes by causing students to have more positive attitudes and confidence in themselves. According to Ellis (2010), motivation positively affects achievement with the two existing in a cycle so that as one increases the other increases.

Synthesis

Base from this related literature and studies, when taken separately, mathematical anxiety, learning style and attitude in Chemistry influences academic achievement. Mathematics Anxiety give the students' negative feelings and mindset themselves fear of their cognitive aspects of their mathematical learning. Students' learning style influences how they are able to learn and give interest to the subject. It is important to each individual how they can improve and influence themselves in learning. A student can be motivated how they see and give interest toward the subject. With this, it motivates the student to learn new skills to fully understand their potential value and have good performance output.

As supported by the studies, the interconnection of the three student attributes gives a vital role in the students' academic achievement in chemistry. It is the goal of this study to determine which of these student attributes clearly contributes to academic level, in the current Grade 9 and 10 learners.

Chapter Three

RESEARCH METHODOLOGY

This chapter presents the methods and procedures used by the researcher in the conduct and completion of this study. Specifically, it described the research design, the sample used, the purposive sampling technique implemented, the source of data referred to, the instruments used, the data-gathering procedure, and the statistical treatment applied in processing the gathered data.

Research Design

The study used the descriptive research, particularly employing the correlation method to determine the students' level of mathematics anxiety, learning style, attitude toward chemistry, and achievement in chemistry. Respondents of this study were Grades 9 and 10 students for the school year 2013-2014 at the Institute of Teaching and Learning at the Philippine Normal University. Three questionnaires were used to gather information reflected the respondents' level of anxiety in mathematics, learning style, and attitude toward chemistry. Academic achievement was the gained scores from the multiple choice and open ended test.

Research Procedure

Figure 2 shows the flowchart of the research procedure of the study which consist of five phases.

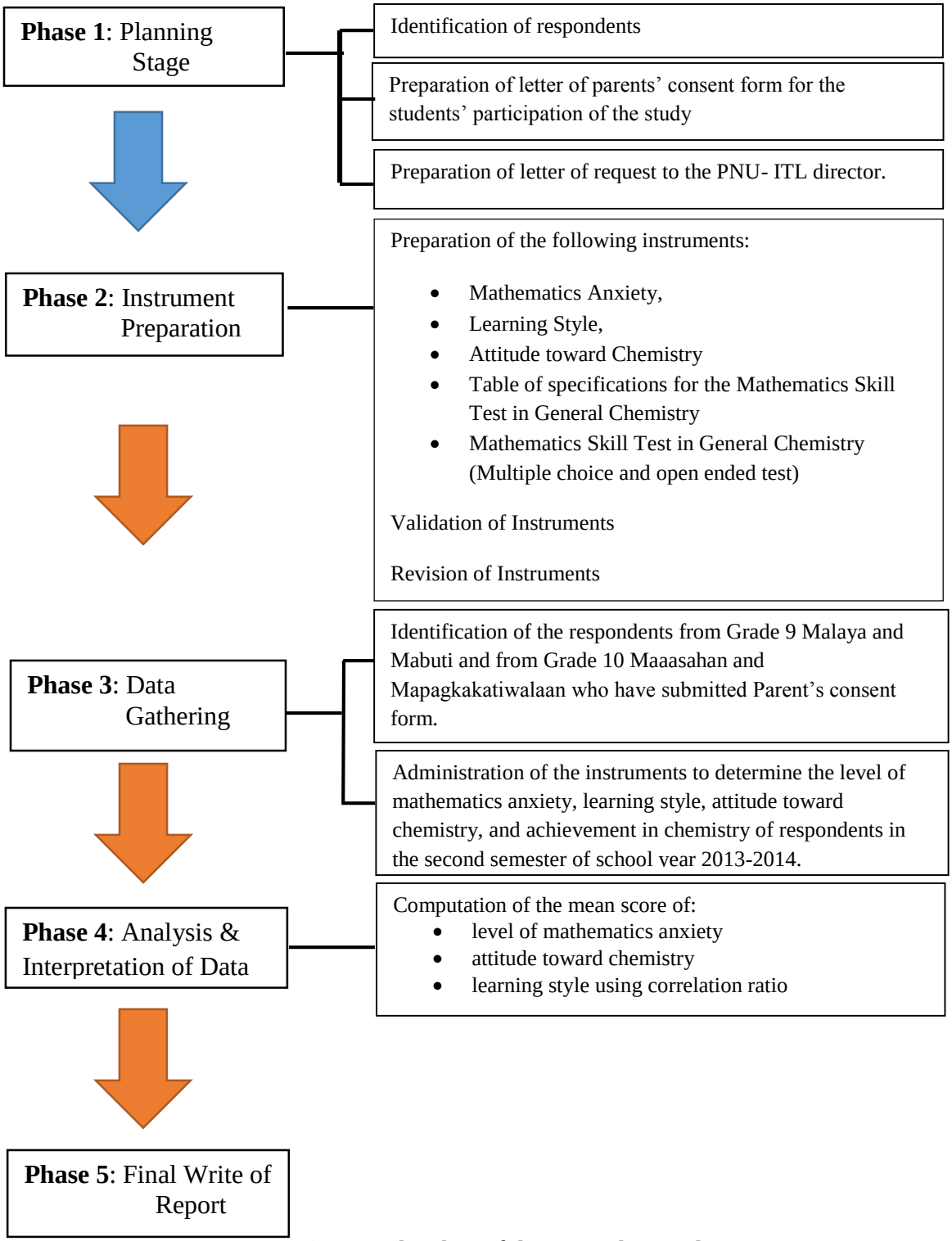


Figure 2. Flowchart of the Research Procedure

Phase 1

In the planning stage, the selection of the respondents utilized the purposive sampling technique because the target respondents are the Grades 9 and 10 students. Letter of request was sent to the PNU-ITL Director (see Appendix A) and a letter of Parent's consent form were prepared for the students who participated in the study.

Participants of the Study

Upon the approval of the PNU-ITL Director for the conduct the study among the Grades 9 and 10 students in school year 2013-2014, parents' consent (see Appendix B) was secured before the respondents were allowed to participate in the study. The participants of this study were selected by purposive sampling. A total of 108 respondents were involved in the study.

Table 1 shows the distribution of the respondents according to year level.

Table 1
Profile of respondents according to year level

Variable	N	%
Grade 9	60	55.6
Grade 10	48	44.4
Total	108	100

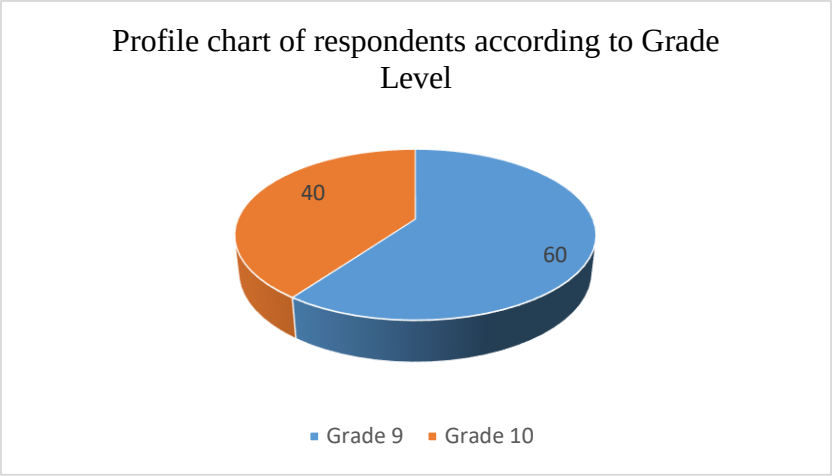


Figure 3: Profile chart of respondents according to year level

Grade 9 respondents composed the 55.6% of the population while the 48 Grade 10 students composed the 44.4% of the population. This is due to the students who had only submitted a reply in the parent's consent form.

Phase 2:

In the instrument preparation, the questionnaires in mathematics anxiety, learning style and attitude toward chemistry was prepared, table of specifications for the mathematics skill test in general chemistry was made to make as a guide in constructing the achievement test in multiple choice and open ended test.

Research Instruments

To elicit information needed in the study, research instruments were developed by the researcher. There were four instruments used in this study—Mathematics Anxiety Rating Scale, Learning Style Reference, Attitude toward Chemistry Scale, and Achievement Test.

The developed instruments were subjected to validation by a pool of validators which included two instructors from different universities (see letter to validators Appendix C). The validation focused on the format and design and language and content of the instruments (see Appendix D, E & F). The results were interpreted based on the following table.

Table 2
Interpretation of Percent Agreement

Range	Remark*
100.0	Perfect agreement
$91.0 < P \leq 100.0$	Very high agreement
$81.0 < P \leq 90.0$	High agreement
$61.0 < P \leq 80.0$	Marked substantial agreement
$41.0 < P \leq 60.0$	Moderate agreement
$21.0 < P \leq 40.0$	Low agreement
$1.0 < P \leq 20.0$	Negligible agreement
0.0	No agreement

*should at least be 30.0 (Gwet, 2010)

Mathematics Anxiety Rating Scale

This study adapted and modified the scale from Hunt, Clark-Carter, and Sheffield (2011) (see Appendix G). The modified Mathematics Anxiety Scale was evaluated by experts on six areas namely; content, level of difficulty, structure, instructions, language and ethical/social. The overall acceptability of the instrument was rated Very High.

There were 20 items which the respondents freely answered. Each student was asked to express his/her degree of agreement to each statement by responding to the question "How anxious would you feel in the following situations?" The scores were added and the mean was obtained and interpreted.

Table 3 shows the interpretation of the test scores by showing a range of arithmetic mean of the mean score and its corresponding questionnaire remarks for the Mathematics Anxiety Scale.

Table 3
Interpretation Test Scores in Mathematics Anxiety Scale

Range	Remark
2.50 < Mean Score ≤ 4.00	High
1.00 ≤ Mean Score ≤ 2.50	Low

The mathematics anxiety rating scale instrument was subjected to expert validation before it was administered. Table 4 presents the results of the validation scores with their corresponding interpretation.

Table 4
Experts' Validation: Mathematics Anxiety Scale

Area	Acceptability			Agreement		
	Mean	**SD**	**Remark**	**Percent**	**SE**	**Remark**
A	4.00	0.000	Very High	100.0	0.000	Perfect
B	3.67	0.500	Very High	33.3	0.000	Low
C	3.67	0.500	Very High	33.3	0.000	Low
D	3.44	0.527	High	33.3	0.000	Low
E	3.00	0.866	High	50.0	0.000	Moderate Agreement
F	4.00	0.000	Very High	100.0	0.000	Perfect
Overall	**3.63**	**0.592**	**Very High**	**63.0**	**0.040**	**Marked Substantial**

The overall inter-rater agreement for the Mathematics Anxiety Scale has a percent agreement of 63.0% which showed that the six validations agreed and acceptable based from Gwet, 2010.

Attitude toward Chemistry Survey

To determine the student's attitude in chemistry, this study adapted and modified the self-rating survey from Aiken (1970) (see Appendix H) which indicates the method of equal-appearing intervals, wherein each of a series of statements reflecting different degrees of negative and positive attitudes toward chemistry.

There were 20 items which the respondents answered freely. Each students was asked to express his/her feelings regarding his/her attitude toward chemistry by responding to the statements with any of the following responses: (1) Strongly Disagree SD; (2) Disagree D; (3) Agree A; and (4) Strongly Agree SA. The mean of the responses was calculated and interpreted.

Table 5 shows the interpretation of test scores by determining the range of arithmetic mean of the mean score for the Attitude toward Chemistry Survey and its corresponding qualitative description.

Table 5
Interpretation Test Scores in Attitude toward Chemistry Survey

Range	Remark
$2.50 < \text{Mean Score} \leq 4.00$	High
$1.00 \leq \text{Mean Score} \leq 2.50$	Low

The modified Attitude toward Chemistry Survey was subjected to expert validation before it was administered. Table 6 presents the results of the validation scores with their corresponding interpretation.

Table 6
Experts' Validation: Attitude toward Chemistry Survey

Area	Acceptability			Agreement		
	Mean	**SD**	**Remark**	**Percent**	**SE**	**Remark**
A	4.00	0.000	Very High	100.0	0.000	Perfect
B	3.67	0.500	Very High	33.3	0.000	Low
C	3.67	0.500	Very High	33.3	0.000	Low
D	3.22	0.441	High	77.8	0.222	Marked Substantial
E	3.33	0.500	High	33.3	0.000	Low
F	4.00	0.000	Very High	100.0	0.000	Perfect
Overall	**3.65**	**0.480**	**Very High**	**63.0**	**0.080**	**Marked Substantial**

The overall acceptability of the instrument was rated Very High. The overall inter-rater agreement for the Attitude toward Chemistry Scale has a 63.0 percent agreement which is Marked Substantial.

Learning Style Reference

To determine the respondents learning styles (see Appendix I), an instrument which was adapted and already validated from Conner, (2013) was used. The questionnaire addressed three learning styles: audio, kinaesthetic/tactile, and visual. The instrument consisted of 12 categories and each category had three statements from which the respondents chose what described them the most.

The number of statements they chose were added to arrive at the highest numerical value. The category with the highest numerical value was considered their learning style preference.

Mathematical Skill Test in General Chemistry

This instrument was a self-evaluating test to measure the respondents' understanding, capabilities, and knowledge in chemistry particularly those that related with their mathematics skills. Twenty multiple choice items were adapted from Martinez (2005) standardized exam, while the other 10 multiple choice items and four open ended questions were developed by the researcher. A Table of Specification (TOS) was prepared based on the RBEC (see Appedix J). These questions assessed the respondents' performance in chemistry in terms of mathematical concept.

The Mathematical Skill Test in General Chemistry (see Appendix K) consisted 30-item multiple choice questions. Each item consisted one point while the open ended questions consist

of a four-item question. The open ended questions were scored using by the given rubrics (see Appendix L).

Table 7 shows the interpretations for test scores in the multiple choice chemistry test through determining the range of scores with its corresponding qualitative description.

Table 7
Interpretation Test Scores for Multiple Choice Chemistry Test

Range	Remark
$23 \leq \text{Score} \leq 30$	Excellent
$15 \leq \text{Score} \leq 22$	Good
$7 \leq \text{Score} \leq 14$	Fair
$0 \leq \text{Score} \leq 6$	Poor

Similarly, table 8 shows the interpretations for test scores in the open ended chemistry test that shows the range of scores and its corresponding qualitative description.

Table 8
Interpretation Test Scores for Open ended Chemistry Test

Range	Remark
$15 \leq \text{Score} \leq 20$	Excellent
$10 \leq \text{Score} \leq 14$	Good
$5 \leq \text{Score} \leq 9$	Fair
$0 \leq \text{Score} \leq 4$	Poor

The modified Mathematical Skilled Test in General Chemistry was evaluated by three experts. Table 9 presents the results with their corresponding interpretation.

Table 9
Experts' Validation: Mathematical Skill Test in General Chemistry

Area	Acceptability			Agreement		
	Mean	**SD**	**Remark**	**Percent**	**SE**	**Remark**
A	4.00	0.000	Very High	100.0	0.000	Perfect
B	4.00	0.000	Very High	100.0	0.000	Perfect
C	3.67	0.500	Very High	33.3	0.000	Low
D	3.67	0.500	Very High	33.3	0.000	Low
E	3.44	0.527	High	33.3	0.000	Low
F	3.33	0.500	High	33.3	0.000	Low
G	4.00	0.000	Very High	100.0	0.000	Perfect
Overall	**3.73**	**0.447**	**Very High**	**61.9**	**0.074**	**Marked Substantial**

The overall acceptability of the instrument was rated Very High. Overall, the inter-rater agreement rating for the Mathematics Skill Test in General Chemistry was Marked Substantial. This means that the validator's ratings were very much the same.

Phase 3:

Administration of the Instrument

A letter of request to the school director were prepared to use the students from the PNU-ITL to be the respondents in this study and scheduled for the test administration. 60 respondents from Grades 9 Malaya and Mabuti and 48 respondents from Grades 10 Maaasahan and Mapagkakatiwalaan who submitted a reply form from the parent's consent were chosen to participate in the study. Administration of the instruments to the selected respondents to determine the level of mathematics anxiety, learning style, attitude toward chemistry, and achievement in chemistry in the second semester of school year 2013-2014. After the request to conduct the study was granted, the researcher administered the instruments to 108 respondents at the Institute of

Teaching and Learning at Philippine Normal University. Four sets of data were gathered. Table 10 shows the administration schedule.

Table 10
Instrument Administration Schedule

Time	Instrument Administered
8:00-8:30am	Level of Mathematics Anxiety
8:30-9:00am	Attitude toward Chemistry
9:00-9:30am	Break
9:30-11:30am	Achievement Test
11:30-12:00pm	Learning Style

Phase 4

In the analysis and interpretation of data, the computation of the mean score of level of mathematics anxiety, learning style and attitude toward chemistry.

Statistical Treatment

In this study, percentage, arithmetic mean, frequency distribution, standard deviation, ANOVA, regression, p-level, and correlation ratio were utilized to describe the data.

To determine the mathematics anxiety scale and attitude toward chemistry, arithmetic mean was employed. Table 11 was used to interpret the relationships among the variables.

Table 11
Interpretation of p-level

Range	Remark
$p \geq 0.050$	not significant
$0.010 \leq p < 0.050$	Significant
$0.001 \leq p < 0.010$	highly significant
$p < 0.001$	extremely significant

Table 12 shows the interpretations of correlation ratio.

Table 12
Interpretation of Correlation Ratio

Range	Remark
$\eta = 1.000$	perfect correlation
$0.900 < \eta < 1.000$	very high correlation
$0.800 < \eta \leq 0.900$	high correlation
$0.600 < \eta \leq 0.800$	marked substantial correlation
$0.400 < \eta \leq 0.600$	moderate correlation
$0.200 < \eta \leq 0.400$	low correlation
$0.000 < \eta \leq 0.200$	negligible correlation
$\eta = 0.000$	no correlation

The differences in attitude toward chemistry by multiple choice and open ended questions, differences in learning style by multiple choice and open ended questions, and differences in level of mathematics anxiety by multiple choice and open ended questions were computed through regression, correlation ratio, p-level and ANOVA.

To determine study the direction and strength of relationships between students' level of anxiety, attitude toward chemistry, and learning style to the achievement in chemistry, the correlation was determined.

Chapter Four

Presentation, Analysis and Interpretation of Data

The discussions follows the order by which the questions are stated in chapter 1.

Problem 1: What is the profile of the respondents in terms of the following variables?

a. Mathematics anxiety

Table 13 shows the respondents' level of mathematics anxiety.

Table 13
Respondents' Level of Mathematics Anxiety

Level	*f*	%	Mean	SD
High	60	55.6	2.86	0.326
Low	48	44.4	2.21	0.268
All Levels	108	100.0	2.57	0.443

The levels of mathematics anxiety were classified into two: high and low. The result of the mathematics anxiety survey showed that 60 out of 108 respondents or (55.6%) had a high level of mathematics anxiety. The remaining 40 students manifested a low level of mathematics anxiety. Of the two levels the high level anxiety got the higher mean (2.86) while the low level anxiety got the lower mean (2.21). The overall mean was 2.57.

b. Learning style

Table 14
Respondents' Learning Style

Style	*f*	%
Audio	36	33.3
Kinaesthetic/Tactile	28	25.9
Visual	44	40.7
All Levels	108	100.0

Students' learning styles were classified into three: audio, kinaesthetic or tactile, and visual. The result of the learning style reference test showed that 44 or 40.7% of the respondents were visual learners, 36 or 33.3% were audio learners, and 28 or 25.9% were kinaesthetic or tactile learners (Table 14).

c. Attitude toward chemistry

Table 15
Respondents' Attitude toward Chemistry

Level	*f*	%	Mean	SD
High	80	74.1	2.89	0.259
Low	28	25.9	2.40	0.111
All Levels	108	100.0	2.76	0.313

The levels of the students' attitude toward chemistry were classified into two: high and low meaning having a high results shows positive attitude while for low result shows negative attitude toward chemistry. The result for the attitude of students toward chemistry showed that 80 out of 108 or 74.1% of the respondents had a high attitude toward chemistry. The remaining 28 of the (25.9%) respondents manifested a low level of attitude toward chemistry. Of the two levels, the high level of attitude got the higher mean (2.89) while the low level attitude got the lower mean (2.40). The overall mean was 2.76.

Based on the data, the majority of the students got a high level of attitude toward chemistry which can be interpreted as positive attitude toward the subject (Table 15).

d. Achievement in chemistry

d.1 Multiple choice test

Table 16
Results of the Multiple Choice Test in Chemistry

Level	*f*	%	Mean	SD
Excellent	3	2.78	23.0	0.000
Good	46	42.6	17.1	1.796
Fair	58	53.7	11.7	1.617
Poor	1	0.93	5.00	0.000
All Levels	108	100.0	14.2	3.594

The result of the multiple choice test in chemistry showed that 58 or 53.7% of the respondents' performance was fair with a mean of 11.7. Forty-six or 42.6% of the respondents had a good level of performance, 3 or 2.78% had an excellent level of performance, and 1 or 0.93% had a poor level of performance.

Of the four levels, the highest mean (11.7) was registered in the fair level while the lowest mean (5.00) in the poor level. Overall, the mean was 14.2 (Table 16).

d.2 Open ended test

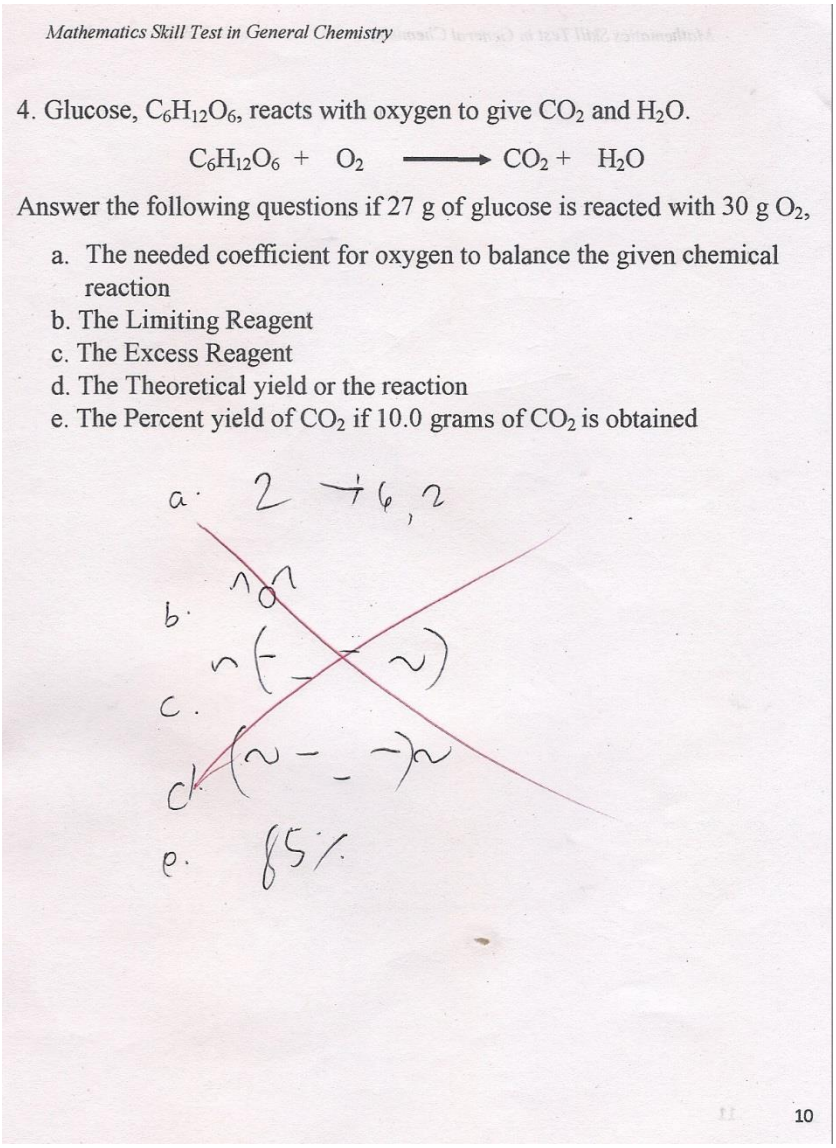
Table 17
Results of the Open ended Test in Chemistry

Level	*f*	%	Mean	SD
Good	2	1.85	11.0	0.000
Fair	22	20.4	8.59	1.593
Poor	84	77.8	1.51	1.990
All Levels	108	100.0	3.13	3.594

As regards the results of the open ended test in chemistry, 84 or 77.8% of the respondents were found to have a poor performance with a mean of 1.51. Twenty-two or 20.4% of the respondents had a fair level of performance and only two or 1.85% had a good level of performance. Of the three levels, the good level had the highest mean (11.0). The poor level, on the other hand the lowest mean (1.51). Overall, the mean was 3.13 (Table 17).

On student's performance in the open ended test, based on how they answered the problem, most of the students got a poor performance.

Figure 4 shows a sample of a poor answer by a respondent in the open ended test in Chemistry.



Mathematics Skill Test in General Chemistry

4. Glucose, $C_6H_{12}O_6$, reacts with oxygen to give CO_2 and H_2O.

$$C_6H_{12}O_6 + O_2 \longrightarrow CO_2 + H_2O$$

Answer the following questions if 27 g of glucose is reacted with 30 g O_2,

a. The needed coefficient for oxygen to balance the given chemical reaction
b. The Limiting Reagent
c. The Excess Reagent
d. The Theoretical yield or the reaction
e. The Percent yield of CO_2 if 10.0 grams of CO_2 is obtained

a. 2 + 6, 2

b.

c.

d.

e. 85%

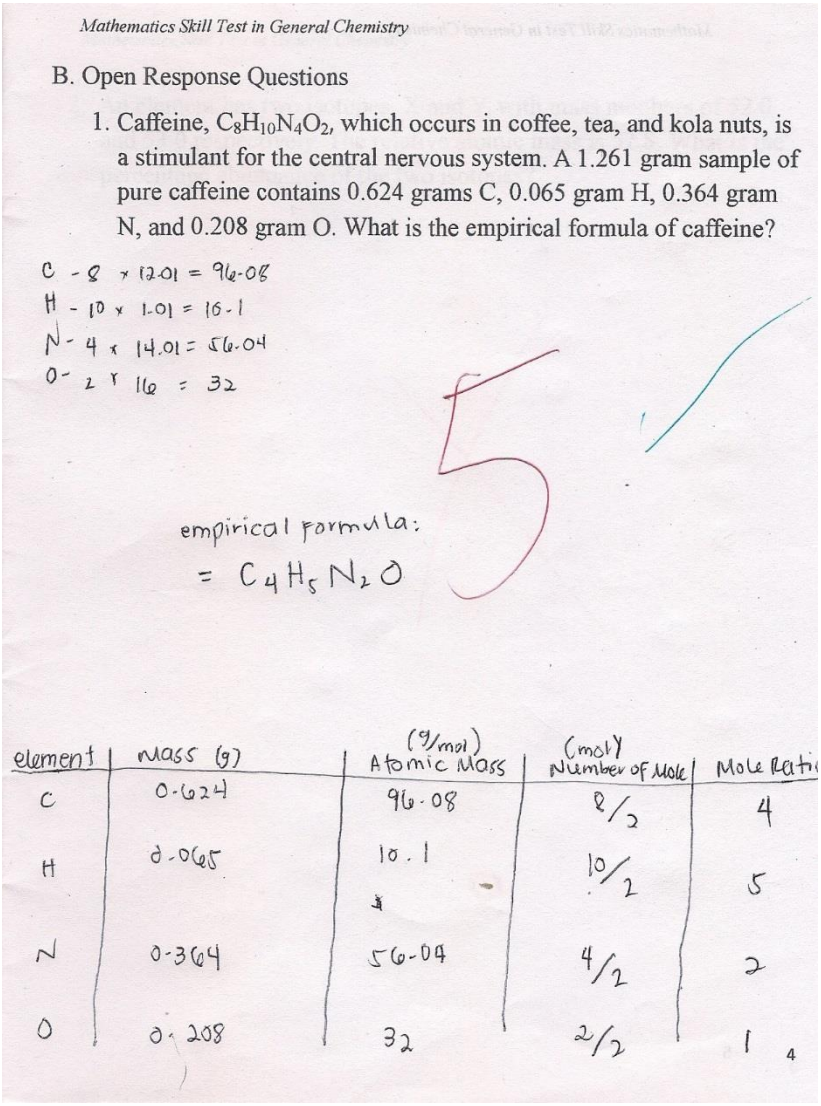
10

Figure 4: Sample of a Student's Poor Answer in the Open ended Test in Chemistry

Only 3 out of 40 respondents from Grade 10 answered the balancing equation correctly while no one in Grade 9 answered the balancing equation correctly.

In the K-12 curriculum the topics under balancing equation and limiting and excess reagents should be given emphasis as they are considered as areas where students are weak at.

Figure 5 shows a sample of a correct answer by a respondent in the open ended test in Chemistry.



Mathematics Skill Test in General Chemistry

B. Open Response Questions

1. Caffeine, $C_8H_{10}N_4O_2$, which occurs in coffee, tea, and kola nuts, is a stimulant for the central nervous system. A 1.261 gram sample of pure caffeine contains 0.624 grams C, 0.065 gram H, 0.364 gram N, and 0.208 gram O. What is the empirical formula of caffeine?

C - 8 x 12.01 = 96.08
H - 10 x 1.01 = 10.1
N - 4 x 14.01 = 56.04
O - 2 x 16 = 32

5

empirical formula:
= $C_4H_5N_2O$

element	mass (g)	(g/mol) Atomic Mass	(mol) Number of Mole	Mole Ratio
C	0.624	96.08	8/2	4
H	0.065	10.1	10/2	5
N	0.364	56.04	4/2	2
O	0.208	32	2/2	1

4

Figure 5: Sample of a Student's Correct Answer in an Open ended Test in Chemistry

In the given problem, a respondent demonstrated an ability to identify the number of atoms and to determine the empirical formula.

Problem 2: Are there significant differences in the Chemistry achievement of respondents when they are categorized according to the following variables:

2.1 mathematics anxiety

2.2 attitude towards chemistry

2.3 learning style

Table 18 shows the differences between the three attributes between mathematics anxiety, attitude toward chemistry and learning style to the achievement of the respondents.

Table 18
Differences in Multiple Choice Results by Three Attributes

Variables	Level	*f*	%	Multiple Choice			Df	F-value	p-level	Remarks
				Mean	SD	Interpretation*				
ANX	H	60	55.6	13.37	3.135	Fair	***1,106***	***8.551***	***0.004***	HS
	L	48	44.4	15.33	3.856	Good				
ATT	H	80	74.1	13.9	3.286	Fair	***1,106***	***2.821***	***0.096***	NS
	L	28	25.9	15.2	4.271	Good				
LS	A	36	33.3	14.4	3.620	Fair	***1,106***	***2.560***	***0.082***	NS
	K/T	28	25.9	15.3	3.356	Good				
	V	44	40.7	13.4	3.591	Fair				

*Based on Mean
ANX= Anxiety
ATT= Attitude
LS= Learning Style
NS= Not Significant
HS= Highly Significant
K= Kinesthetic
T= Tactile
V= Visual
A= Audio
H= High
L= Low

The data shows that the respondents' level of mathematics anxiety has an F-value of 8.551 at p-level of 0.004.affected their performance in the achievement test particularly in the multiple choice. This data reveals that mathematics anxiety affects their performance in chemistry.

As regards attitude, 80 or 74.1% of the respondents had a high level while 28 or 25.9% had a low level of attitude in chemistry. Test of significance revealed that the differences between the

achievement of respondents in chemistry and their level of attitude was not significant. This indicates that their attitude toward chemistry does not influence their achievement in the subject.

As regards learning style, 44 or 40.7% of the respondents were visual learners, 36 or 33.3% were audio learners, while 28 or 25.9% were kinaesthetic/tactile learners. Test of significance revealed that the differences in the achievement of students in chemistry and their learning style was not significant. This indicates that learning style does not influence achievement in chemistry.

The data further revealed that there were differences in the students' level of mathematics, attitude toward chemistry, and learning style in terms of the multiple choice exams. It suggests that the students' level of anxiety has a great impact on their achievement in chemistry.

Table 19 shows the difference in open ended results to the three attributes; mathematics anxiety, attitude toward chemistry and learning style.

Table 19
Differences in Open ended Results by Three Attributes

Variables	Level	*f*	%	Open ended			Df	F-value	p-level	Remarks
				Mean	SD	Interpretation*				
ANX	H	60	55.6	2.87	3.127	Poor	***1,106***	***0.721***	***0.398***	NS
	L	48	44.4	3.46	3.803	Poor				
ATT	H	80	74.1	2.91	3.490	Poor	***1,106***	***1.127***	***0.291***	NS
	L	28	25.9	3.75	3.874	Poor				
LS	A	36	33.3	3.00	3.560	Poor	***1,106***	***0.039***	***0.962***	NS
	K/T	28	25.9	3.14	3.504	Poor				
	V	44	40.7	3.23	3.747	Poor				

*Based on Mean
ANX= Anxiety
ATT= Attitude
LS= Learning Style
NS= Not Significant
A= Audio
K= Kinesthetic
T= Tactile
V= Visual
H= High
L= Low

It can be gleaned from Table 19 that the respondents' achievement in chemistry, as revealed by the result of the open ended test, was not influenced by their anxiety in mathematics, attitude

toward chemistry, and learning style. This shows that the students' anxiety in mathematics does not affect their performance in the achievement test in chemistry since their level of mathematics anxiety does not influence their performance in the achievement test particularly in the open ended part of the test.

As regards attitude, 80 or 74.1% of the respondents had a high level while 28 or 25.9% had a low level of attitude toward chemistry. Test of significance revealed that the differences between the respondents' achievement in chemistry in the open ended part of the test and their attitude toward chemistry were not significant. This indicates the attitude toward chemistry does not influence achievement in chemistry.

As regards learning style, 44 or 40.7% of the respondents were visual learners, 36 or 33.3% were audio learners, while 28 or 25.9% were kinaesthetic/tactile learners. Test of significance revealed that the differences of the respondents' achievement in chemistry and their learning style was not significant. This indicates that the respondents' their learning styles does not influence their achievement in chemistry.

Further, the data revealed that there were differences in the respondents' level of mathematics anxiety, attitude toward chemistry, and learning style in the open ended part of the test. It is shown that none of the variables identified had any impact on the respondents' performance in the achievement test in Chemistry. It can be deduced from this result that regardless of challenges in the level of mathematical anxiety, learning style and attitude toward chemistry conceptual understanding is necessary to answer open ended questions. The learner should be exposed to math skills to promote understanding.

Problem 3: Is there a significant difference between the scores of grades 9 and 10 in terms of multiple choice, open ended, anxiety and attitude?

Table 20 shows the grades 9 and 10 performance in the multiple choice achievement test.

Table 20
Distribution of Multiple choice by class year level

CYL	Excellent		Good		Fair		Poor		Mean[a]	SD[a]	Remarks[b]
	f	%	*f*	%	*f*	%	*f*	%			
9	2	3.3	37	61.7	21	35.0			15.57	3.346	Good
10	1	2.1	9	18.8	37	77.1	1	2.1	12.58	3.10	Fair

a. Based on raw scores
b. Based on mean
Retention factor (topics)

Twenty-one of the grade 9 students got a mark of fair, thirty-seven got a good remark while two of the students got an excellent remark. For the grade 10 students, one of them got a poor remark, thirty-seven of them got a fair remark, nine of them got a good remark while only one of the students got an excellent remark. This only shows that the grade 9 students performance in their achievement test is good while for the grade 10 students shows their performance is only fair. This reason can be that the students of grade 9 still has a fresh knowledge of the topics in chemistry because they are still taking the subject on the other hand, the grade 10 students has a low memory retention or they don't remember the topics because they don't take the subject anymore.

Table 21 shows the p-level correlation ratio between grade 9 and 10 respondents to their multiple choice scores.

Table 21
ANOVA: Multiple Choice by Class Year Level

CYL	N	Mean	SD	Df	F-value	p-level	Remark
9	60	15.57	3.346	1, 106	21.984	0.000	Extremely significant
10	48	12.58	3.210				

p<0.001

Table 21 shows that the p-level associated with the computed F-value of 21.984 in all the grade level is less than the adopted level of significance (p<0.001). These implies that the performance of grade 9 has an extremely significant difference compared to the performance of grade 10 students in the multiple choice test.

Table 22 shows the results of the grade 9 and 10 students performance in their open ended achievement test.

Table 22
Distribution of Open ended by Class year Level

CYL	Good		Fair		Poor		Mean[a]	SD[a]	Remarks[b]
	f	%	*f*	%	*f*	%			
9	2	3.3	22	36.7	36	60.0	5.22	3.503	Poor
10					48	100.	0.52	1.220	Poor

a. Based on raw scores
b. Based on mean

Thirty six of the students from the grade 9 level have poor remark, twenty two students got a fair remark while two students attempted to answer and got a good remark not like the grade 10 students, most of them got a poor remark. From the overall result, both grade levels shows that they have poor remarks on their open ended achievement test.

Table 23 shows that the p-level associated with the computed F-value in all the grade level is less than the adopted level of significance ($p<0.001$).

Table 23
ANOVA: Open ended by Class Year Level

CYL	N	Min	Max	Mean	SD	Df	F-value	p-level	Remark
9	60	0.00	11.00	5.22	3.503	1, 106	78.486	0.000	Extremely significant
10	48	0.00	6.00	0.52	1.220				

$p<0.001$

These implies that there is an extremely significant difference between the grades 9 and 10 students performance in the open ended test. The grade 9 results is much favourable than grade 10, it can be explained substantially by the fresh retention of concepts of grade 9 and the likely forgotten concepts by grade 10 students.

Table 24 shows the distribution of attitude between the students of grades 9 and 10.

Table 24
Distribution of Attitude by Class Year Level

CYL	Very Like		Like		Dislike		Mean[a]	SD[a]	Remarks[b]
	f	%	*f*	%	*f*	%			
9			48	80.0	12	20.0	2.73	0.304	Like
10	2	4.2	40	83.3	6	12.5	2.81	0.304	Like

a. Based on raw scores
b. Based on mean

Twelve of the students from grade 9 find it that they dislike chemistry while forty eight of them find it that they like chemistry while from the grade 10 students, six of them find it that they dislike chemistry, forty of them find it that they like chemistry while only two of them find it that

they very like the subject chemistry. In the overall result, both grade levels like the subject chemistry.

Table 25 shows that the p-level associated with the computed F-value in all the grade level is more than the adopted level of significance ($p \overline{>} 0.050$).

Table 25
ANOVA: Attitude by Class Year Level

CYL	N	Min	Max	Mean	SD	Df	F-value	p-level	Remark
9	60	2.10	3.45	2.73	0.304	1, 106	1.651	0.202	Not significant
10	48	2.20	3.55	2.81	0.324				

$p \overline{>} 0.050$

These implies that there is no significant difference between the grades 9 and 10 students attitude towards chemistry.

Table 26 shows the grades 9 and 10 students distribution of anxiety.

Table 26
Distribution of Anxiety by Class Year Level

CYL	Extreme		High		Low		Negligible		Mean[a]	SD[a]	Remarks[b]
	f	%	*f*	%	*f*	%	*f*	%			
9	1	1.7	32	53.3	26	43.3	1	1.7	2.50	0.442	High
10	3	6.3	30	62.5	15	31.3			2.68	0.430	High

a. Based on raw scores
b. Based on mean

In the grade 9 level, only one students have a negligible anxiety, twenty six have a low anxiety level, thirty two have a high anxiety level while one has an extreme anxiety level in taking chemistry.

Table 27 shows that the p-level associated with the computed F-value in all the grade level is more than the adopted level of significance ($0.010 \overline{<} p < 0.050$).

Table 27
ANOVA: Anxiety by Class Year Level

CYL	N	Min	Max	Mean	SD	Df	F-value	p-level	Remark
9	60	1.50	3.60	2.50	0.442	1, 106	4.704	0.032	Significant
10	48	1.80	3.95	2.68	0.430				

$0.010 \overline{<} p < 0.050$

These implies that there is a significant difference between the grades 9 and 10 students anxiety in mathematics. The result showed that grade 9 students has higher response in multiple choice and open ended questions. Furthermore, they are currently expose to the chemistry subject, gives Grade 9 students more confidence in dealing with the Mathematics Skill in General Chemistry Test.

Problem 4: Which among the independent variables serves as the best predictor of chemistry achievement?

Table 28 shows the following pairs were subjected to a test of correlation: anxiety and multiple choice, anxiety and open ended, attitude and multiple choice; attitude and open ended, learning style and multiple choice; learning style and open ended; and multiple choice and open ended.

Table 28
Correlation between Chemistry Achievement and Relevant Variables

Pair	Ŋ	Df	F-value	p-levels	Remark
ANX vs MC	0.890	1, 106	8.551	0.004*	HC; HS
ANX vs OE	0.083	1, 106	0.721	0.398	
ATT vs MC	0.163	1, 106	2.822	0.096	
ATT vs OE	0.103	1, 106	1.128	0.291	
LS vs MC	0.216	2, 105	2.506	0.082	
LS vs OE	0.027	2, 105	0.039	0.962	
MC vs OE	0.246	3, 104	2.229	0.089	

*HS= Highly significant
HC= Highly Correlated
ANX= Anxiety
ATT= Attitude
LS= Learning Style
MC= Multiple Choice
OE= Open Ended

The anxiety and multiple choice showed a highly positive correlation. The correlation may be justified by the study of Sherman and Wither (2003) that the level of mathematics anxiety among students is strongly related to their achievement. It is supported by Elenchothy's study (2007) which showed an inverse relationship between mathematics anxiety and students' achievement.

Table 29 shows the forecasting efficiency of three attributes.

Table 29
Forecasting Efficiency of Three Attributes

Pair	η^2, %	1- η^2, %	E, %
Anxiety vs Multiple Choice	79.2	20.8	54.4
Anxiety vs Open Ended	0.7	99.3	0.3
Attitude vs Multiple Choice	2.7	97.3	1.3
Attitude vs Open ended	1.1	98.9	0.5
Learning Style vs Multiple Choice	4.6	95.4	2.4
Learning Style vs Open ended	0.1	99.9	0.0
Multiple Choice vs Open ended	6.0	94.0	3.1

The 79.2% of the variation in the multiple choice scores could be explained by anxiety while the 20.8% of the variation in the multiple choice could not be accounted by it. As the results suggest, anxiety and multiple choice are a good predictors of the students' performance in the achievement test while the other variables—attitude toward chemistry and learning style—are not.

Table 30 shows the regression ANOVA in multiple choice by three attributes.

Table 30
Regression ANOVA: Multiple Choice by Three Attributes

Sources of Variation	Sums of Squares	Df	Mean Squares	F-value	p-level	Remarks
Regression	239.798	4	59.950	5.407	0.001	ES
Residual	1141.943	103	11.087			
Total	1381.741	107	71.037			

ES= Extremely Significant

Correlation and regression ANOVA were to examine the relationship between the achievement test of the respondents in the multiple choice and other potential predictors. Table 30 summarizes the descriptive statistics and analysis results. The results of regression ANOVA with four degrees of freedom showed the F-value of 5.407 and p-level of 0.001 with an extreme level of significance. With the p-level of 0.001, one of the predictors emerged to be an extremely significant factor that could affect the students' performance in chemistry.

Table 31 shows the regression summary in multiple choice by three attributes.

Table 31
Regression Summary: Multiple Choice by Three Attributes

Predictors	Beta	Std. Error Of Beta	R	Std. Error Of Beta	t(1.03)	p-level	Remarks
Intercept			21.51	2.908	7.396	0.000	
Anxiety	-0.340	0.121	-2.76	0.985	-2.802	0.006	HS
Attitude	-0.008	0.121	-0.096	1.386	-0.069	0.945	NS
Visual	-0.077	0.103	-0.560	0.744	-0.752	0.454	NS
Kinesthetic/Tactile	0.146	0.103	1.168	0.819	1.427	0.157	NS
HS= Highly Significant NS= Not Significant N=108	R= 41.659062			R^2= 17.354774		SE= 3.3297	

The four predictors—anxiety, attitude, visual and kinaesthetic/tactile had p-levels of 0.006, 0.945, 0.454, and 0.157 respectively. Noticeably, only the anxiety showed a high significance while the others showed no significance on the respondents' performance in chemistry. Results also showed an R value of 41.659 and an R^2 value of 17.355.

The regression model with all four predictors produced R^2= 17.354774, $p < 0.001$. As presented in Table 31, the analytic and quantitative scale of anxiety had a highly significant positive regression weights, indicating that the predictor greatly affects the respondents' performance in chemistry while the other predictors do affect at all the respondents' performance in chemistry.

Table 32 shows the regression ANOVA in open ended by three attributes.

Table 32
Regression ANOVA: Open ended by Three Attributes

Sources of Variation	Sums of Squares	Df	Mean Squares	F-value	p-level	Remarks
Regression	20.795	4	5.199	0.393	0.813	NS
Residual	1361.390	103	13.217			
Total	1382.185	107	18.416			

NS= Not Significant

The results of regression ANOVA with four degrees of freedom showed that the F-value of 0.393 and p-level of 0.813 had no significance on the respondents' performance in chemistry.

Correlation and regression ANOVA were to examine the relationship between the achievement test of the respondents in the open ended questions and other potential predictors. Table 24 summarizes the descriptive statistics and analysis results. As exhibited, there are no predictors that showed significance or could affect the respondents' performance in chemistry.

Among the four variables, mathematics anxiety was found to be the best predictor in the students achievement.

Chapter Five

Summary, Conclusions and Recommendations

This chapter presents the summary of findings, conclusions, and recommendation relative to the problems of the study.

Summary of Findings

Based on the data gathered and analyzed, the following findings were come up with:

1. The majority of the respondents showed a high level of mathematics anxiety and attitude toward Chemistry. As regards learning style, most of the respondents were visual learners, that is, they got more information from visual images. The respondents' mathematical anxiety was related to their performance in Chemistry.

2. The respondents performed fairly in the multiple choice questions and poorly in the open ended questions. Despite low performance in the achievement test, the results showed that the respondents' anxiety in mathematics was significantly related with their performance in Chemistry, unlike their attitude toward the subject and learning style.

3. In the different grade level of students, the respondents showed different performance in their multiple choice and open ended tests. When it comes to their attitude towards chemistry, they show no significance but in terms of their mathematics anxiety, there is a significant difference between the grade 9 and 10 students.

4. Among the four variables identified in the study, the anxiety in mathematics was found out to be the best predictor of students' performance in the Chemistry achievement test.

Conclusions

In light of the findings, the following conclusions on mathematics anxiety, learning style, achievement and attitude of students toward chemistry were made:

1. Students today are very anxious to learn topics involving mathematics. The respondents are visual learners therefore the students are achieved by using visual stimuli rather than auditory and kinaesthetic. The students have a positive attitude toward chemistry thus their performance is not affected towards the subject and the students still has a mastery in the topics of chemistry.

2. It shows that anxiety in mathematics has a marked effect in their learning chemistry than learning style and attitude in chemistry.

3. From the grades 9 and 10 students, Grade 9 students still has a retention of the topics in chemistry because they are currently taking the subject while the Grade 10 students are currently taking different branch of science therefore some of the topics are forgotten.

4. Students' attitude toward chemistry and learning style doesn't affect their achievement in dealing with chemistry concepts involving math skills.

Recommendations

Based on the conclusions made in this study, the following are hereby recommended:

1. For future researcher may use the instrument, to further validate the results of the study.
2. Include some of the indicators of attitude toward chemistry and anxiety in mathematics.
3. Infer interview sessions to the students to integrate qualitative elements.
4. In a similar study, the number of respondents should be increased to make the data more decisive.
5. To increase the generalizablity of the result, other or more educational institutions should be involved.
6. To suit more levels of respondents, the instruments used in this study should be further refined.
7. More topics in chemistry which involve mathematical operations should be included to fulfill the requirements of the K to 12 curriculum.
8. Students should be motivated to appreciate and love rather than fear or regard negatively the subjects which involve mathematics.

References:

Aiken, L.R. (1970). Attitudes towards mathematics. Review of Educational Research, 40(4), 551-596.

Allport, G.W (1935). Attitudes in C. Murchison (Ed.), handbook of social psychology. Worcester, Mass: Clark University Press

Allport, G.W (1954). The historical background of modern social psychology. In G. Lindzey (Ed.), Handbook of social psychology (Vol. 1, pp. 3-56) Cambridge, MA: Addison-Wesley

Arcavi, A.(1994). 'Symbol Sense: Informal Sense Making in Formal Mathematics', For the learning of Mathematics, vol 14(3), 24-35.

Ballado, R. S. (2014). Mathematics Anxiety and Academic Achievement of Junior pre-service Teacher Education Students . *WEI International Academic Conference Proceedings*.

Balog lu, M. & Koçak, R. (2006). A multivariate investigation of the differences in mathematics anxiety. Personality & Individual Differences, 40(7), 1325–1335.

Bandura, A. (1989). Human agency in social cognitive theory. American Psychologist, 44, 1175–1184.

Bem, D.J. (1970). Beliefs, attitudes, and human affairs. Belmont, CA: Brooks/Cole

Bennett, J., Lubben, F. and Hogarth, S. (2003) A systematic review of the effects of context-based and Science Technology-Society (STS) approaches to the teaching of secondary science. Research Evidence in Education Library [REEL].

Burris, C. C., Heubert, J. P., & Levin, H. M. (2004). Math acceleration for all. Improving Achievement in Math and Science, 61(5), 68-71.

Campbell, D.T. (1950). The indirect assessment of social attitudes. Psychological Bulletin, 47, 15-38.

Carbonel, L. G. (2013). Learning styles, Study Habits, And Academic Performance Of College Students At Kalinga-Apayao State College, Philippines. *International Journal of Advanced Research in Management and Social Sciences , 2*(8), 245-258.

Coleman, B. (2009). From home to school: The relationship between parental involvement, student motivaion, and academic achievement. Honors Thesis, The University of Southern Mississippi, Department of Curriculum, Instruction, and Special Education.

Collinson, E. (2000). A survey of elementary students' learning style preferences and academic success. Contemporary Education, 71(4), 42-48. Retrieved from EBSCO host database.

Cuaresma, J. (2008). Learning style preferences and academic performance of PHEM majors at the University of the Cordilleras. Unpublished Undergraduate Thesis. University of the Cordilleras, Baguio City.

Di Martino, P. & Zan, R. (2002). 'An attempt to describe a 'negative' attitude towards mathematics', in Di Martino, P. (Ed.) Proc. MAVI-XI European Workshop, 22-29.

Eagly, A. H., & Chaiken, S. (1993). The psychology of attitudes. Fort Worth, TX: Harcourt Brace Jovanovich.

Eggleton, P. (n.d.). Motivation: A key to effective teaching. The Mathematics, 3(2).

Elenchothy, D., 2007. Kebimbangan matematik dan hubungannya dengan pencapaian pelajar tingkatan empat di daerah Klang. [Mathematics anxiety and their relationship with achievement among Form Four students]. Master Thesis, Universiti Putra Malaysia.

Ellis, A. K. (2010). Teaching and learning elementary social studies (Vol. 9). Boston, Massachusetts: Pearson Education Inc.

Evans, J. & Hannula, M. & Philippou, G. & Zan, R. (2004). 'Affect and Mathematical Thinking –Introduction to Thematic Working Group 2' in Mariotti, M.A. (Ed.) Proc. CERME 3, Bellaria (Italy), 28 February-3 March 2003. Edizioni Plus, Pisa.

Felder, R.M. (1993). "Reaching the Second Tier: Learning and Teaching Styles in College Science Education," J. Coll. Sci. Teaching, 23(5), 286--290 (1993)

Felder, R.M. (1996). "Matters of Styles". ASEE Prism, 6(4), 18-23.

Freiberg, M. (2005). Math – that four-letter word! Academic Exchange Quarterly, 9(3), 7-11.

Furner, J., & Berman, B. (2003). Math anxiety: Overcoming a major obstacle to the improvement of student math performance. Childhood Education, 79(3), 170–174.

Fuson, W.M. (1942). Attitudes: A note on the concept and its research consequences. American Sociological Review, 7, 856-857

Gwet, K. L. (2010). Handbook of Inter-Rater Reliability (2nd Edition), Advanced Analytics, LLC. Maryland, USA.

Gwet, K. L. (2011a). The Practical Guide to Statistics, Advanced Analytics, LLC. Maryland, USA.

Honey, P. & Mumford, A. (1982) Manual of Learning Styles London: P Honey

Hopko, D.R. (2003). Confirmatory factor analysis of the Math Anxiety Rating Scale - Revised. Educational and Psychological Measurement, 63, 336–351.

Horney, K. (1937). The Neurotic Personality of our Time. New York: Norton

Horney, K. (1950). Neurosis and human growth: The struggle toward self-realization. New York: Norton.

Hunt, T., Clark-Carter, D., Sheffield D. (2011) The Development and Part Validation of a U.K. Scale for Mathematics Anxiety

Ikitde, G. A., & Edet, U. B. (2013). Influence Of Learning Styles And Teaching Strategies On Students' Achievement In Biology. *Voice Of Research*, *1*(4), 1-13.

Jain, S., & Dowson, M. (2009). Mathematics anxiety as a function of multidimensional self-regulation and self-efficacy. Contemporary Educational Psychology, 34(3), 240–249.

Jennison, M., & Beswick, K. (2009). Students' perceptions of the impacts of parents, teachers, and teaching upon their anxiety about the learning of fractions. In R. Hunter, B. Bicknell & T. Burgess (Eds.), Crossing divides (Proceedings of the 32nd Annual Conference of the Mathematics Education Research Group of Australasia, Vol. 1, pp. 265-272). Palmerston North: MERGA

Jung, C.G. (1921/1971). Psychological types. In collected works (vol. 6)

Kelly, G. A. (1955). The Psychology of Personal Constructs (Vols 1 and 2). New York: Norton.

Kieran, K. (1990). 'Cognitive Processes involved in Learning School Algebra', in Nesher P. & Kilpatrik, J. (Ed.): Mathematics and Cognition, ICMI Study Series, Cambridge University Press, 96-112.

Kieran, K.: 1992, 'The Learning and Theaching of School Algebra', in Grouws D.A., (Ed.) Handbook of Research of Mathematics Teaching and Learning, Macmillan, NY, 390-419.

Kolb, A. Y., & Kolb, D. A. (2005). Learning Styles and Learning Spaces: Enhancing Experiential Learning in Higher Education. Academy of Management Learning & Education, 4(2), 193-212.
Kolb, D.A. (1984) 'Experiential Learning experience as a source of learning and development', New Jersey: Prentice Hall

Krech, D., & Crutchfield, R.S. (1948). Theory and problems of social psychology. New York: MacGraw-Hill.

Lee, J. (2009). Universals and specifics of math self-concept, math self-efficacy, and math anxiety across 41 PISA 2003 participating countries. Learning and Individual Differences, 19(3), 355-365.

Ma, X. (2003). Effect of early acceleration of students in mathematics on attitude toward mathematics and mathematics anxiety. Teachers College Record, 105(3), 438-464.

Malinsky, M., Ross, A., Pannells, T., & McJunkin, M. (2006). Math anxiety in pre-service elementary school teachers. Education, 127(2), 274–279.

Marchini, C.:2002, 'Instruments to detect variabiles in primary school', Proc. CERME 2, Part I, 47-57

Marchini, C. & Kaslova, M. (2003). "Substitutions and variables in primary school, a comparative study on preconceptions', Proc. Semt 01, 113-117

Martinez, F. (2005). Multiple Intelligences of College Chemistry Students, Their Relationship to Chemistry Achievement and Program of Study.

Mc Leod, D.B. (1992). 'Research on Affect in Mathematics Education: a Reconceptualization', in Grouws, D.A. (Ed.) Handbook of Research of Mathematics Teaching and Learning, Macmillan, NY, 575-596.

Middleton, J. A., & Jansen, A. (2011). Motivation matters, and interest counts: Fostering engagement in mathematics. Reston, VA: National Council of Teachers of Mathematics.

Miller, H., & Bichsel, J. (2004). Anxiety, working memory, gender, and math performance. Personality and Individual Differences, 37(3), 591-606.

Miller, S. F. (1981). A study of the relationship of mathematics anxiety to grade level. Gender intelligence, and mathematics achievement. Proquest Dissertations and Theses, 52(04) DAI (Publication No. AAT 9127651)

Pashler, H., McDaniel, M., Rohrer, D., & Bjork, R. (2008). Learning styles concepts and evidence. Psychological Science in the Public Interest, On the Effect of Learning Style on Scholastic Achievement 59(3), 105-119.

Restrepo, G., & Villaveces, J. L. (2012). Mathematical Thinking in Chemistry. HYLE--International Journal for Philosophy of Chemistry, 18(1), 3-22.

Richardson, F. C., & Suinn, R. M. (1972). The Mathematics Anxiety Rating Scale: Psychometric data. Journal of Counseling Psychology, 19, 551–554.

Rinaldi, M.G., Marchini, C., Moscucci, M., Piccione, M. & Simoni, S. (2006). Mathematical Discomfort and school drop-out in Italy. Fourth Congress of the European Society for Research in Mathematics Education.

Ryan, R. M., & Stiller, J. (1991). The social contexts of internalization: Parent and teacher influences on autonomy, motivation and learning. In P. R. Pintrich & M. L. Maehr (Eds.), Advances in motivation and achievement (Vol. 7, pp. 115–149). Greenwich, CT: JAI Press.

Scarpello, Gary, (2005) The Effect of Mathematics Anxiety on the Course and Career Choice of High School Vocational-Technical Education Students

Sherman, Brian F., and David P. Wither. "Mathematics anxiety and mathematics achievement." *Mathematics Education Research Journal* 15.2 (2003): 138-150.

Silver, A.& Kenney, P.A.: (1997). 'Results from the sixth mathematics assessment of the National Assessment of Educational Progress', Reston, VA : National Council of Teachers of Mathematics.

Singh, K., Granville, M., & Dika, S. (2002). Mathematics and science achievement: Effects of motivation, interest, and academic engagement. The Journal of Educational Research, 95(6), 323-332.

Smith, S. S. (1997). Early Childhood Mathematics. Boston: Allyn & Bacon.

Snyder, R.F. (2000). The Relationship Between Learning Styles/Multiple Intelligences and Academic Achievement of High School Students. High School Journal, 83(2), 11-21.

Sorge, C., Newsom, H.E, and Hagerty, J.J. (2000) Fun is not enough: Attitudes of Hispanic middle school students towards science and scientists, Hispanic Journal of Behavioral Sciences, 22, 332-345

Sullivan, H.S. (1953b). The Interpersonal Theory of Psychiatry. New York: Norton

Tinio, M. F. (2009). Academic engagement scale for grade school students. The Assessment Handbook, 2, 64-75.

Vygotsky, L. S. (1962). *Thought and Language.* Cambridge MA: MIT Press.

Whyte, J. M. (2009). Maths anxiety: The what, where, and how. Unpublished

Masterate research report. Palmerston North: Massey University

Zywno, M. S. (2002). Effect of Individual Learning Styles on Students Outcome in Technology-enable Education-Global Journal of Engineering Education 6(1) pp 240-249.

Web References

Achievement test. (n.d.). Defined. Retrieved May 27, 2013, from http://www.alleydog.com/glossary/definition.php?term=Achievement%20test

Acknowledging Math Anxiety. (n.d.).Acknowledging Math Anxiety. Retrieved June 1, 2013, from http://teachers.sduhsd.net/jastorino/Thesis.htm

anxiety. (n.d.). The Free Dictionary. Retrieved June 1, 2013, from http://www.thefreedictionary.com/anxiety

Bai, H., Wang, L., Pan, W., Frey, M. (2009) Measuring mathematics anxiety: psychometric analysis of a bidimensional affective scale The Free Library Retrieved September 1, 2013, from http://www.thefreelibrary.com/Measuring mathematics anxiety: psychometric analysis of a...-a0211235540

Bhatti, R., & Bart, W. M. (2013). On the effect of learning style on scholastic achievement. Current Issues in Education, 16(2). Retrieved from http://cie.asu.edu/ojs/index.php/cieatasu/article/view/1121

Bluman, A. (n.d.). The Nature and Causes of Math Anxiety Help.Education.com. Retrieved May 1, 2014, from http://www.education.com/study-help/article/pre-algebra-help-part-i-nature-causes/

Conner, M. (n.d.). What is Your Learning Style?. *Marcia Conner What is Your Learning Style Comments*. Retrieved September 18, 2013, from http://marciaconner.com/assess/learningst

Correlation Ratio - Statistics Solutions. (n.d.). *Statistics Solutions*. Retrieved August 17, 2014, from https://www.statisticssolutions.com/directory-of-statistical-analyses-correlation-ratio/

Curtain-Phillips,, M. (n.d.). The Causes and Prevention of Math Anxiety. The Causes and Prevention of Math Anxiety. Retrieved June 17, 2013, from http://www.mathgoodies.com/articles/math_anxiety.html

Escalona, L. P. (2005). Attitude Towards Chemistry And Chemistry Performance: A Correlational Study . *John b. Lacson colleges foundation - bacolod, inc.*. Retrieved October 17, 2014, from http://www.jblcf-bacolod.edu.ph/escalona.php

Felder design model. (n.d.). - EduTech Wiki. Retrieved June 17, 2013, from http://edutechwiki.unige.ch/en/Felder_design_model

Forbes, K. J. (n.d.). Building math self-efficacy : a comparison of interventions designed to increase math/statistics confidence in undergraduate students. Full text of "Building math self-efficacy : a comparison of interventions designed to increase math/statistics confidence in undergraduate students". Retrieved July 19, 2013, from http://archive.org/stream/buildingmathself00forb_djvu.txt

Heick, T. (2013, August 10). The Definition Of Intrinsic Motivation.TeachThought. Retrieved December 10, 2013, from http://www.teachthought.com/learning/the-definition-of-intrinsic-motivation/

Hood, K. (n.d.). Exploring Learning Styles and Instruction. Karen Hood's Paper. Retrieved May 18, 2013, from http://jwilson.coe.uga.edu/emt705/EMT705.Hood.html

Math Anxiety. StudyMode.com. Retrieved June 3, 2013, from http://www.studymode.com/essays /Math-Anxiety-43888717.html

Mobbs, D. R. (n.d.). Honey and Mumford. University of Leicester. Retrieved January 12, 2014, from http://www2.le.ac.uk/departments/gradschool/training/eresources/teaching/theories/honey-mumford

Olufemi. (2014, April 16). Kolb Learning Styles. College Essay. Retrieved April 28, 2014, from http://www.cyberessays.com/Term-Paper-on-Kolb-Learning-Styles/86901/

Professor's talk: Math: the language of science. (n.d.). The Daily. Retrieved April 8, 2013, from http://dailyuw.com/archive/2008/10/15/imported/professors-talk-math-language-science#.UWJB_cqH-ME

Regression Terminology Help - Transtutors. (n.d.). Regression Terminology Help - Transtutors. Retrieved December 29, 2013, from http://www.transtutors.com/homework-help/statistics/bivariate-regression/terminology/

Research Gate. (n.d.). Research Gate. Retrieved May 11, 2013, from http://www.researchgate.net/post/Is_there_a_math_anxiety_scale_that_has_been_validated_for_adolescents

Science Anxiety. (n.d.). Academic Anxiety Resource Center. Retrieved June 17, 2013, from http://academicanxiety.org/?page_id=102

Shan, K. Y., Yong, L. S., Shan, L. Z., Toh, V., & Weng, U. H. (n.d.). Mathematics Anxiety. Scribd. Retrieved August 13, 2013, from http://www.scribd.com/doc/76230575/Mathematics-Anxiety

Shodor (2008) Mathematics in Chemistry. (n.d.).Mathematics in Chemistry. Retrieved April 8, 2013, from http://www.shodor.org/unchem/math/

Strawderman, Ph.D, V. S. (n.d.). Math Anxiety Model.Math Anxiety Model. Retrieved May 30, 2013, from http://www.mathgoodies.com/articles/math_anxiety_model.html

Theories of Cognitive Development: Lev Vygotsky.. (n.d.). Psycho Hawks. Retrieved July 25, 2013, from http://psychohawks.wordpress.com/2010/11/03/theories-of-cognitive-development-lev-vygotsky/

Thompson, S. (2011, July 18). Memletics Accelerated Learning Styles Inventory.eHow. Retrieved May 21, 2013, from http://www.ehow.com/info_8751613_memletics-accelerated-learning-styles-inventory.html

Understand Bandura's Social Learning Theory. (n.d.) About.com Psychology. Retrieved April 30, 2014, from http://psychology.about.com/od/developmentalpsychology/a/sociallearning.htm

Vani29981. (n.d.). Uses of Math.StudyMode. Retrieved October 23, 2013, from http://www.studymode.com/essays/Uses-Of-Math-742324.html

Yunus, S. S. (2011, November 17). Math Anxiety_4. Kurikulum Matematik. Retrieved April 3, 2013, from http://kurikulummatematik.wordpress.com/2011/11/17/math-anxiety_4/

APPENDICES

Appendix A

LETTER TO THE PRINCIPAL

10 December 2013

PROF. MARIA LOURDES SANTIAGO-AGUSTIN
Director, PNU-Institute of Teaching and Learning
Taft Avenue, Manila Philippines

Dear Madam,

It is my pleasure to inform you that I am currently on the data gathering stage of my graduate thesis entitled "**Mathematics Anxiety, Learning Style, Achievement and Attitude of Students Towards Chemistry"** at the College of Graduate Studies Philippine Normal University, Manila.

This study seeks to determine and correlate the student's mathematics anxiety, learning style and attitude towards chemistry and determine their impact on the student's achievement in the said subject.

In line with this, I am asking your permission to allow me to conduct the said research to the third and fourth year students who already have completed the subject course of Chemistry on December 13, 2013 from 8:00am- 12:00 pm.

Rest assured that I will be coordinating with the concerned teachers who will be affected in administering the research instruments.

Thank you for your participation and response on the conduct of this research study. Your participation in understanding the behavior of the 21st century learners on their anxiety, learning, style, attitude and achievement is an essential part to the success of this undertaking. Your favorable response on this matter will be highly appreciated.

Thank you.

Respectfully yours,

Angela Francisca B. Veloso
Researcher

Noted:

Dr. Virgil Duad
Faculty, FSTeM
Philippine Normal University

Vic Marie I. Camacho
Faculty, FSTeM
Philippine Normal University

Appendix B

PARENT'S CONSENT FORM

10 December 2013

Dear Parents,

I am Angela Francisca B. Veloso, a graduate student from the Philippine Normal University under the program Master of Arts Major in Chemistry. Having completed the academic requirements of the said course, I am currently writing my thesis paper as the terminal prerequisite prior to my commencement this second semester of the School Year 2013-2014.

My graduate thesis looks at Mathematics Anxiety, Learning Style, Achievement and Attitude of Students towards Chemistry which determines and correlates the relationship of student's level of anxiety, learning style and attitude towards chemistry to their achievement.

I am happy to inform you that your son/daughter was chosen to be one the respondents of Mathematics Anxiety, Learning Style, Achievement and Attitude of Students towards Chemistry being conducted for completion for my Master's Degree. This study will be done within the school campus grounds. His/Her classes will not be affected as I have obtained the necessary permits to conduct this study from the principal and other persons of authority.

In this regard, I am seeking your permission for your child to participate in this activity. Rest assured that his/her response would be confidential and the information would not be used for any other purposes except for the above mentioned study.

Hoping for your cooperation and support.

Thank you very much

Respectfully,

Angela Francisca B. Veloso
Researcher

Recommending Approval:

Prof. Maria Lourdes S. Agustin
Director, Institute of Teaching and Learning
Philippine Normal University

PERMIT TO PARTICIPATE

____ I will allow my son/daughter/ward

____ I will not allow my son/daughter/ward

to participate in this study entitled Mathematics Anxiety, Learning Style, Achievement and Attitude of Students towards Chemistry

Signature over Printed name of Parent/Guardian

Signature over Printed name of Student

Appendix C

LETTER TO VALIDATORS

Dear Sir/Madam,

Greetings!

I am Angela Francisca B. Veloso, a graduate student from the Philippine Normal University under the program Master of Arts Major in Chemistry. Having completed the academic requirements of the said course, I am currently writing my thesis paper as the terminal prerequisite prior to my commencement this first semester of the School Year 2013-2014.

My graduate thesis looks at **Mathematics Anxiety, Learning Style and Attitude toward Chemistry as Predictors of Students' Performance in Chemistry** which determines and correlates the relationship of student's level of anxiety, learning style and attitude towards chemistry to their achievement.

In line with the completion of the investigation, I will be utilizing different instruments to address its objectives and come up with the reliable data and results. It is in this light that I would like to ask for your assistance in validating my instrument and provide comments and suggestions for the improvement of the study. I believe that your expertise and inclination on the field is the most reliable source of ideas and supplements deemed necessary for the accuracy and sustainability of the research instruments to be used.

Attached are the following: the instruments used for the conduct of the study;

1. Mathematical anxiety level test
2. Learning style
3. Attitude towards chemistry and;
4. Mathematics Skill Test in General Chemistry

Thank you for taking time to complete the items on the validation checklist.

Very truly yours,

ANGELA FRANCISCA B. VELOSO
Researcher

Noted:

Dr. Virgil Duad
FSTeM
Philippine Normal University

Vic Marie I. Camacho
FSTeM
Philippine Normal University

Appendix D

RUBRICS FOR CONTENT AND FACE VALIDITY OF THE ATTITUDE TOWARD CHEMISTRY

Evaluator _____
Educational Attainment _____
Position _____
Institution _____

DIRECTIONS: Below is a list of different criteria for evaluating the **ATTITUDE TOWARD CHEMISTRY**. Please rate each item by ticking (/) the corresponding equivalent on the four poin t scale as described below:

Description	Scale
All indicators are observed	4
Two of the indicators are observed	3
Only one of the indicators is observed	2
No Indicators observed	1

EVALUATION CRITERIA	RATE			
A. CONTENT	4	3	2	1
a.				
b. Items are relevant to the topic/subject being measured.				
c.				
B. LEVEL OF DIFFICULTY				
a. There are no hints in each question.				
b.				
c. The instrument indicates the level of understanding that i s parallel to the students' skill level.				
C. STRUCTURE				
a.				
b. The instrument has a clear layout such as margins, spaces in between questions and choices.				
c.				
D. INSTRUCTIONS				
a. Instructions are well constructed.				
b.				
c. Instructions are appropriate for the type of test.				

E. LANGUAGE				
a.				
b. The instrument contains correct capitalization of words.				
c.				
F. ETHICAL/SOCIAL				
a. The instrument contains relevant or associated texts that are free from offensive language.				
b.				
c. The instrument has equal reference to both male and fem ale gender in the test questions.				

COMMENTS AND SUGGESTIONS:

_____
_____
_____
_____
_____

_____

Signature over Printed Name of the Evaluator

Appendix E

RUBRICS FOR CONTENT AND FACE VALIDITY OF THE MATHEMATICAL SKILL TEST IN GENERAL CHEMISTRY

Evaluator _____
Educational Attainment _____
Position _____
Institution _____

DIRECTIONS: Below is a list of different criteria for evaluating the **ACHIEVEMENT TEST IN GENERAL CHEMISTRY**. Please rate each item by ticking (/) the corresponding equivalent on the four point scale as described below:

Description	Scale
All indicators are observed	4
Two of the indicators are observed	3
Only one of the indicators is observed	2
No Indicators observed	1

EVALUATION CRITERIA	RATE			
A. CONTENT	4	3	2	1
a. Topics being measured are in the scope of the curriculum.				
b.				
c. There is only one correct answer per question.				
B. ITEMS				
a.				
b. Number of items are correctly assigned in the Table of Specifications.				
c.				
C. LEVEL OF DIFFICULTY				
d. There are no hints in each question.				
e.				
f. The instrument indicates the level of performance which increases with equal increment that is parallel to the				

students' skill level.				
D. STRUCTURE				
d.				
e. The instrument has a clear layout such as margins, spaces in b etween questions and choices.				
f.				
E. INSTRUCTIONS				
d. Instructions are well constructed.				
e.				
f. Instructions are appropriate for the type of test.				
F. LANGUAGE				
d.				
e. The instrument contains correct capitalization of words.				
f.				
G. ETHICAL/SOCIAL				
d.				
e. The instrument is free from cultural discrimination.				
f.				

COMMENTS AND SUGGESTIONS:

_____
_____
_____
_____
_____

_____

Signature over Printed Name of the Evaluator

Appendix F

RUBRICS FOR CONTENT AND FACE VALIDITY OF THE LEVEL OF MATHEMATICS ANXIETY SURVEY

Evaluator _____
Educational Attainment _____
Position _____
Institution _____

DIRECTIONS: Below is a list of different criteria for evaluating the **LEVEL OF MATHEMA TICS ANXIETY SURVEY**. Please rate each item by ticking (/) the corresponding equivalent o n the four point scale as described below:

Description	Scale
All indicators are observed	4
Two of the indicators are observed	3
Only one of the indicators is observed	2
No Indicators observed	1

EVALUATION CRITERIA	RATE			
G. CONTENT	4	3	2	1
d.				
e. Items are relevant to the topic/subject being measured.				
f.				
H. LEVEL OF DIFFICULTY				
g. There are no hints in each question.				
h.				
i. The instrument indicates the level of understanding that is par allel to the students' skill level.				
I. STRUCTURE				
g.				
h. The instrument has a clear layout such as margins, spaces in b etween questions and choices.				
i.				

J. INSTRUCTIONS				
g. Instructions are well constructed.				
h.				
i. Instructions are appropriate for the type of test.				
K. LANGUAGE				
g.				
h. The instrument contains correct capitalization of words.				
i.				
L. ETHICAL/SOCIAL				
g. The instrument contains relevant or associated texts that are fr ee from offensive language.				
h.				
i. The instrument has equal reference to both male and female g ender in the test questions.				

COMMENTS AND SUGGESTIONS:

_____
_____
_____
_____
_____

_____

Signature over Printed Name of the Evaluator

Appendix G

LEVEL OF MATHEMATICS ANXIETY

DIRECTIONS: Each of the statements expresses a feeling which a particular person has towards Mathematics. Express on a four-point scale, the extent of agreement between the feelings described each statement and your own personal feelings. The four points are: (1) Strongly Disagree ,SD; (2) Disagree ,D; (3) Agree ,A; and (4) Strongly Agree ,SA. Check (✓) the column which best indicates how closely you agree or disagree with the feeling expressed in each statement AS IT CONCERNS YOU.

	SA	A	D	SD
	4	3	2	1
When I see problem solving questions, I feel…				
1. Confused				
2.				
3. lack self-control				
4.				
5. aware that sometimes I get things wrong				
Before taking the test, I feel…				
6.				
7. I can't think clearly				
8.				
9. scared about what I have to do				
10.				
During taking the test, I feel…				
11. my mind goes blank				
12.				
13. I don't want to be doing this				

14.				
15. I expect to have difficulty doing what is required				
After taking the test, I feel…				
16.				
17. difficulty in breathing				
18.				
19. worried about others thinking I am stupid				
20.				

Appendix H

ATTITUDE TOWARD CHEMISTRY

DIRECTIONS: Each of the statements expresses a feeling which a particular person has towards Chemistry. Express on a four-point scale, the extent of agreement between the feelings described each statement and your own personal feelings. The four points are: (1) Strongly Disagree ,SD; (2) Disagree ,D; (3) Agree ,A; and (4) Strongly Agree ,SA. Check (✓) the column which best indicates how closely you agree or disagree with the feeling expressed in each statement AS IT CONCERNS YOU.

	SA	A	D	SD
	4	3	2	1
1. In solving chemistry problems, I feel that analyzing problems with the aid of mathematical concept is the most important part of the process.				
2.				
3. To be able to use an equation in a problem, I need to know what each variables in the equation represents.				
4.				
5. Equations can be understand in a simplest way; they are just given that one can use to calculate numerical answers.				
6.				
7. It makes me happy to even think about having to do a chemistry problem.				
8.				
9. I liked chemistry and considered it to be the most interesting subject that's why I study before taking the test				
10.				
11. My mind goes active and I am able to think clearly when working with chemistry problem.				
12.				
13. Taking chemistry exam makes me feel comfortable and patient.				
14.				
15. I understand my classmate how they obtained their answer by explaining their solutions using mathematical formula				
16.				

17. I get excited whenever the teacher returns our exam papers				
18.				
19. I feel a definite positive reaction to chemistry; it's enjoyable.				
20.				

Adapted from Aiken, L.R. (1970). Attitudes towards mathematics. Review of Educational Research, 40(4), 551-596.

Appendix I

LEARNING STYLE REFERENCE

Dear Participant,

Learning style refers to the ways you prefer to approach new information. Each of us learns and processes information in our own special style, although we share some learning patterns, preferences, and approaches. Knowing your own style also can help you to realize that other people may approach the same situation in a different way from your own.

- Take a few minutes to complete the following questionnaire to assess your preferred learning style.
- Begin by reading the words in the left-hand column.
- Of the three responses to the right, circle the one that best characterizes you, answering as honestly as possible with the description that applies to you right now.

1. When I try to concentrate…	I grow distracted by clutter or movement, and I notice things around me other people don't notice.	I get distracted by sounds, and I attempt to control the amount and type of noise around me.	I become distracted by commotion, and I tend to retreat inside myself.
2. When I visualize…	I see vivid, detailed pictures in my thoughts.	I think in voices and sounds.	I see images in my thoughts that involve movement.
3. When I talk with others…	I find it difficult to listen for very long.	I enjoy listening, or I get impatient to talk myself.	I gesture and communicate with my hands.
4. When I contact people…	I prefer face-to-face meetings.	I prefer speaking by telephone for serious conversations.	I prefer to interact while walking or participating in some activity.
5. When I see an acquaintance…	I forget names but remember faces, and I tend to replay where	I know people's names and I can usually quote what we discussed.	I remember what we did together and I may almost "feel" our time together.

	we met for the first time.		
6. When I relax…	I watch television, see a play, visit an exhibit, or go to a movie.	I listen to the radio, play music, read, or talk with a friend.	I play sports, make crafts, or built something with my hands.
7. When I read…	I like descriptive examples and I may pause to imagine the scene.	I enjoy the narrative most and I can almost "hear" the characters talk.	I prefer action-oriented stories, but I do not often read for pleasure.
8. When I spell…	I envision the word in my mind or imagine what the word looks like when written.	I sound out the word, sometimes aloud, and tend to recall rules about letter order.	I get a feeling for the word by writing it out or pretending to type it.
9. When I do something new…	I seek out demonstrations, pictures, or diagrams.	I want verbal and written instructions, and to talk it over with someone else.	I jump right in to try it, keep trying, and try different approaches.
10. When I assemble an object…	I look at the picture first and then, maybe read the directions.	I read the directions, or I talk aloud as I work.	I usually ignore the directions and figure it out as I go along.
11. When I interpret someone's mood…	I examine facial expressions.	I rely on listening to tone of voice.	I focus on body language.
12. When I teach other people…	I show them.	I tell them, write it out, or I ask them a series of questions.	I demonstrate how it is done and then ask them to try.
umber of Responses			
Learning Style	Visual	Audio	Tactile/Kinesthetic

- Count the number of circled items and write your total at the bottom of each column. The questions you prefer provide insight into how you learn.

Name:_____ Age:_____

School:_____ Section:_____

INTERPRETATION OF LEARNING STYLE

If your primary learning style is **visual**, draw pictures in the margins, look at the graphics, and read the text that explains the graphics. Envision the topic or play a movie in your thoughts of how you'll act out the subject matter.

If your primary learning style is **auditory**, listen to the words you read. Try to develop an internal conversation between you and the text. Don't be embarrassed to read aloud or talk through the information.

If your primary learning style is **tactile/kinesthetic**, use a pencil or highlighter pen to mark passages that are meaningful to you. Take notes, transferring the information you learn to the margins of the book, into your journal, or onto a computer. Doodle whatever comes to mind as you read. Hold the book in your hands instead of placing it on a table. Walk around as you read. Feel the words and ideas. Get busy- both mentally and physically.

Source: Courtesy of Marcia L. Conner, http://agelesslearner.com

Appendix J

Table of Specification for Mathematical Skill Test in General Chemistry

Table of Specification for **MATHEMATICS SKILL TEST IN GENERAL CHEMISTRY**

	Table of Specifications		Item #		
Topic (Old Curriculum)	Year Taken	Specific Objectives	Multiple Choice	Open-Ended	% item distribution
Q1					
• Significant Figures		➢ Demonstrate skills in assigning the correct number of significant figure. ➢ Identify and demonstrate the correct number of significant figure.	1,2,3		8.82%
• Conversion of Units		➢ Demonstrate skills in converting units from one to another. ➢ Identify appropriate conversion factors for unit conversion.	4, 5, 6, 7		11.8%
• Colligative Properties of Solutions	Grade 8 (1st Qtr)	➢ Identify the different colligative properties and calculate the freezing point depression of a solution.	8		2.94%
Q2					
• Gas Laws	Grade 10 (1st Qtr)	➢ Identify the different gas law and solve problems involving gases.	10, 11, 12	Part B #3	11.8%
• Percent Abundance		➢ Show proficiency in calculating the average atomic mass of an element.	13	Part B # 2	5.88%
• Atomic Particles		➢ Identify the different subatomic particles ➢ Understand the concept of radioactivity and solve radioactivity problems.	14, 15		5.88%

Table of Specification for **MATHEMATICS SKILL TEST IN GENERAL CHEMISTRY**

Q3					
• Mole Concept	Grade 9 (1st Qtr)	➢ Determine the number of particles of a substance using Avogadro's number. ➢ Determine the molar mass of a substance. ➢ Convert mass to mole and vice versa.	9, 16, 17, 18, 19, 20, 21		20.6%
Q4					
• Percent Composition	Grade 9 (1st Qtr)	➢ Calculate the percent composition of an element in a compound.	22, 23		5.88%
• Molecular and Empirical Formulas		➢ Determine the empirical formula of a compound based on percent composition ➢ Simplify a compound to its empirical formula using atomic ratio. ➢ Determine the molecular formula of a compound using its empirical formula.	24, 25, 26, 27	Part B #1	14.7%
• Balancing Chemical Equations	Grade 10 (1st Qtr)	➢ Balance chemical equations by inspection	30		2.94%
• Stoichiometry		➢ Identify the limiting and excess reagent in a chemical reaction. ➢ Determine the mass of a reactant/product in a chemical reaction using stoichiometric coefficients.	28, 29	Part B #4	8.82%

Appendix K

MATHEMATICS SKILL TEST IN GENERAL CHEMISTRY

General Instructions:

This is a test of your knowledge in General Chemistry. Read each question carefully and decide which the best answer is. In your answer sheet, blacken the circle that corresponds to your answer.

- This instrument is to evaluate your understanding on the selected topics applying mathematical concept commonly used in studying chemistry concepts you have understand in your previous academic year.
  This instrument is composed of two parts:

  Part A: Multiple Choice

  This section has thirty (30) items. Choose the best answers and shade the corresponding letter in a separate sheet provided. Extra sheets of paper are provided in your answer sheet booklet as your scratch paper.

  Part B: Open Response Questions

  This section has four (4) items. Solve the following problems and show your solution in a separate sheet provided. Extra sheets of paper are provided in your answer sheet booklet as your scratch paper.

- A Periodic Table of Elements is provided at the beginning of the Multiple Choice in case you should need to find important data in solving problems. Conversion table is also provided.
- Use of personal calculator is allowed. Borrowing of calculators is greatly discouraged.
- If you have any questions, address them to the test administrators.
- Utilize space provided on each task. You are only given 120 minutes to finish the test.

MATHEMATICS SKILL TEST IN GENERAL CHEMISTRY

Part A: Multiple Choice

Directions: This is a test of your knowledge in general chemistry. Read each question carefully and choose the best answer is. In your answer sheet, shadow the circle that corresponds to your choice.

1. Arlai wants to know the total mass of the three mass samples as shown in the table below

SAMPLE	MASS (g)
A	4.392
B	102.40
C	2.51

What should be the reported answer following the rules in significant figure?

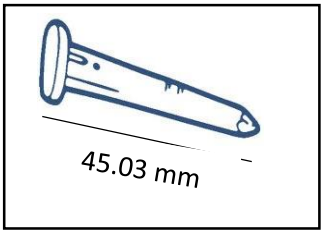
a. 109.30 g b. 109.302 g c. 109.3 g d.110 g

2.

---

3. What is the correct number of significant figures in the given length of the nail?

a. five c. six
b. four d. none



4.

---

5. If a wood screw is exactly 2 ¾ inches long, what is its equivalent numerical value in millimeter?

a. 62.75 mm b. 63.51 mm c. 65.27 mm d. 69.85 mm

6.

7. A 1.5 gram sample of metal pellets is put into a graduated cylinder, containing holds 5.0 mL of water. After the metal pellets are added to the graduated cylinder, the water level stands at 8.0 mL. What is the density of the metal pellet?

   a. 11.55 g/mL b. 0.50 g/mL c. 0.3 g/mL d. 0.19 g/mL

8.

9. When 0.450 grams of a substance was dissolved in 300 grams of water, the freezing point was lowered to 0.150°C. What is the molecular mass of the compound?

   a. 10.6 g/mol b. 18.6 g/mol c. 20.4 g/mol d. 23.8 g/mol

10.

11. The temperature of one liter of gas at constant pressure was changed from 0°C to 273 °C. What is the new volume of a gas expressed in liters?

    a. 0.5 L b. 1.0 L c. 2.0 L d. 2.5 L

12.

---

13. What is the average atomic mass of copper from the given data?

Isotope	% Abundance	Amu
^{63}Cu	69.17	62.9296
^{65}Cu	30.83	64.9278

a. 63.546 amu
b. 62.472 amu
c. 64.278 amu
d. 61.238 amu

14.

---

15. An isotope of uranium with a mass number of 235 and an atomic number of 92, is radioactive because it has an unstable nucleus which loses an alpha-particle. Which one of the following isotopes is produced during this process in addition to the alpha-particle?

a. Uranium-231
b. Radium-231 (the atomic number of radium is 88)
c. Thorium-231 (the atomic number of thorium is 90)
d. Plutonium-231 (the atomic number of plutonium is 94)

---

16. Chemists use Avogadro's number to define a term called the mole. If a mole is equivalent to 6.02×10^{23} molecules, how many molecules are present in 75 grams of H_2?

a. 2.25×10^{25} b. 3.05×10^{23} c. 4.50×10^{21} d. 5.00×10^{26}

17.

18. Which combination of protons, neutrons, and electrons is correct for the isotope of copper, $^{63}_{29}Cu$?

	No. of Protons	No. of Electrons	No. of Neutrons
A.	34	29	34
B.	29	29	34
C.	63	63	29
D.	29	63	29

19.

20. What is the molecular mass of the compound Na_2CO_3?

a. 103 g/mol b. 105 g/mol c. 106 g/mol d. 107 g/mol

21.

22. In the compound, $Ca(NO_3)_2$, What is the percent composition of nitrogen?

a. 59% b. 42% c. 24% d. 17%

23.

---

24. An analysis of white smoke formed in the laboratory, is found to contain 66.4% Cl; 26.2% N, and 7.5% H by mass. What is the empirical formula of the smoke?

a. NH_3Cl b. NH_4Cl c. NHCl d. N_3HCl

25.

---

26. A high level of cholesterol in a person is believed to cause hypertension. The molar mass of cholesterol is 386 g/mol. The compound contains 83.94% C; 11.92% H, and 4.12 % O. What is the molecular formula of cholesterol?

a. $C_{27}H_{46}O$ b. $C_{54}H_{92}O_2$ c. $C_{27}H_{46}O_5$ d. $C_{27}H_{46}O_2$

27.

---

28. $KClO_3$ decomposes to form KCl and O_2 at its standard temperature and pressure. This can be represented by the chemical equation:

$$2\ KClO_3 \longrightarrow 2\ KCl + 3\ O_2$$

How much $KClO_3$ in grams must be heated to obtain 25 grams of O_2?

a. 54.2 grams b. 58.6 grams c. 7.27 grams d. 6.35 grams

29.

---

30. Ammonia is a gas evolved from the decomposition of urea which is made by reacting hydrogen from air. What are the corresponding coefficients of the reactants and products to make the equation balanced?

	$H_{2\,(g)}$ +	$N_{2\,(g)}$ $\longrightarrow$	$NH_{3\,(g)}$
A.	1	2	3
B.	1	1	3
C.	3	1	2
D.	2	1	3

Part B: Open Response Questions:

Direction: Solve the following problems. Show your solution on your test booklet. (5 pts each)

1.

---

2. An element has two isotopes, X and Y, with mass numbers of 52.0 and 53.0 respectively. The relative atomic mass of the element is 52.8. What is the percentage abundance of the two isotopes?

3.

---

4. Glucose, $C_6H_{12}O_6$, reacts with oxygen to produce CO_2 and H_2O.

$$C_6H_{12}O_6 + O_2 \rightarrow CO_2 + H_2O$$

Answer the following questions if 27 g of glucose is reacted with 30 g O_2,

a. The needed coefficient for oxygen to balance the given chemical reaction
b. The Limiting Reagent
c. The Excess Reagent
d. The Theoretical yield or the reaction
e. The Percent yield of CO_2 if 10.0 grams of CO_2 is obtained

Appendix L

Rubrics for Open ended Question in Mathematical Skill Test in General Chemistry

Mathematics Skill Test in General Chemistry Rubrics for Open-Ended Question

Item	5	4	3	2	1
1.	Gives the correct Empirical Formula of Caffeine	Determines the molecular formula of Caffeine	Translates/Converts mass to mole	Converts percent to mass	Identifies the given data
2.	Shows the correct percentage abundance of the second isotope	Shows the correct percentage abundance of the first isotope	Substitutes formula correctly	Identify the formula to be used	Identify the given data
3.	Shows the correct volume of oxygen	Determine what is needed to be found	Substituted the formula correctly	Identifies the formula correctly	Identify the given data
4a.	Shows the complete balanced equation.	Shows the equation with three correct coefficients.	Shows the equation with two correct coefficients.	Shows the equation with one correct coefficient.	Shows the complete unbalanced equation.
4b.	Identifies the correct Limiting Reagent with complete computation	Translates/Converts mole A to mole B	Translates/Converts mass to mole of the reagents	Identify the formula to be used	Identify the given data
4c.	Identifies the correct Excess Reagent with complete computation	Translates/Converts mole A to mole B	Translates/Converts mass to mole of the reagents	Identify the formula to be used	Identify the given data
4d.	Identifies the correct theoretical yield with complete computation	Translates/Converts mole A to mole B	Translates/Converts mass to mole of the limiting reagent	Identify the formula to be used	Identify the given data
4e.	Identifies the correct percent yield in percent form	Identifies the correct percent yield in decimal form	Substitutes formula correctly	Identify the formula to be used	Identify the given data

Appendix M

Profile of Evaluators

Evaluator	Educational Attainment	Position	Institution
1	MA Ed General Science	Instructor I	PNU- Manila
2	MST- Chemistry	Assoc. Prof. III	TUP- Manila
3	BS Chemistry for Teachers	Research Assistant	DLSU- Manila

Appendix N

Table of Result in Mathematics Anxiety

Category	Frequency table: ANZZZ (data gathering(veloso			
	Count	Cumulative Count	Percent	Cumulative Percent
0	48	48	44.4444	44.444
1	60	108	55.5555	100.000
Missing	0	108	0.0000	100.000

Breakdown Table of Descriptive Statistics (data gathering(vel
N=108 (No missing data in dep. var. list)

ANZZZ	ANM Means	ANM N	ANM Std.Dev.	ANM Minimum	ANM Maximum
0	2.20729	48	0.26816	1.05000	2.50000
1	2.86000	60	0.32557	2.55000	3.95000
All Grps	2.56990	108	0.44295	1.05000	3.95000

Appendix O

Table of Results in Attitude toward Chemistry

Category	Frequency table ATTZZZ (data gathering(veloso			
	Count	Cumulative Count	Percent	Cumulative Percent
0	28	28	25.9259	25.925
1	80	108	74.0740	100.000
Missing	0	108	0.0000	100.000

Breakdown Table of Descriptive Statistics (data gathering(vel N=108 (No missing data in dep. var. list)					
ATTZZZ	ATTM Means	ATTM N	ATTM Std.Dev.	ATTM Minimum	ATTM Maximum
0	2.40000	28	0.11138	2.10000	2.50000
1	2.88562	80	0.25903	2.55000	3.55000
All Grps	2.75972	108	0.31366	2.10000	3.55000

Appendix P

Table of Results in Learning Style

Category	Frequency table LS (data gathering(velosc			
	Count	Cumulative Count	Percent	Cumulative Percent
0	36	36	33.3333	33.333
1	28	64	25.9259	59.259
2	44	108	40.7407	100.000
Missing	0	108	0.0000	100.000

Appendix Q

Table of Results in Multiple Choice

Category	Frequency table: MCXX (data gathering(veloso			
	Count	Cumulative Count	Percent	Cumulative Percent
0	1	1	0.9259	0.925
1	58	59	53.7037	54.629
2	46	105	42.5925	97.222
3	3	108	2.7778	100.000
Missing	0	108	0.0000	100.000

Breakdown Table of Descriptive Statistics (data gathering(vel
N=108 (No missing data in dep. var. list)

MCXX	MC Means	MC N	MC Std.Dev.	MC Minimum	MC Maximum
0	5.0000	1	0.00000	5.0000	5.0000
1	11.6551	58	1.61735	8.0000	14.0000
2	17.1304	46	1.79640	15.0000	22.0000
3	23.0000	3	0.00000	23.0000	23.0000
All Grps	14.2407	108	3.59353	5.0000	23.0000

Appendix R

Table of Results in Open ended Questions

Category	Frequency table: OEXX (data gathering(velosc			
	Count	Cumulative Count	Percent	Cumulative Percent
0	84	84	77.7778	77.778
1	22	106	20.3703	98.148
2	2	108	1.8518	100.000
Missing	0	108	0.0000	100.000

Breakdown Table of Descriptive Statistics (data gathering(vel
N=108 (No missing data in dep. var. list)

OEXX	OE Means	OE N	OE Std.Dev.	OE Minimum	OE Maximum
0	1.5119	84	1.99090	0.0000	6.0000
1	8.5909	22	1.59341	6.0000	10.0000
2	11.0000	2	0.00000	11.0000	11.0000
All Grps	3.1296	108	3.59410	0.0000	11.0000

Appendix S

Analysis of Variance between Multiple Choice and Mathematics Anxiety

Breakdown Table of Descriptive Statistics (data gathering(vel
N=108 (No missing data in dep. var. list)

ANZZZ	MC Means	MC N	MC Std.Dev.	MC Minimum	MC Maximum
0	15.3333	48	3.85554	5.00000	23.0000
1	13.3666	60	3.13518	8.00000	22.0000
All Grps	14.2407	108	3.59353	5.00000	23.0000

Analysis of Variance (data gathering(veloso))
Marked effects are significant at p < .05000

Variable	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
MC	103.140	1	103.140	1278.60	106	12.0622	8.55069	0.00422

Appendix T

Analysis of Variance between Open ended and Mathematics Anxiety

Breakdown Table of Descriptive Statistics (data gathering(vel
N=108 (No missing data in dep. var. list)

ANZZZ	OE Means	OE N	OE Std.Dev.	OE Minimum	OE Maximum
0	3.45833	48	3.80346	0.00	11.0000
1	2.86666	60	3.42704	0.00	10.0000
All Grps	3.12963	108	3.59410	0.00	11.0000

Analysis of Variance (data gathering(veloso))
Marked effects are significant at p < .05000

Variable	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
OE	9.33518	1	9.33518	1372.85	106	12.9514	0.72078	0.39780

Appendix U

Analysis of Variance between Multiple Choice and Attitude toward Chemistry

Breakdown Table of Descriptive Statistics (data gathering(vel
N=108 (No missing data in dep. var. list)

ATTZZZ	MC Means	MC N	MC Std.Dev.	MC Minimum	MC Maximum
0	15.2142	28	4.27184	5.00000	23.0000
1	13.9000	80	3.28633	8.00000	23.0000
All Grps	14.2407	108	3.59353	5.00000	23.0000

Analysis of Variance (data gathering(veloso))
Marked effects are significant at p < .05000

Variable	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
MC	35.8264	1	35.8264	1345.91	106	12.6973	2.82158	0.09595

Appendix V

Analysis of Variance between Open ended and Attitude toward Chemistry

Breakdown Table of Descriptive Statistics (data gathering(vel
N=108 (No missing data in dep. var. list)

ATTZZZ	OE Means	OE N	OE Std.Dev.	OE Minimum	OE Maximum
0	3.75000	28	3.87417	0.00	11.0000
1	2.91250	80	3.49028	0.00	11.0000
All Grps	3.12963	108	3.59410	0.00	11.0000

Analysis of Variance (data gathering(veloso))
Marked effects are significant at p < .05000

Variable	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
OE	14.5476	1	14.5476	1367.63	106	12.9022	1.12753	0.29071

Appendix W

Analysis of Variance between Multiple Choice and Learning Style

Breakdown Table of Descriptive Statistics (data gathering(vel
N=108 (No missing data in dep. var. list)

LS	MC Means	MC N	MC Std.Dev.	MC Minimum	MC Maximum
0	14.4166	36	3.62037	5.00000	22.0000
1	15.3214	28	3.35607	9.00000	23.0000
2	13.4090	44	3.59145	8.00000	23.0000
All Grps	14.2407	108	3.59353	5.00000	23.0000

Analysis of Variance (data gathering(veloso))
Marked effects are significant at p < .05000

Variable	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
MC	64.2472	2	32.1236	1317.49	105	12.5475	2.56014	0.08211

Appendix X

Analysis of Variance between Open ended and Learning Style

Breakdown Table of Descriptive Statistics(data gathering(vel
N=108 (No missing data in dep. var. list)

LS	OE Means	OE N	OE Std.Dev.	OE Minimum	OE Maximum
0	3.00000	36	3.56971	0.00	10.0000
1	3.14285	28	3.50358	0.00	10.0000
2	3.22727	44	3.74702	0.00	11.0000
All Grps	3.12963	108	3.59410	0.00	11.0000

Analysis of Variance (data gathering(veloso))
Marked effects are significant at p < .05000

Variable	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
OE	1.02934	2	0.51467	1381.15	105	13.1538	0.03912	0.96164

Appendix Y

Regression Summary in Multiple Choice

N=108	Regression Summary for Dependent Variable: MC (data gathering(veloso R= .41659062 R²= .17354774 Adjusted R²= .14145251 F(4,103)=5.4073 p<.00054 Std.Error of estimate: 3.3297					
	Beta	Std.Err. of Beta	B	Std.Err. of B	t(103)	p-level
Intercept			21.5083	2.90799	7.3963	0.00000
ANM	-0.34029	0.12142	-2.7607	0.98509	-2.8024	0.00606
ATTM	-0.00835	0.12100	-0.0957	1.38626	-0.0690	0.94509
a	-0.07711	0.10251	-0.5595	0.74376	-0.7522	0.45361
b	0.14620	0.10248	1.1675	0.81845	1.4265	0.15674

N=108	Regression Summary for Dependent Variable: MC (data gathering(veloso R= .36852535 R²= .13581093 Adjusted R²= .12765820 F(1,106)=16.658 p<.00009 Std.Error of estimate: 3.3563					
	Beta	Std.Err. of Beta	B	Std.Err. of B	t(106)	p-level
Intercept			21.9239	1.90997	11.4786	0.00000
ANM	-0.36852	0.09029	-2.9896	0.73250	-4.0814	0.00008

Appendix Z

Regression Summary in Open ended

Effect	Analysis of Variance; DV: OE (data gathering(veloso				
	Sums of Squares	df	Mean Squares	F	p-level
Regress.	20.795	4	5.1988	0.39333	0.81300
Residual	1361.39	103	13.2173		
Total	1382.18				

Appendix AA

Validation Result in Mathematics Anxiety

	Evaluator 1	Evaluator 2	Evaluator 3
Content			
A	4	4	4
B	4	4	4
C	4	4	4
Level of difficulty			
A	3	4	4
B	3	4	4
C	3	4	4
Structure			
A	3	4	4
B	3	4	4
C	3	4	4
Instructions			
A	3	4	3
B	3	4	3
C	3	4	4
Language			
A	2	4	3
B	2	4	3
C	2	4	3
Ethical/Social			
A	4	4	4
B	4	4	4
C	4	4	4
Sum	57	72	67
mean	3.17	4	3.72

Appendix AB

Validation Result in Attitude toward Chemistry

	Evaluator 1	Evaluator 2	Evaluator 3
Content			
A	4	4	4
B	4	4	4
C	4	4	4
Level of difficulty			
A	3	4	4
B	3	4	4
C	3	4	4
Structure			
A	3	4	4
B	3	4	4
C	3	4	4
Instructions			
A	3	3	3
B	3	3	3
C	3	4	4
Language			
A	3	4	3
B	3	4	3
C	3	4	3
Ethical/Social			
A	4	4	4
B	4	4	4
C	4	4	4
sum	60	70	67
mean	3.33	3.89	3.72

Appendix AC

Validation Result in Achievement Test

	Evaluator 1	Evaluator 2	Evaluator 3
Content			
a	4	4	4
b	4	4	4
c	4	4	4
Items			
a	4	4	4
b	4	4	4
c	4	4	4
Level of difficulty			
A	3	4	4
B	3	4	4
C	3	4	4
Structure			
a	3	4	4
b	3	4	4
c	3	4	4
Instructions			
a	3	4	3
b	3	4	3
c	3	4	4
Language			
a	3	4	3
b	3	4	3
c	3	4	3
Ethical/Social			
a	4	4	4
b	4	4	4
c	4	4	4
Sum	72	84	79
Mean	3.42	44	3.76

Appendix AD

Plagiarism Check

PHILIPPINE NORMAL UNIVERSITY
(The National Center for Teacher Education)
College of Graduate Studies and Teacher Education Research
UNIVERSITY PUBLICATIONS OFFICE
publications.office@pnu.edu.ph
Room 202, Pedro T. Orata Hall
Taft Avenue, Manila, 1000, Philippines
Tel. No. 3171768, Loc. 530

University Publications Office
CGSTER

CERTIFICATION

This is to certify that the thesis of ANGELA FRANCISCA B. VELOSO entitled "*Mathematics Anxiety Learning Style, Achievement and Attitude of Students Towards Chemistry at the Institute of Teaching and Learning* " **passed** the authenticity test performed by the office on May 14, 2014 using the Anti-Plagiarism software of the university.

ANTRIMAN V. ORLEANS, Ph.D.
Director

PNU OR No, 143861
UCRSS PO: 2014-0068
Student No: G2011131570

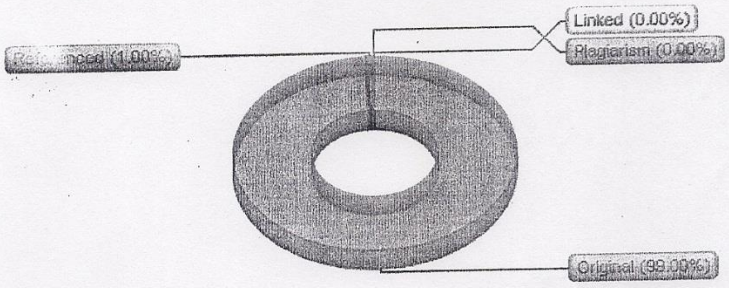
Plagiarism Detector - Originality Report

Plagiarism Detector Project: [_____] Application core verrsion: 556

Originality report details:

Generation Time and Date:	5/14/2014 4:46:02 PM
Document Name:	
Document Location:	E:\final paper for defense-Angela Veloso.pdf
Document Words Count:	19654

: to understand what exactly is meant by any report value - you can click "Help Image". It will navigate you to the most detailed explanation at our web site.



/ Linked 0%

/

Hot Flags: [beta]

Appendix AE

Language Check

C E R T I F I C A T I O N

This is to certify that the thesis of **ANGELA FRANCISCA B. VELOSO** titled "**MATHEMATICS ANXIETY, LEARNING STYLE AND ATTITUDE TOWARD CHEMISTRY AS PREDICTORS OF STUDENTS' PERFORMANCE IN CHEMISTRY**" was language-edited in May 2014 by the undersigned editor.

RAMER V. OXIÑO, MAT ELA
Language Editor

Name: Angela Francisca Bajamundi Veloso
Address: B4 L6 Guinto St. Guinto Park Subd. Pulanglupa II, Las Piñas City
Contact Nos.: 09328454165 / 02-4230185
E-mail Address: angela.veloso@deped.gov.ph

Personal Details

Date of Birth	May 19, 1989	**Sex**	Female
Place of Birth	Caloocan City	**Civil Status**	Single
Age	25		

Academic Background

Graduate Studies
2011-2014 Philippine Normal University
College of Sciences, Taft Ave., Manila
Masters of Arts in Science Education Major in Chemistry

Tertiary
2006 - 2010 Philippine Normal University
College of Sciences, Taft Ave., Manila
BSE in Chemistry with Certificate of Teaching in Mathematics

Secondary
2003 -2006 St. Joseph's Academy
P. Cera Ave., Poblacion, Las Piñas City

2002-2003 St. Rita College P'que
Dr. A. Santos Parañaque City

Government Examinations Passed
Licensure Exam for Teachers
September 2010 Passer

Association
Philippine Association of Chemistry Teachers, Inc.

PROFESSIONAL EXPERIENCE
University of the Philippines- Manila
College of Medicine
Research Assistant
(January 2014- present)

Technical University of the Philippines
College of Science
Chemistry Instructor (Part-Time)
(November 2013-present)

Las Piñas East National High School
Physics, Chemistry, Science I, Open High School Teacher, Values and Research Adviser
(July 2011-present)

Bloomfield Academy, BF Resort Village Las Piñas City
Grade School Science Teacher
(June 2010- April 2010)

Awards and Recognitions

1st Place Division Level Science Investigatory Project
Applied Science Category
"Anti-*Staphylococcus aureus* Facial Cream from Citronella Grass"
September 2012
Research Adviser

GRADUATE RESEARCH

"Mathematics Anxiety, Learning Style and Attitude toward Chemistry as Predictors of Students' Performance in Chemistry"

UNDERGRADUATE RESEARCH

"Qualitative Analysis and Anti-*Staphylococcus aureus* Activity of Extracted Coffee Alamid (*Paradoxurus Hermaphroditus*) Beans"

SEMINARS ATTENDED

"Level Up teaching Science for the 21st Century"
UP Integrated School, UP Diliman Quezon City, May 15, 2013

"Seminar-Workshop on Laboratory Safety in Schools"
San Beda College, Mendiola Manila, October 27, 2012

"CHEM S3: Chemistry: Society, Sustainability and Safety"
San Beda College, Mendiola Manila, October 25-27, 2012

"Seminar-Workshop on Sustaining Effective and Holistic Management of Large Classes through Active Life Model"
Las Piñas East National High School, Las Piñas City,
February 20-21, 2012

"Division Seminar-Workshop on Science Investigatory Project for Elementary and Secondary SIP (Science Investigatory Project) Advisers"
Las Piñas East National High School, Las Piñas City,
November 2011

"Classroom Management and Learning Assessment"
Olivarez College Parañaque City, October 2011