March 2015

Contextual and Psychological Constructs of Sixth Grade Pupils' Mathematical Proficiency

Feejay A. Dimaculangan

Philippine Normal University

CONTEXTUAL AND PSYCHOLOGICAL CONSTRUCTS OF SIXTH GRADE PUPILS' MATHEMATICAL PROFICIENCY

FEEJAY ALDOVINO DIMACULANGAN

College of Graduate Studies
And Teacher Education Research
Philippine Normal University
Taft Avenue, Manila

MARCH 2015

APPROVAL SHEET

This dissertation entitled "CONTEXTUAL AND PSYCHOLOGICAL CONSTRUCTS OF SIXTH GRADE PUPILS' MATHEMATICAL PROFICIENCY" prepared and submitted by FEEJAY A. DIMACULANGAN, in partial fulfillment of the requirements for the degree Doctor of Philosophy (Ph. D.) in Mathematics Education, has been examined and recommended for approval and acceptance.

RENE R. BELECINA, Ph. D.
Adviser

ERMINDA C. FORTES, Ph. D.
Adviser

Approved in partial fulfillment of the requirements for the degree Doctor of Philosophy (Ph. D.) in Mathematics Education by the Oral Examination Committee.

ZENAIDA Q. REYES, Ph. D.
Chairperson

DANILO K. VILLENA, Ph. D.
Member

ELISA S. BACCAY, Ed. D.
Member

TERESITA T. RUNGDUIN, Ph. D.
Member

Accepted in partial fulfillment of the requirements for the degree Doctor of Philosophy (Ph. D.) in Mathematics Education.

Date: ____________________

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

ACKNOWLEDGMENT

Writing this dissertation, as I would like to consider it, has been one of the most hard – hitting academic endeavor I ever experienced. This paper became my terra firma for almost a year that is full of challenges, which entailed me to unlearn, learn, and relearn things. This study would not have been completed if the following people did not share their asymmetrical support. It is to them that I owe a lot of gratitude.

- Dr. Rene R. Belecina and Dr. Erminda C. Fortes, my dissertation advisers, for munificently resting their knack on this quest, and for their relentless motivation and guidance, which inspired me throughout the study.
- Dr. Fortunato G. Vendivel, Dr. Danilo K. Villena, Dr. Robert Diaz, Dr. Elisa S. Baccay, and Dr. Rogen A. Doronila for their acumen and proficiency in sociology and mathematics education, to the highest standards, in validating my research instruments.
- Dr. Rosemarievic V. Diaz, Dr. Elisa S. Baccay and Dr. Danilo K. Villena, members of the Oral Examination Committee, for giving me valuable suggestions and for sharing me their valued time despite the demands of their academic works.
- Dr. Zenaida Q. Reyes, dean of PNU College of Graduate Studies Teacher Education and Research (CGSTER), for the impetus and shared optimism during the final stages of this study.
- Faculty members of the Department of Mathematics of PNU, for the abet they extended to improve my dissertation during the proposal stages.

- Dr. Rogen A. Doronila, my friend, for allowing me to adopt his validated instruments that could measure the psychological construct of mathematical proficiency and for laying his untiring assistance in the statistical computation of the data.
- Rev. Fr. Carlo Magno C. Ilagan, president of USAL, for allowing me to conduct this study in the member schools of USAL, Grade School Department.
- Principals and Mathematics teachers of the participating schools for helping me get through during the various phases of data collection.
- Sixth grade pupils who participated in this study, for giving me their trust and confidence, despite the gargantuan work they had done.
- Dr. Randy M. Baja, STC Director for Academics and Principal, for the scholarship and assistance, and for the profound understanding, which inspired me to push this study until the end.
- My colleagues in STC, who were always there to show moral support.
- My family for their encouragement and unending support.

And above all, to **G** (God), who always answers prayers and keeps me motivated during the toughest times of my academic challenges.

This dissertation is dedicated to all educationists who tirelessly believe that creating mathematically proficient students in a 'knowledge society' are the key towards national development.

ABSTRACT

Name of Researcher	:	**Feejay Aldovino Dimaculangan**
Title of Research	:	**Contextual and Psychological Constructs of Sixth Grade Pupils' Mathematical Proficiency**
Key Concepts	:	**Mathematical proficiency, student background, school background, curiosity, motivation**
Degree	:	**Doctor of Philosophy**
Specialization	:	**Mathematics Education**
Advisers	:	**Rene R. Belecina, Ph. D. Erminda C. Fortes, Ph. D.**

••

This study determined whether the social – contextual and psychological constructs, namely: student background, school background, curiosity, and motivation influence mathematical proficiency. Data were gathered from the 645 sixth grade pupils and 15 Mathematics VI teachers through self – report questionnaires and a developed mathematical proficiency test.

Results showed that majority of the sixth grade pupils' have 4 – 6 household members, parents who are college graduates, access to social media, average level of performance in English, both parents at home, and high level of parental involvement in their education; have mathematics teachers who specialized in Mathematics, spent 20 – 29 years in teaching, with MA units, attended seminars and workshops as participants, and very satisfactory work values; have class size of 31 –35, ability grouping based on

academic performance, library and laboratories for computer, livelihood education, and science, and MTAP as an academic program in Mathematics. Furthermore, the sixth grade pupils are highly mathematically curious and motivated and have average level of mathematical proficiency. With skewness close to zero, the scores of the participants in the MPT depict that of the normal distribution.

Seven perspectives of regression analyses were investigated using regression and covariance analyses. In each perspective, regression analysis was performed on the specific subscales of each construct, employing parsimony principle through backward elimination method when necessary. Student background, school background, and curiosity significantly predict mathematical proficiency. The specific dimensions number of household members, access to educational technology, family formation, level of parental involvement in child's education, class size, exploration, absorption, epistemic curiosity, and perceptual curiosity were found the most significant predictors of mathematical proficiency. These dimensions explain a statistically significant portion (91.2%) of the variance in their mathematical proficiency.

The structural equation modeling (SEM) technique was used to combine regression models in one analysis. Through SEM, the CPMP Model emerged. The model was tested and was found empirically valid and generally acceptable with fit indices: x^2 = 0.065, RMSEA = 0.029, and CFI = 0.979. It describes that the person's mathematical proficiency is psychologically channelized by the influence of the contextual constructs student and school backgrounds.

Table of Contents

List of Tables

List of Figures

List of Appendices

Chapter I

THE PROBLEM AND ITS BACKGROUND

Introduction

National development is the ability of a country to improve the social welfare of the people (Meisenberg & Lynn, 2010). It involves development of infrastructure such as roads, hospitals, airports, dams, schools, education, health, sports as well as development of its citizenry. National development encompasses economic development which is the increase in the standards of living of a nation's population with sustained growth from a simple, low-income economy to a modern, high –income. So, economic development and growth implies a national development. Historically, no civilization or nation could stand up the test of times in terms of national development without the application of mathematical concepts.

Mathematics is a tool that is utilized in societal transformation (Abubakar et al., 2012). Each of the diverse branches of Mathematics has useful applications on which fields of human endeavor hangs, thus human capital with high mathematical proficiency is necessary. This pivotal position that high mathematical proficiency occupies makes it a tool for development. This paper focuses on improving the mathematical proficiency of the learners as a pivotal rebranding tool for national development.

Any nation, especially the Philippines, which aspire to become one of the "Tigers of Asia" once again, cannot deny that mathematics is an indispensable tool in all human endeavors. The central position that human capital with high mathematical proficiency plays in all field have been highlighted above. The teaching of mathematics should be done to help learner see, evaluate and appreciate the beauty and inherent universal usefulness in all sphere of the economy. There is the need to keep learners firmly anchored on a set of human values; to teach young teachers how to process the vast variety of information so that they pick up mathematical knowledge and understanding that are qualitative and functional to themselves and the society at large (Abubakar, 2010).

According to the principle of human capital theory, the economic development of a nation is a function of the quality of its education. The modern world in which we live is often termed as “knowledge society” in the sense that education and information have become production factors. In this rapidly globalizing economy, mathematics proficiency is one of the bases for almost every technical competence in the modern marketplace, including fields as diverse as computer programming, physics, engineering and manufacturing (Olaniyan & Okemakinde, 2008). As a result, cultivating a workforce with strong mathematical proficiency is necessary to keep the country competitive in the global arena. The national government should take the first step towards this action.

The government is spending the largest share of its national budget on education as mandated by the Constitution. But despite this fact, the achievement test results on mathematics reflect a low level of proficiency on the part of most Filipino school children. From school year 2005 – 2006 to school year 2011 – 2012, the mathematics proficiency of Grade VI pupils in the Philippines are ranging from 54.66% to 68.15% (Department of

Education) versus the benchmark passing grade of 75%. Clearly, these scores are not levels of proficiency that will help our children become productive and competitive adults that could serve the country.

Moreover, the current performance of our country's students in science and mathematics lags behind their international peers and not enough students are pursuing careers in science and mathematics. Last 2011, in one international comparative survey test, the Trends in International Math and Science Survey (TIMSS), among the 45 countries who participated the Philippines ranked 42nd in Mathematics. Our Filipino school children have proficiency of significantly lower than the international average in Mathematics. This data indicate an almost unchanged status from the 1999 TIMSS figures.

Indeed, the country is lagging behind its ASEAN counterparts in terms of mathematical proficiency and faces serious challenges from highly educated foreign competitors. In terms of mathematical proficiency, students have the most difficulty in using formula to solve specific problems or to calculate certain results. The ability to manipulate numbers and equations is weak. The ability to think conceptually and spatially is even weaker. Problem solving using mathematical concepts and established logic and equations is poor.

During the twentieth century, the meaning of successful mathematics learning underwent several shifts in response to changes in both society and schooling. For roughly the first half of the century, success in learning the mathematics of pre-kindergarten to eighth grade usually meant facility in using the computational procedures of arithmetic, with many educators emphasizing the need for skilled performance and others emphasizing the need for students to learn procedures with understanding (The National Academies, 2015).

The analyses of the mathematics to be learned, reading of the research in cognitive psychology and mathematics education, experience as learner and teacher of mathematics, and judgment as to the mathematical knowledge, understanding, and skill people need today have led to the adoption of a composite, comprehensive view of successful mathematics learning. This view, admittedly, represents no more than a single committee's consensus. Yet the various backgrounds have led to formulate, in a way that others can and will accept it, the goals toward which mathematics learning should be aimed. Recognizing that no term captures completely all aspects of expertise, competence, knowledge, and facility in mathematics, *mathematical proficiency was chosen* to capture what is believed to be necessary for anyone to learn mathematics successfully.

Moreover, the National Council of Teachers of Mathematics (NCTM, 2000) in their vision of mathematics teaching and learning describes an interactive process in which classes explore mathematical ideas in a social context, where the communication of mathematical thinking is an integral part of learning, and where "students confidently engage in complex mathematical tasks chosen carefully by teachers". This implies a more complex definition of mathematical proficiency than simply the ability to compute fluently and manipulate mathematical expressions.

The topic of mathematical proficiency has become the center of considerable attention in two disciplines, social science and cognitive science. Some years ago, researchers were asking what relation is there, or might there be, between these different disciplines' concerns with mathematical proficiency.

Children in a nation come from a variety of family situations, income strata, and cultural backgrounds. As a result, the nation's schools are faced with unique challenges as they strive to provide equal educational opportunities to all students. Factors such as family income, family structure, and parents' education have been shown to influence a child's educational opportunities. Students from racial/ethnic minority backgrounds and low income families are more at risk for poor school outcomes and are becoming an increasing share of the student population.

Since the mid-1960s, studies have linked the educational disadvantage of minority students to a combination of out-of-school factors, many of which center on family characteristics, such as poverty and parents' education. Changes over time in the composition of students in terms of factors such as student English language proficiency, family income, parents' education, and family structure affect the social context of education.

Social background factors such as race/ethnicity, limited English proficiency, family income, parental education, and family structure are associated with various levels of educational access and different educational outcomes. For example, differences in preprimary enrollment, incidence of early childhood academic and behavioral problems, level of student achievement, and the likelihood of dropping out of school or going on to college after graduation are each associated with various social background factors. Such factors are interrelated, however, and must be examined jointly when trying to understand the effect of any single factor on education. For example, a recent study showed that variation in student performance associated with family structure disappeared when other factors, such as family income, family size, and parents' education level, are taken into account.

The social context of schooling is also a function of how students with various characteristics are distributed across schools. The data on the mentioned factors reflect changing conditions that schools must confront in order to be effective. In order to provide equal educational opportunity, policymakers must be aware of differences in the background of students, as well as differences in the climate and resources of schools (Lee & Shute, 2010).

The controversy over "school effects" ignited by that study has continued to this day. Family, gender and sexuality form a broad area of inquiry studied in many subfields of social context. The social context of the family examines the family, as an institution and unit of socialization, with special concern for the comparatively modern historical emergence of the nuclear family and its distinct gender roles.

The next factor that entails attention for inclusion in this study is curiosity. Research on curiosity in mathematics is scarce. However, there is a presence of literature within the discipline of psychology grounded in an educational context (Litman, 2000).

According to McLeod, et al. (2013), who also studied curiosity as related to sixth grade mathematics classroom with technology – integrated learning, curiosity is an important construct for educators as it is connected with knowledge and higher-order thinking, goal-oriented behavior, motivation, and persistence. McLeod, et al. (2013) added that in a classroom with technology – integrated learning, curiosity is a strong motivator for learning mathematical procedural knowledge, conceptual knowledge and problem solving knowledge. Several researchers have attempted to relate curiosity to various measures of academic achievement, learning performance, and understanding (e.g., Berlyne, 1960; Keller, 1999, as cited by Doronila, 2012). Thus, it is important to look at sixth grade pupils' curiosity in developing mathematical proficiency.

Another factor that is worth looking into is the students' motivation. In the last fifty years, researchers had curiosity with the effect of motivation. They studied students' motivation and learned a great deal about the effect of motivational practices on school learning. It pointed to more simple aspects, such as achievement motivation, intrinsic motivation, and goal orientation as well as the effect of teacher practices which promote motivational beliefs. To be able to talk further about motivation in learning mathematics, it is essential to know what motivation actually means. Motivation is defined as an internal state that arouses, directs, and maintains behavior (Woolfolk, 2008).

Researchers found that although students have achievement, ability, and perceived competence which support the desire in learning mathematics, in fact intrinsic motivation comes to decrease developmentally (Lepper, Corpus, & Iyengar, 2005). This is one of motivational problem toward mathematical proficiency. Also, researchers tend to internalize the activity's initially external regulation in which people tend to take the regulation and integrate it with their sense of self (Ryan & Deci, 2005). It is likely that students must feel comfortable with mathematics, must be challenged to achieve, and must expect to succeed before the development of intrinsic motivation can begin. Therefore, this kind of problem has to be overcome, it is important to investigate role motivational practices on improving mathematical proficiency. This study will determine how students will become at ease with mathematics though constructs such as motivation.

To sum up, the present study is an exploration of the social – contextual and psychological constructs of mathematical proficiency in relation to sixth grade pupils' student background, school background, curiosity, and motivation. This study was conducted to find out whether or not these variables influence the mathematical proficiency of a group of sixth grade pupils in the province. Although groups of sixth grade pupils may vary in size, culture and character, different kinds of groups may appear to share some fundamental common features in terms of social – contextual and psychological constructs of mathematical proficiency, thus, making it possible to study the group in general. At the outset of this study, the nature of mathematical proficiency of these groups via identified intertwining variables is described.

Conceptual Framework

The theoretical bases of this study are anchored on the existing theories and/or models (see Table 1) on: (1) Mathematical Proficiency, (2**)** Social **–** Contextual Constructs, and (3) Psychological Constructs. This section includes the theories and/or models developed and applied in the learning of mathematics. This study is inclined enough to the possible inclusion of theories and/or models relevant and necessary to better understand the social – contextual and psychological constructs in mathematics education.

Table 1
Theories and Models Relevant to the Present Study

Theories / Models on	Proponents		
Mathematical Proficiency	Polya (1945) Skemp (1976)	Schoenfeld (1985), Kilpatrick, J., Swafford, J., and Findell, B. (2001)	Brownell (2008), Wu (2008) Herrmann (2013)
Social – Contextual	Bronfenbrenner (1979), Vygotsky (1981), Stevenson & Stigler (1992)	Dewey (1993), Lachance & Mazzocco (2006), Jonassen(2006), Earle & Earle (2007)	Murphy & Manzanares, (2008),Desai, Hart, & Richards (2008)Lee & Shute (2010), and Russell, 2010
Psychological	Berlyne (1954) Keller (1987)	Pintrich, Smith,Garcia & McKeachie (1991)	Locke & Latham, 2002 Litman, 2005 Ozturk, 2012

Mathematical Proficiency

It has long been recognized that successful mathematical learning comprises much more than just knowledge of skills and procedures. As early as 1944, in an article entitled *The progressive nature of learning mathematics*, the noted American mathematics educator William A. Brownell argued that teaching mathematics from a behaviorist perspective results, at best, in “pseudo- learning, memorization, and superficial, empty verbalization” (Brownell, 2007). Brownell’s argument was reprinted as one of two articles from the 1940s in the *100 Years of*

Mathematics Teacher special issue of the *Mathematics Teacher* in 2007, where it is stated that "readers may be surprised at the modern ideas expressed by Brownell more than sixty years ago and will find numerous parallels to current discussions about conceptual understanding, problem solving, and the provision of quality mathematics education for all students".

Skemp (1976) identified the advantages of teaching mathematics for what he referred to as *relational* rather than *instrumental* understanding. Skemp argued that, while instrumental understanding may have short-term benefits, such as taking less time to learn skills and procedures, relational understanding is more adaptable to new tasks, is easier to understand, and is an appropriate goal in itself. He further contrasts instrumental and relational understanding, likening the former to providing learners with a series of steps to achieve certain goals, while the latter allows learners to build their own mental maps or schema, which, in principle, enable them to find their own paths to achieve a variety of mathematical goals.

More recently, Kilpatrick, Swafford and Findell (2001) proposed five "intertwining strands" of mathematical proficiency, namely: *Conceptual Understanding – comprehension of mathematical concepts, operations and relations; Procedural Fluency – skill in carrying out procedures flexibly, accurately, efficiently and appropriately; Strategic Competence – ability to formulate, represent, and solve mathematical problems; Adaptive Reasoning – capacity for logical thought, reflection, explanation and justification; and Productive Disposition – habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy.*

According to Kilpatrick et al. (2001), these strands are not independent but instead, "represent different aspects of a complex whole" (p. 116), thus leading to the notion of intertwined strands, as shown in Figure 1.

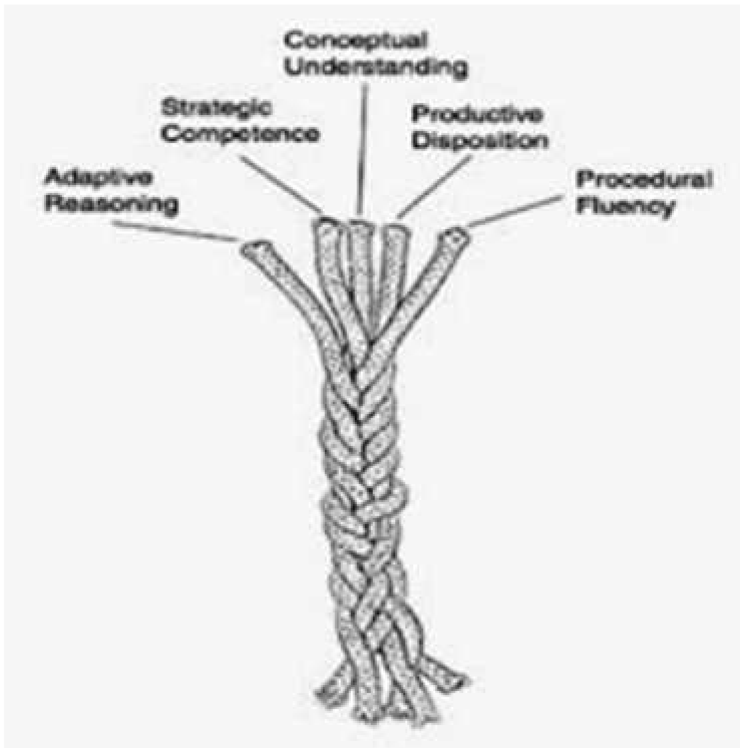


Figure 1. Intertwined Strands of Mathematical Proficiency

An evolution took place in mathematics education (Shoenfeld, 1989). The knowledge base remains important; it goes without saying that anyone who lacks a solid grasp of facts, procedures, definitions, and concepts is significantly handicapped in mathematics. But there is much more to mathematical proficiency than being able to reproduce standard content on demand. A mathematician's job consists of at least one of: extending known results; finding new results; and applying known mathematical results in new contexts. The problems mathematicians work on, in academia or in industry, are not the kind of exercises that get solved in a few minutes or hours; they are problems that may take days, weeks, months, or years to solve. Thus, in addition to possessing a substantial amount of specialized knowledge, mathematicians possess other things as well. Good problem solvers are flexible and resourceful. They have many ways to think about problems—alternative approaches if they get stuck, ways of making progress when they hit roadblocks, of being efficient with (and making use of) what they know. They also have a certain kind of mathematical disposition—a willingness to pit themselves against difficult mathematical challenges under the assumption that they will be able to make progress on them, and the tenacity to keep at the task when others have given up. As will be seen below, all of these are aspects of mathematical proficiency; all of them can be learned (or not) in school; all of them can help explain why some attempts at problem solving are successful and some not.

A major source of controversy over the past decade has involved not only the level of procedural skills expected of students, but also what is meant by “understanding.” For example, what does it mean for an elementary school student to understand base-ten subtraction? For some people—notably, those who wrote the current mathematics standards, understanding a concept means being able to compute the answers to exercises that employ that concept.

One of the strands of mathematical proficiency described is “*strategic competence*—ability to formulate, represent, and solve mathematical problems” (NRC, 2001). It goes without saying that “knowing” mathematics, in the sense of being able to produce facts and definitions, and execute procedures on command, is not enough. Students should be able to use the mathematical knowledge they have. The starting place for any discussion of problem solving strategies is the work of George Polya. In 1945, Polya opened up the study of problem solving strategies. The core of the book was devoted to a “short dictionary of heuristic.” To quote from Polya, “The aim of heuristic is to study the methods and rules of discovery and invention. The present book is an attempt to revive heuristic in a modern and modest form” (Polya, 1945). “Modern Heuristic endeavors to understand the process of solving problems, especially the *mental operations typically useful* in this process”. Polya described powerful problem solving strategies such as making use of analogy, making generalizations, re-stating or re-formulating a problem, exploiting the solution of related problems, exploiting symmetry, and working backwards. Polya’s subsequent volumes, *Mathematics and Plausible Reasoning* and *Mathematical Discovery*, elaborated substantially on the ideas in *How to Solve It*, showing how one could marshal one’s mathematical knowledge in the service of solving problems.

To cut a long story short (Schoenfeld 1989), the heuristic strategies Polya describes are more complex than they appear. Consider, for example, a strategy such as “if you cannot solve the proposed problem . . . could you imagine a more accessible related problem?”. The idea is that although the problem you are trying to solve may be too difficult for now, you might be able to solve a simpler version of it. You might then use the result, or the idea that led to the solution of the simpler problem, to solve the original problem.

Reflecting on progress while engaged in problem solving, and acting accordingly ("monitoring and self-regulation") is one aspect of what is known as metacognition—broadly, taking one's thinking as an object of inquiry. Failing to do so can guarantee failure at problem solving: if one is fully occupied doing things that do not help to solve the problem, one may never get to use the "right" knowledge in the right ways. As was the case with strategies, the story here is that (a) effective problem solvers behave differently; and (b) students can learn to be much more efficient at monitoring and self-regulation, and become more successful problem solvers thereby.

In order to learn knowledge and skills, retain them, and be able to apply them to solve problems, students must learn with understanding (Wu, 2008). Understanding is the process of mental activity consisting of five parts: 1) constructing a relationship; 2) extending and applying mathematical knowledge; 3) reflecting on experiences; 4) articulating what one knows; and 5) making mathematical knowledge one's own. These five components are consistent with the NRC and RAND's two main components in mathematical proficiency - developing conceptual understanding by constructing a relationship (1), and building competence in applying knowledge to make one's own problems (2 & 5), which are included as two of the main criteria used to measure Chinese students' mathematics proficiency.

One or more of the five parts of mathematics proficiency to help children learn mathematics with understanding were explored. Conceptually Based Instruction (CBI), for example, focused on building relationships using different representations, which are used as tools for solving problems, demonstrating and recording children's strategies for solving problems, and communicating their strategies; Cognitively Guided Instruction (CGI) focused on teachers' understanding of children's mathematical thinking; Supporting Ten-Structured Thinking (STST) project provided explicit guidance and support for making connections between representations; The Problem-Centered Mathematics Project (PCMP) focused on computational procedures that build directly on children's number concepts and their knowledge of properties of number operations. The findings from these projects show that "When students learn skills in relation to developing an understanding, not only does understanding develop, but mastery of skills is also facilitated" (Wu, 2008). Although each of these projects has helped children understand mathematics in different ways, "in reality they are not isolated but integrated". However, more studies are needed to tie conceptual understanding, procedural fluency, and competency in word problem applications into a connected network that builds student mathematics proficiency on a solid knowledge base.

According to NCTM (2000), "Assessment should support the learning of important mathematics and furnish useful information to both teachers and students". However, studies reveal a problem in assessment: "Less attention appears to have been paid to how teachers' assessments might help improve mathematics learning". The integration of assessment and learning as an interacting system has been too little explored. A good assessment would be the tasks they frame create a strategic space for students' work and for gaining insight into students' thinking. Nevertheless, researchers recognized that assessing mathematical proficiency, especially assessing understanding, is not an easy task, and it requires combining knowledge from a number of sources (NCTM, 2000).

To construct a valid and practical assessment for measuring proficiency, Wu (2008) provides five indicators of student mathematics proficiency. Among them, conceptual understanding, procedural fluency, and problem solving in application are the essential components of the proficiency strands. These three components are also addressed in the guiding principles of the California Mathematics Framework: To achieve balance within mathematics – basic computational and procedural skills, conceptual understanding, and problem solving.

Based on the core strands of proficiency from NRC (2001) and the guiding principles of the California Mathematics Framework, Wu developed a unique approach in the model–strategy-application (MSA) to build a knowledge base for measuring pre-service teachers' knowledge of mathematics teaching and for improving their mathematics learning. Later, this model was adapted in a teaching ability study (Wu, 2008) as a measurement tool to gauge teacher changes. The model displays a structure of the knowledge base, indicating the conditions that must be met in order to achieve effective teaching: a teacher must focus on creating a variety of visual models to aid in addressing and proving mathematical concepts, building strategies for procedural and computational fluency, and applying the strategies to solve real-life word problems.

According to Herrmann (2013), in an increasingly interconnected world, where resources and information are more abundant and powerful than ever, can no longer ignore the new and unique challenges brought about by the 21st Century. He even mentioned what was written by Howard Gardner, "…The world of the future – with its ubiquitous search engines, robots, and other computational devices – will demand capacities that until now have been mere options. To meet this new world on its own terms, we should begin to cultivate these capacities now".

Just what are these new capacities and how do we cultivate them? As researchers and educators often do, several theoretical and research-based frameworks have been offered to help lead the way. In one of the more popular frameworks, Tony Wagner identifies these skills as Critical Thinking and Problem Solving, Collaboration Across Networks and Leading by Influence, Agility and Adaptability, Initiative and Entrepreneurialism, Effective Oral and Written Communication, Accessing and Analyzing Information, and Curiosity and Imagination (Herrmann, 2013).

The Common Core Standards for Mathematical Practice offers a new way of thinking about what it means to be mathematically proficient. These standards reflect a vision of proficiency that is a far cry from traditional routine memorization and regurgitation of facts and procedures. Rather, these standards for mathematical practice map directly onto Wagner's Survival Skills. The skills that will make a person mathematically proficient are the same skills that will make that person successful in the 21st century.

While Wagner talks about "Effective Oral and Written Communication," the Standards of Mathematical Practice talks about the need to "Construct viable arguments and critique the reasoning of others." "Accessing and analyzing information" is on par with "Reason abstractly and quantitatively." It's hard to exercise "Agility and

Adaptability" without knowing when and how to "Use appropriate tools strategically." "Critical thinking and Problem Solving" is nearly identical to "Make sense of problems and preserve in solving them" (Herrmann, 2013).

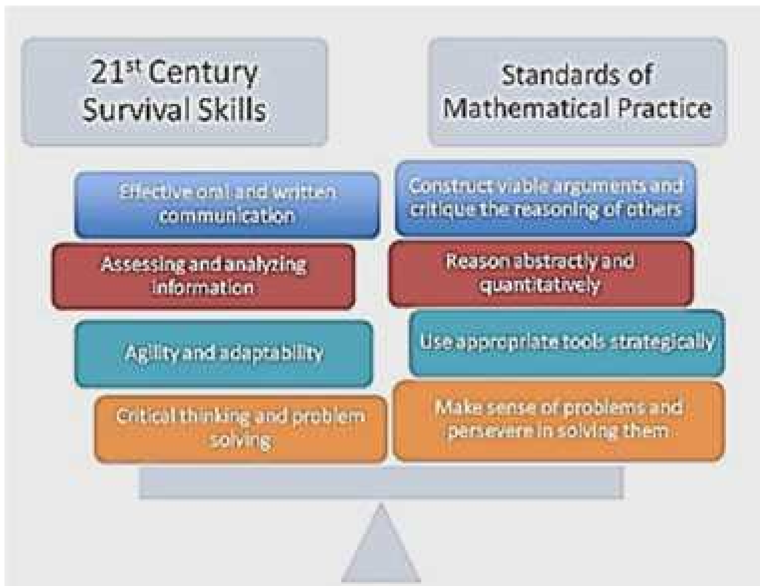


Figure 2. 21st Century Survival Skills and Standards of Mathematical Practice

Herrmann (2013) added that these components must characterize the learning environment. That is, in order for learning to take place, these things must be fostered within the classroom environment. The more curiosity and imagination students have, the more initiative and entrepreneurism they demonstrate, and the more they collaborate and lead, the riper the environment is for learning.

The way Mathematically Proficient students are defined by the Standards for Mathematical Practice, proficiency with these skills has implications far beyond mathematics. These skills are the essential skills one need in every field in the 21st Century – technology, medicine, law, politics, education, business, finance, and more.

Social – Contextual Theory

A social - contextual perspective of learning has been discussed by several people including Lee and Shute (2010). Lee and Shute emphasized that social-contextual factors involve the variables that originate from outside of the student. There is no black-and-white distinction between personal and social-contextual factors. In fact, these two groups of factors are so intertwined that it is sometimes hard to discern their origin (i.e., inside or out- side of the student). For instance, students' engagement with schoolwork can originate from the student's own motivation but may also be heavily influenced by the social context. They categorized major factors into one or the other, based on the locus of control on the student's part. That is, the locus of control shifts from inside-to-outside of the student: from student engagement to learning strategies to social-contextual influences. Many of the student engagement variables reside within a student's mind, will, and/or attitude. Schools can teach students about particular learning strategies, but it is the student herself who ultimately decides to employ (or not) the instructed or learned strategies. On the other hand, the locus of control shifts more to the outside world when considering social – contextual factors.

Lee and Shute (2010) posited that the main components of school climate include teacher interaction, principal leadership, and a unique atmosphere of a particular school created by the school's mission and emphasis. Whereas social-family influences can contribute to school climate through parental involvement or peer norms, they formed the social-familial influence factor as a separate entity in their framework as parents and peers can exert their influence on behavior and attitudes of learners within and outside of school.

Variables within the factors are presumed to be reciprocally interacting with each other. For instance, the two personal factors—student engagement and learning strategy—interact and influence each other. That is, highly engaged students are likely to employ well-developed learning strategies, and students who effectively use various learning strategies would likely maintain a high level of engagement (Fredricks et al., 2004; Pintrich & DeGroot, 1990; Zimmerman, 1990, as cited by Lee & Shute, 2010). In relation to the social-contextual factors, it is conceivable that parents can initiate and motivate a school's climate in a certain direction, and vice versa—schools' particular programs and policies can motivate parents and students to engage in positive (or negative) behaviors. Lee and Shute also established a bidirectional relationship in their PSCF framework between the personal and social-contextual factors. Although it is more likely that social-contextual factors exert a greater influence on personal factors (e.g., parents' influence on their children's learning) than vice versa, it is also possible that individuals' personal factors can change the dynamics in social-contextual factors (e.g., a child attaining good or improved grades can increase parents' expectations and aspirations for the child, which are positively associated with school achievement; see Fan & Chen, 2001). Ultimately, they argue that the personal and social-contextual factors, independently and together, influence academic achievement.

Included in the PSCF framework of Lee and Shute (2010) are two major categories of constructs (i.e., school climate and social-familial influences) under social-contextual factors that are believed to impact students' academic achievement. The framework illustrated the school climate construct: its definition, subcomponents, and empirical links to students' reading and mathematics achievement. *School climate* is defined as the organizational characteristics that are persistent in and unique to a particular school (Lee & Shute, 2010). The term *school climate* has been used interchangeably with other terms such as *school culture*, *school atmosphere*, *school environment, learning environment, sense of community,* and *academic climate* (Hoy & Hannum, 1997, as cited by Lee & Shute). Hoy and his colleagues have suggested subcomponents of school cli- mate to be academic emphasis, teacher affiliation, collegial leadership, principal influence, and resource support. Others have highlighted different dimensions of school climate (e.g., community influences and school policies, class size, demographics), but they employ the conceptualization by Hoy and his colleagues in the school climate construct, mainly due to their underlying theme of the roles of motivation, affect, and cognition in shaping the climate of a particular school. Their conceptualization focuses on how students and teacher "feel" in the school (i.e., academic emphasis and collegial leadership), how teachers "feel" and "think" about their teaching and working with other colleagues in the school (i.e., teacher affiliation), and what the principal "thinks" and is "motivated" to do about the school' activities and vision (i.e., principal influences).

Similarly, Vygotsky (1981) claimed that individual mathematical development and learning are influenced by communication with others in social settings. In his view, interacting with peers in cooperative social settings gives the learner ample opportunity to observe, imitate, and subsequently develop higher mathematics proficiency. This theoretical perspective, then, emphasizes human interactions as a key factor to facilitate mathematics learning (Chapman, 2005).

Everything people learn takes place in a social context. From birth and throughout their lives, their interactions with others shape their understanding of the world. Learning occurs as parents talk with their children, as children play together, and as teachers assist students. Even as they sit reading a novel by themselves, they interact with the author, the social and cultural context of the novel, and, in some sense, others who have read the same book. Learning takes place through people interactions and communication with others. These ideas are based heavily on the work of Russian teacher and psychologist Lev Vygotsky, whose theory of learning has been developed and put into practice in schools by many other teachers and researchers.

While Piaget focused on the individual child's progress through biologically determined learning stages, Vygotsky called attention to the ways in which social environments influence this learning process. Vygotsky proposed the idea that learning and development take place in the interactions children have with peers as well as with teachers and other adults. These social interactions develop language—which supports thinking—and they provide feedback and assistance that support ongoing learning. In a variety of ways, these social interactions form the basis of the understandings that eventually become internalized in the individual. The classroom teacher plays a key role in shaping these social interactions when she carefully assesses students' current understandings and creates situations that allow students to grow further. This is the notion of teaching as "assisted performance." Teachers can build on the ways children learn from each other by creating a learning environment where there are ample opportunities for student-to-student discussion, collaboration, and feedback.

On the other hand, consistent with Bronfenbrenner's theory, children's learning as influenced by interactions among people within and across different contexts - in this case between children, their families, and schools is conceptualized. In order to understand children's math learning, one must consider what the child brings to the task and what support systems are available at home and school. For example, Crosnoe, Leventhal, et al. (2010), found that young children's math development as they transitioned into school was a function of home, preschool and school stimulation.

Mathematics problems often require established procedures and knowing what and when to apply them. To identify procedures, a student has to be familiar with the problem situation, familiarity of setting or society, and be able to collect the appropriate information, identify a strategy or strategies and use the strategy appropriately (Russell, 2010).

Contemporary learning theorists now recognize that some mathematical knowledge is present before entry into elementary school. They have continued to argue, however, that attention should be focused on mathematics learning during the elementary school years. The theoretical position taken is that differences in mathematics proficiency stems solely from classroom and home practices during the elementary school years (Stevenson & Stigler, 1992, as cited by Pezdek, et. al., 2002). Likewise, contemporary Piagetian theorists have acknowledged that young children possess informal mathematical proficiency (Lachance & Mazzocco, 2006). They too have continued to argue that attention should be focused on the elementary school years. The theoretical position taken is that young children from different sociocultural contexts develop few, if any, differences in informal mathematical proficiency, and that early proficiency differences are the result of practices during the elementary school years instead of any experiential deprivation during early childhood (Ginsburg & Allardice, 1984, as cited by Feldmann, 2012).

Vygotsky's four major criteria distinguish between elementary and higher mental functions: (1) the shift of control from environment to the individual; (2) the emergence of conscious realization of mental processes; (3) the social origins and social nature of higher mental functions; and (4) the use of signs to mediate higher functions (Wertsch, 1985; Doronila, 2012).

Social Context theory, as cited by Earle and Earle (2007), has a social psychological orientation. That is, the model is used to identify societal structures and socialization processes in a given prevailing *social environment*, as well as the associated patterns of social behavior they facilitate, or inhibit, among individuals in society at any given period of *time*. Social Context theory also provides a means of examining social agitation forces initiated by individuals and groups who seek to change or challenge broader societal structures and social beliefs, in order to establish new social behaviors.

Social environment dimension has three major components:

Societal structures (Shapers). These are macro social forces that shape the ways in which people approach their daily living activities and relationships either directly or indirectly. They are external to individuals, and include factors such as technology, social class, demography, urbanization, mass media, and the various social institutions that serve to influence the patterning of social behavior between and among individuals in society, such as family, education, religion, leisure, health, economy/work and government.

Social processes (perceptions, attitudes, values). Social processes comprise the internal forces (perceptions, attitudes, and values) that are central to the socialization of individuals in society. They tend to serve as 'societal supporters,' in that they provide a degree of consistency and uniformity in people's views, and a crucial facilitating (and in some cases non- facilitating) link between prevailing societal structures and common (accepted) social behavior patterns.

Common patterns of social behavior (social realities). The prevailing common patterns of social behavior represent the social realities that most individuals collectively acknowledge as guides to their thinking and actions. This incorporates consideration of the various folkways, mores (norms), and laws present in a society.

The time dimension is critical when examining the power of the existing societal forces in maintaining social behavior patterns, and the endeavors of individuals agitating for change to improve social conditions and better meet specific social needs. Indeed, there are time periods when the social context of society is more receptive to change, and also times when change is difficult. Astute politicians monitor the relationships between societal structures and social perceptions, attitudes, and values, when championing social reforms, or alternatively when pressing for restraint and stability. These positions are commonly aligned with being seen as progressive or conservative.

Consistency between macro pressures (societal structures such as class, technology, media), and micro pressures (perceptions, attitudes, and values) held by individuals at a given point in time, tends to drive the third component; namely, common patterns of social behavior or ‘outcomes,’ that are reflected in a community’s norms and laws. These are the social realities generally accepted by a society. Inconsistencies between macro societal structures and micro processes, by contrast, provide the momentum for social change. Proponents of change utilize this through initiating social agitation and creating social turbulence. Such conflicts can become social change movements instigated by those who consider the prevailing societal structures to be perpetuating social inequalities and dysfunctional outcomes, thereby failing to meet established and changing human needs.

Social Context theory can be used as a tool of analysis to identify, understand, and make predictions in relation to social issues and societal needs. More specifically, it can be applied to *social issues* that affect the life chances of individuals in society, and also to *social concerns* that have implications for present and future lifestyle challenges.

While Social Context theory is conceived to be applied by those in the disciplines of social psychology, psychology, and sociology, it can also be used by practitioners in human services professions, such as community development, social policy, social work, community work, community services, financial planning, public relations, education, and health. A social contextual framework offers the versatility to do this, because it is comprehensive in scope, systematic in structure, and provides ongoing currency because of its inherent time dimension. Analysis can start from any point in the social context, namely society structures (e.g., class), micro processes (e.g., attitudes), or social behavior patterns (e.g., societal or community norms). To a certain extent, the commencement point is influenced by professional orientation. Many sociologists identify a macro structure, psychologists a micro process, and community personnel (such as social workers, policy personnel, and politicians), patterns of social behavior as their initial particular focus.

Learning Theories

The history of learning theories sheds light on an ever-changing and evolving field. Through studying behavior, knowledge acquisition, and memory, promising new procedures and/or concepts have prompted discussion and further research regarding the nature of learning. Currently, within the field of education, constructivism has taken the limelight to how knowledge is constructed. Even as constructivism has and continues to be a main focus of learning theorists, the tools used in education have become increasingly powerful and crossed the crevasse between day-to-day life and education. These tools relate to one another under the umbrella we term technology.

Technology as a tool in learning has been embraced by some and disgraced by many, yet today's digital natives traverse virtual worlds without hesitancy or misgivings. Students are far more technologically savvy than the institutions that support them. This poses a problem as teachers try to reconcile personal constructivist pedagogies with a tool they are unaccustomed to or intimidated by. Yet, it's this very tool which opens the door to new and innovative applications of constructivist teaching and learning methods. According to Desai, Hart, and Richards (2008), "The vast amount of information that computers supply on a daily basis has allowed teachers and students new ways to explore education compared to ordinary instructional tools". Technology offers flexibility and adaptability reflective of pedagogies across various learning models based in constructivism.

The early roots of Constructivism are from the educational theories of John Dewey and Jean Piaget. Dewey set the foundation for constructivism by finding inquiry to be a key part of learning. Piaget's theories also helped to shape constructivism with the key concepts of assimilation, accommodation and schema. Combined, these theories constitute the beginning of the constructivist learning process by focusing on how learning is processed.

Constructivism was further developed through the works of Bruner, Vygotsky and Papert. Vygotsky's fundamental contribution to constructivism was the formal introduction of a social aspect to learning. Theorists who have contributed to the development of constructivism have a common theme which is knowledge is considered dynamic and constantly changing. Learning is an active process which involves the learners personal interpretations created through experience. Instructors take an interactive role providing scaffolding and collaboration for learners. Constructivist pedagogies are built from these foundations.

"In an educational context, pedagogy often refers to the teaching strategies, techniques or approaches that teachers use to deliver instruction or facilitate learning" (Wun, 2008). Constructivism, stated simply, contemplates how the learner constructs knowledge in a meaningful way. One way this is done is a focus on the types of tasks given to learners. Two guidelines used to determine if the task falls within constructivist pedagogy include if the task is meaningful and if it is authentic. To be considered a meaningful task, the learner should derive applicable, understandable knowledge from it. An authentic task is directly related to the course of study and is applicable to the real world.

Constructivism emphasizes the responsibility of learning lies within the student while the teacher acts as a facilitator of learning. Desai, Hart, and Richards (2008) stated, "Technology is also often assumed to be the catalyst of new pedagogical change". This paper clarifies pedagogical change impacted by technology within three constructivist based learning theories; activity theory, social constructivism, and situated learning.

Based on Marxist philosophy, Activity Theory was developed from the works of Vygotsky, Leont'ev and Luria (Jonassen, 2006). Aligning the importance of social interaction with cognitive development, Activity Theory provided an alternative to the more popular theories at the time. Traditional theories focused on cognitive development through internal activities separate from external activities while Activity Theory assumes that activity and learning cannot be separated (Jonassen, 2006). Learners produce cognitive tools through social interactions resulting from the cultural environment produced by an activity system.

The purpose of an activity system is to process an object which produces an outcome and that outcome is the production of knowledge (Jonassen, 2006). An activity system produces a product or object through the interaction of two subsystems which interact with each other in order to produce said object. The components of both sub-systems are interrelated and cannot produce the outcome individually. Components of the sub-systems include a subject, object, tools, rules, community and division of labor (Jonassen, 2006).

Activity Theory prior to technology was relegated to the physical classroom. Murphy and Manzanares (2008) list the elements of the system with the teacher as subject, teaching students as objects. Tools include eye contact, body language, textbooks and blackboard; rules include seating in rows facing the teacher, informal planning and no talking in class (Murphy & Manzanares, 2008). The community consists of teachers, students, parents and administrators, and the division of labor is strictly linear following a direct line down from the Department of Education, school district, community, school, principal to the teacher (Murphy & Manzanares, 2008).

With the advent of technology in the form of the virtual classroom, the rules and tools affecting an activity system differ dramatically from the environment of the physical classroom. According to Murphy and Manzanares (2008) instead of the tools being tangible, such as chalk and a blackboard, they take the shape of email, software and texting. The pedagogies associated with Activity Theory have been impacted due to technologies influence on the activity system components. The time and workload invested in the virtual classroom compared to the physical classroom is significantly heightened. Preparation, planning, evaluation and assessment in the physical classroom may be done informally and with ease Teachers in the virtual classroom must complete the same steps formally which result in a heavy investment of time and effort (Murphy & Manzanares, 2008). Murphy and Manzanares (2008) provided an example of students in a physical classroom handing in homework which the teacher assesses during class time and gives feedback if needed. In a virtual classroom homework must be downloaded, reviewed, marked appropriately and then sent back to the student. Technology is assumed to automatically increase production by completing tasks more efficiently and effectively but the initial impact requires a significant investment from the teacher.

Additionally the instructional design in a virtual classroom requires extensive planning and preparation which is not the case in the physical classroom. “E – teachers need the lead-time to get PowerPoint notes developed. They cannot start from scratch on a blank outline whiteboard” (Murphy & Manzanares, 2008). Virtual classrooms present some difficulty because few teachers have the knowledge and expertise needed to fully utilize educational multimedia, virtual learning environments and the types of educational transaction they support. While the components of Activity Theory may be scaffolded by technology, in order to be fully realized, teachers must invest a significant amount of time and effort in learning the technologies themselves.

Technology's greatest pedagogical impact within this theory may be in the area of social interaction. The exchange of personal, social and cultural norms determines the work environment which in turn creates the rules of performance in an activity system. In a physical classroom the personal, social and cultural clues are learned from direct social interaction in the form of body language, visual cues and facial expressions (Murphy & Manzanares, 2008). The application of technology in a virtual classroom removes all physical contact and the environment of the system must be determined through email, texting and discussion forums. This impacts the object of Activity Theory by shifting it from teaching students to helping them learn (Murphy & Manzanares, 2008).

The origins of Social Constructivism are attributed to post-revolutionary Russian psychologist Lev Vygotsky. Vygotsky (1981) expanded the Constructivist epistemology by arguing that social interaction plays a key role in the development of cognitive function and higher order thinking results from relationships between individuals. The distinction between constructivism and social constructivism is that in social constructivism learners are incorporated into a knowledge community based on language and culture (Vygotsky, 1981).

According to Social Constructivism, learning is a collaborative process which is differentiated between two developmental levels. Distinguishing between these levels as actual development and potential development resulted in Vygotsky's identification of the "zone of proximal development" (Vygotsky, 1981, p. 85). The zone of proximal development is the potential level of cognitive development a learner has if they are provided with the appropriate support. Scaffolding is the process that supports individual efforts through the structuring of interactions and the breakdown of instruction into steps that are manageable by the student in response to their level of performance.

Technology has impacted the pedagogies of Social Constructivism significantly. According to Desai, Hart, and Richards (2008) instructional design is a critical factor in the creation of effective online instruction. One of the most important steps in creating a successful e-learning environment includes the development of flexible technology-based course content. There must be a significant investment of time and effort on behalf of the instructor in order to create a successful e-learning environment. “Instructors find that e-learning is much more labor intensive and they have to acquire unusual skills, experience, and dedication to be successful than comparable traditional learning” (Desai et al., 2008).

Social interaction, a key component in the Social Constructivist pedagogy, is also dramatically altered by the impact of technology. “In a nutshell, each major transition in communication media from speech to print to video to electronic form has resulted in changes in our means to create, record, store, distribute, access and retrieve information” (Desai et al., 2008). As a result of these changes, the social interactions between students and students, and teachers and students have changed. Students are no longer dependent on the teacher as the main source of information. Web-based environments are important forums for joint problem solving, knowledge building and the sharing of ideas.

Because students learn in a social setting by communicating with more knowledgeable people, educators in an online environment must redefine their communication skills (Desai et al., 2008). A high degree of interaction between student and teacher is critical to the success of instruction (Desai et al., 2008). In a pre-technology setting, traditional classroom communication would have not required much forethought. Technology requires the teacher to remain active in communicating to students in order to maintain attention and motivation.

Part of social interaction in the context of an online learning environment includes learner participation in group work. Communication practices within virtual group work include email, texting and instant messaging, all of which provide for a “Social Presence” (Desai et al., 2008). Prior to technology, a social presence was communicated by dialogue and social clues such as facial expressions, non-verbal clues and inflection. Technology requires “a distinct interaction with learners and high technology devices” providing “a strong interaction between the learner, learner/instructor, and the content as well as other learners” in the distance education environment (Desai et al., 2008). Online learning management systems such as Moodle are based on Social Constructivism where a culture is fostered by the collaboration of groups to construct knowledge.

Curiosity

Historically, learning mathematics has been motivated by the belief that a study of mathematics helps students to learn to reason and apply such reasoning to everyday problems. It is believed that learning mathematics leads to learners’ cognitive development (Tripathi, 2009).

According to Schoenfeld (1989) as cited by Doronila (2012), the way people engage in mathematical activities is shaped by their conceptions of mathematics. There have been many studies that confirm that affective factors shape how students behave. For instance, perceived personal control and perceived usefulness of mathematics are all positively correlated with achievement in mathematics. However, it is unclear if there is a cause and effect relationship between affective factors and achievement in mathematics. It is interesting to note that Schoenfeld found that the strongest correlation was between mathematical performance and perceived mathematical ability.

As mentioned earlier that curiosity is viewed as a very important part of the learning process, it implies that it is also one key element in understanding, computing, applying, reasoning and engaging. When D. E. Berlyne began his path – breaking research on curiosity in the early 1950s, he recognized that the concept had become fragmented and proposed a categorization of different types of curiosity. He located curiosity on two dimensions: one extending between perceptual and epistemic curiosity and the other spanning specific and diverse curiosity. *Perceptual curiosity* refers to “a drive which is aroused by novel stimuli and reduced by continued exposure to these stimuli” (Berlyne, 1954; Doronila, 2012). It was intended to describe the exploratory behaviors of the subjects he studied. Epistemic curiosity refers to “a desire for knowledge and applied mainly to humans” (Loewenstein, 1994; Doronila, 2012).

Berlyne (1960) believes that curiosity is a motivational prerequisite for exploratory behavior. The term curiosity is used both as a description of a specific behavior as well as a hypothetical construct to explain the same behavior. Exploration refers to all activities concerned with gathering information about the environment. This leads to the conflict and question of whether exploratory behavior should be defined in terms of the movements that an animal or human performs while exploring or in terms of the goal or purpose of the behavior observed. A clear distinction between these two may not always be possible (Edelman, 1997; Doronila, 2012).

The evolutions of Berlyne's theoretical contributions are traced by contrasting his particular developments with seven characteristics of Hullian theory. Berlyne is seen to have dismantled each element and replaced it with a vastly different theoretical position and structure. Berlyne developed a truly general theory, which was then differentiated with special concepts in specific areas as diverse as thinking and aesthetics (Walker, 1980; Doronila, 2012).

Piccone (1999), as cited by Doronila (2012), discussed types of explorative behavior. The first distinction to make is intrinsic vs. extrinsic exploration. Intrinsic explorative behavior is performed for its own sake, independent of external reinforcement (Piccone, 1999, as cited by Doronila, 2012). Activities such as play, spontaneous activity, imaginative behavior (and other comparable activities) are thought of as intrinsic because it's difficult (or impossible) to subsume them into a general principle of survival (Keller, 1987, as cited by Doronila, 2012). Extrinsic explorative behavior is performed in order to receive an external reinforcement that is attainable only through that behavior. For example, at a job interview someone may show great curiosity in asking question about the company and interviewer but in fact just be motivated by the task of getting the job.

Building on Berlyne's (1967), as cited by Doronila (2012), two – dimensional model of curiosity (and his proposition that curiosity is induced by the stimulus properties of novelty, complexity, uncertainty, and conflict), Kashdan, et al. (2004) presented the development of a new dispositional measure of curiosity comprising (a) exploration or tendencies to seek out new information and experiences and (b) absorption or tendencies to become fully engaged in these rewarding experiences. Both facets are self – determined and reflect an appetitive motivational orientation. In 2009, Kashdan, et al. renamed exploration as stretching (motivation to seek out knowledge and new experiences) and absorption as embracing (willingness to embrace the novel, uncertain, and unpredictable nature of everyday life).

Litman (2005) cited in his paper 'Curiosity and the pleasures of learning: Wanting and liking new information' that curiosity is often described in terms of positive affectivity, and acquiring knowledge when one's curiosity has been aroused is considered intrinsically rewarding and highly pleasurable (Peterson & Seligman, 2001). However, it is noted that discovering new information may also be rewarding because it dispels undesirable states of ignorance or uncertainty rather than stimulates one's interest (Litman & Jimerson, 2004). These different views on the ways in which the attainment of knowledge can be pleasurable are reflected in two major theoretical accounts of curiosity: the optimal arousal model and curiosity – drive theory, respectively.

Curiosity – drive theory, according to Litman (2005), equates curiosity to relatively unpleasant experiences of ‘uncertainty’, the reduction of which is rewarding. In essence, curiosity – drive theorists assume that coherence which is preferred in our cognitions and percepts, is disrupted by stimuli that are novel, complex, or ambiguous. By gathering new information about the relevant stimulus, cognitive and perceptual coherence is restored. In support of the curiosity – drive approach, numerous studies have demonstrated that the presentation of new or unusual stimuli elicits approach behavior and sustained attention from humans.

Litman (2005) mentioned that an alternate account of curiosity and exploratory behavior was soon developed that argued humans are motivated to maintain an optimal level of arousal, which is pleasurable, whereas being over – or under – aroused is unpleasant. According to the optimal arousal model, when organisms encounter stimuli that are too intense, very high levels of physiological arousal are experienced that motivate avoidance behavior. On the other hand, if organisms are under – aroused they will be motivated to increase their arousal to an optimal level, and will explore the environment in search of stimuli that may excite their curiosity and generate positive feelings of interest. Based on this view, after new information has been obtained, boredom is assumed to quickly return, motivating organisms to seek new stimulation once again. Thus, contrary to the drive account, optimal arousal theorists assume that curiosity induction is rewarding, and involves feelings of interest rather than uncertainty.

Motivation

To be motivated means to be moved to do something. A person who feels no impetus or inspiration to act is thus characterized as unmotivated, whereas someone who is energized or activated toward an end is considered motivated. Mostly, everyone who works or plays with others is, accordingly, concerned with motivation, facing the question of how much motivation those others, or oneself, has for a task, and practitioners of all types face the perennial task of fostering more versus less motivation in those around them. Most theories of motivation reflect these concerns by viewing motivation as a unitary phenomenon, one that varies from very little motivation to act to a great deal of it.

Student motivation, for some time, has been described as one of the foremost problems in education. It is certainly one of the problems most commonly cited by teachers. Ames (1992), as cited by Ozturk (2012), stressed that motivation is important because it contributes to achievement, but it is also important itself as an outcome. According to Ames, goals serve as a mechanism or a filter which determine the process and interpretation of the incoming information. Unlike the goal – setting theory, the goal – orientation theory was developed in a classroom context to give an explanation to students' learning and performance. Goal – orientation is related to the student's perception of the causes why he/she is interested in learning a task. According to goal – orientation theory, individual's performance and her/his accepted goals are interrelated.

In 1991, Pintrich, Smith, Garcia, and McKeachie, as cited by Doronila (2012), developed the Motivated Strategies for Learning Questionnaire (MSLQ). The MSLQ is an 81 – item, self – report instrument designed to measure college students' motivational orientations and their use of various learning strategies (Pintrich, et al., 1991). In this model, a students' motivation is directly linked to their ability to self – regulate their learning activities; where self – regulated learning is defined as being metacognitively, motivationally, and behaviorally active in one's own learning processes and in achieving one's own goals (Eccles & Wigfield, 2002). This framework assumes that motivation and learning strategies are not static traits of the learner, but rather that "motivation and learning strategies are not static traits of the learner, but rather that "motivation is dynamic and contextually bound and that learning strategies can be learned and brought under the control of the student" (Duncan & McKeachie, 2005). Stated in another way, students' motivations change from course to course (e.g., depending on their interest in the course, efficacy for performing in the course, etc.), and their learning strategies may vary as well, depending on the nature of the course.

Self – efficacy theory was introduced by Bandura (1977), as cited by Ozturk, 2012, who defines self – efficacy as 'individuals' confidence in their ability to organize and execute a given course of action to solve a problem or accomplish a task, and also as people's beliefs about their capabilities to exercise control over events that affect their lives. Pintrich et al. (1991), as cited by Ozturk, 2012, also define self – efficacy as a self – appraisal of one's ability to perform a task, and it contains one's belief and confidence in oneself to achieve that specific task. Bandura (1977), as cited in Eccles and Wigfield, 2002, proposes that 'individuals' self – efficacy expectations are the major determinants of goal setting, activity choices, willingness to expend effort, and persistence. Their sense of efficacy affects their selection of activities, and how much effort they give.

Overall, the social – contextual and psychological constructs under consideration are all theoretically related to mathematical proficiency. Figure 3 presents the schematic diagram showing the theoretical framework of this study; the symbolic interactions and relationships between and among the variables and theories are purposely made to give the general picture of how this study would be guided by them. In a sixth grade mathematics classroom, the researcher notes the above factors in looking into students' mathematical proficiency. This study will provide exploratory investigation of sixth grade pupils' student background, school background, curiosity, and motivation as they attempt to solve mathematical problems.

For this study, social – contextual is integrated with conceptualizations from educational psychology. The present study examined relations between social - contextual and psychological constructs, and the intertwining variables that may influence mathematical proficiency.

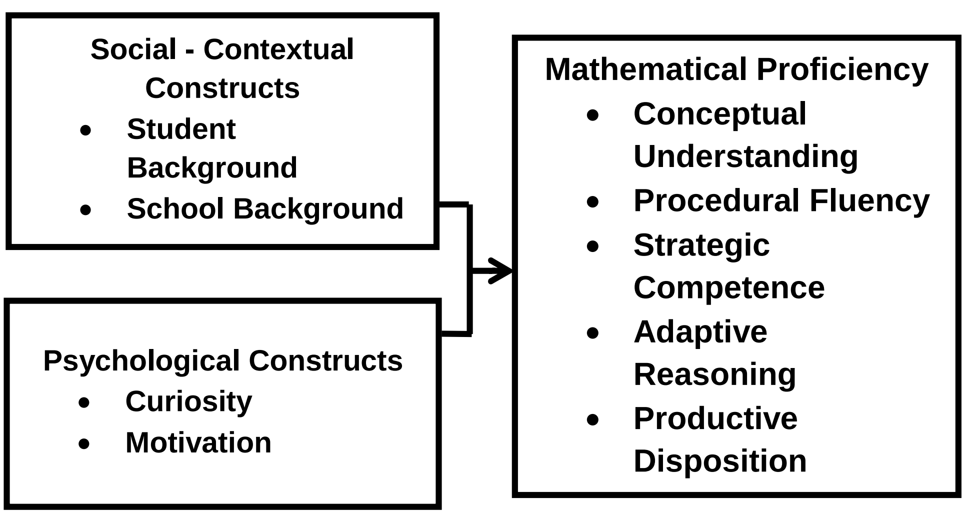


Figure 3. Conceptual Paradigm

The schematic diagram showing the conceptual framework in Figure 3 illustrates the linkage between and among the theories discussed. Anchored on the theories and models on sociology, psychology and mathematical proficiency, structural equations modeling (SEM) technique will be used to test the empirical validity and general acceptability of the model that depicts the schematic diagram of the conceptual framework.

Whether the respondents of this study show high or low level of mathematical proficiency, the concerns of this study are: (1) the intertwining characteristics of and the interactions between and among the independent variables namely student background, school background, curiosity, and motivation; and (2) the significance and relationships of these independent variables to mathematical proficiency.

Statement of the Problem

This study aims to determine the social – contextual and psychological constructs influencing the mathematical proficiency of sixth grade pupils.

Specifically, this study seeks to answer the following questions:

1. How may the sixth grade pupils be described in terms of

   1.1 Social – Contextual Constructs

      1.1.1 Student Background;

      1.1.2 School Background;

   1.2 Psychological Constructs

      1.2.1 Curiosity in Mathematics and

1.2.2 Motivation in Mathematics?

2. What is the level of pupils' mathematical proficiency in terms of

   2.1 Conceptual Understanding;

   2.2 Procedural Fluency;

   2.3 Strategic Competence;

   2.4 Adaptive Reasoning and

   2.5 Productive Disposition?

3. Which social – contextual constructs influence mathematical proficiency?
4. Which psychological constructs influence mathematical proficiency?
5. Are the interactions between the social – contextual and psychological constructs statistically significant?
6. What model(s) could be proposed to describe the social – contextual and psychological composition of sixth grade pupils' mathematical proficiency?

Research Hypotheses

Based on the conceptual paradigm, with the assumption that the sample was representative of target population, the following hypotheses will be tested in this study:

1. Student and school backgrounds do not significantly influence mathematical proficiency.
2. Curiosity and motivation do not significantly influence mathematical proficiency.

3. Social – contextual and psychological constructs do not significantly interact with one another.

Significance of the Study

To think about the student and school backgrounds of a sixth grade pupil, as well as the curiosity and motivation in learning mathematics is to propose educational environments that (1) set social – contextual and psychological constructs that influence mathematical proficiency, (2) that improve the level of mathematical proficiency, and (3) that favor mathematics as a tool in nation building.

Studying the social – contextual and psychological constructs that influence mathematical proficiency of sixth grade pupils in Batangas Province is not only significant to grade schools in the said province, but practically to all grade schools in the Philippines. This is because, based on the researchers' readings, no other study has been done related to the social – contextual and psychological constructs of mathematical proficiency among sixth grade pupils. In other words, this study is a break – through in mathematics education.

Specifically, this study will help increase the school administrators' awareness of the factors that influence mathematical proficiency. The information will aid them in enhancing the instructional program of the school. It is assumed that by gathering information, by observation and interpreting what is found, patterns and generalizations will emerge. Through the result of this study, administrators may plan various educational activities such as faculty development programs that will enhance the proficiency level of pupils in mathematics. They will likewise be informed of the level of pupils' proficiency in mathematics that can help them modify policies and mode of instruction. Development of facilities and improvement of syllabus which are two great factors affecting quality education can also be evaluated and improved.

The mathematics teachers will be given additional data that will serve as guidelines on how to prepare lesson plans that will heighten the pupils' motivation, increase curiosity, and present lesson that will help the pupils learn how to learn mathematics. Such a review will have an important implication for Mathematics teaching. The teacher's methodology being predominantly process – oriented will play more significant role in assisting pupils under their tutelage in gaining higher mathematical proficiency.

On the part of the pupils, they will then become more conscious that their levels of mathematical proficiency are of great importance for them to develop to understand and decide practically and mathematically. Moreover, it will help the students to pupils to promote their awareness that the constant and almost automatic use of mathematics will enable them to explore and cope with the demands of the society. In a macroscopic view, they will become part of our country's human capital, our future nation builders and developers.

It is anticipated that the result of this study on social – contextual and psychological constructs that influence mathematical proficiency of sixth grade pupils will contribute to the development and improvement of Mathematics Education, thereby helping pupils to properly enhance and enrich their academic performance. This will also serve as an avenue for the future researchers to examine some other variables that may enhance the sixth grade pupils' mathematical proficiency.

Scope and Delimitation of the Study

This study investigated the factors that influence mathematical proficiency and focused on student and school backgrounds, curiosity, and motivation of sixth grade pupils in the Unified Schools of the Archdiocese of Lipa (USAL), Batangas, Region IV – A, Philippines. The participants of the study are sixth grade pupils in the catholic schools in Batangas Province who are enrolled during the school year 2014 – 2015. There are thirteen (13) participating catholic schools, the names of which are presented in Chapter 3.

The social – contextual constructs that were investigated in this study are student background and school background. Student background was analyzed using data on number of household members, father's level of education, mother's level of education, access to educational technology, level of performance in English, family formation, and level of parental involvement in child's education. On the other hand, the school background was investigated in terms of class size, ability grouping, school's support facilities, school's academic programs in Mathematics, and background attribute of the math teacher such as area of specialization, number of years spent in teaching, educational qualifications, honors and awards received, level of seminars/workshops attended, nature of participation in seminars/workshops, and work values.

The psychological constructs that were investigated in this study are curiosity and motivation. Curiosity was described in terms of exploration, absorption, epistemic curiosity, and perceptual curiosity. In addition, motivation was described in terms of goal orientation, task value and self – efficacy.

Mathematical proficiency was defined in terms of conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition. A mathematical proficiency test was developed to determine the participants' level of proficiency. Table 2 presents the topics included in the instrument.

Table 2
Table of Specifications of the Mathematical Proficiency Test

	STRANDS OF MATHEMATICAL PROFICIENCY				
TOPICS	**Conceptual Understanding**	**Procedural Fluency**	**Strategic Competence**	**Adaptive Reasoning**	**Productive Disposition**
Factors and Multiples	1	11	21	31	41
Angles	2	12	22	32	42
Fractions	3	13	23	33	43
Ratio and Proportion	4	14	24	34	44
Decimals	5	15	25	35	45
Percentage	6	16	26	36	46
Average	7	17	27	37	47
Volume	8	18	28	38	48
Triangles	9	19	29	39	49
Polygons	10	20	30	40	50
TOTAL (50)	**10**	**10**	**10**	**10**	**10**

The instruments used in this study were discussed in Chapter 3. These instruments were used to measure the variables present in this study.

It is believed that there are a lot of variables or constructs that may influence the nature of mathematical proficiency. However, this study is limited to probe on such nature only through the variables student background, school background, curiosity, and motivation.

Definition of Terms

The following terms are defined based on how they were used in this study:

CPMP Model. Also called CPMP – SEM or the structural equation model of the **contextual** and **psychological** constructs of **mathematical proficiency**. This refers to the theoretical model that evolved from the structure of contextual and psychological constructs in relation to the mathematical proficiency. This multi – level model evolved at the macro analysis of this study using structural equation modeling and was tested to be empirically valid and generally acceptable.

Ability Grouping. This refers to the explicit school policy regarding the selection of its students (Judd, 2014).In this study, it is one of the dimensions of school background, a social – contextual construct.

Adaptive Reasoning. This refers to the capacity to think logically about the relationships among concepts and situations (Kilpatrick, 2001). Such reasoning is correct and valid, stems from careful consideration of alternatives, and includes knowledge of how to justify the conclusions. In this study, it is one of the five strands that are interwoven and interdependent in the development of proficiency in mathematics.

Class Size. It refers to the number of students in a given course or classroom (Pritchard, 2013).In this study, it is one of the dimensions of school background, a social – contextual construct.

Conceptual Understanding. This refers to an integrated and functional grasp of mathematical ideas (Kilpatrick, 2001). In this study, it is one of the five strands that are interwoven and interdependent in the development of proficiency in mathematics.

Construct. This refers to the unobservable or latent concepts that this study can define in conceptual terms but cannot be directly measured or measured without error. It cannot be articulated by a single response that totally and perfectly provides a measure of it (Hair, Black, Babin, and Anderson, 2010). In this study, the constructs are the main variables, namely: student background, school background, curiosity, and motivation. In structural equation modeling, level of mathematical proficiency is considered a construct measured through a 50–Item test.

Curiosity. This pertains to the desire for acquiring new knowledge and new sensory experience that motivates exploratory behavior (Litman and Spielberger, 2003). In this study, this refers to the construct that captures the level of individual's epistemic curiosity, perceptual curiosity, exploration and absorption.

Dimension. This refers to the sub – construct or factor of the construct under investigation. These are also latent variables that are measured through sets of items articulated to provide measures that are not free of error. In this study, the dimensions are the sub – variables (e.g. exploration is a dimension of the construct curiosity).

Education Technology. It refers to an area of technology devoted to the development and application of tools (including software, hardware, and processes) intended to promote education (Lazaro, 2014). In this study, it is one of the dimensions of school background, a social – contextual construct.

Family Formation. This refers to the composition of a family where the child belongs (Ferguson, 2008). In this study, it is one of the dimensions of student background, a social – contextual construct.

Level of Mathematical Proficiency. This refers to the level of performance in mathematics through written test. In this study, it is the extent of using the five strands of mathematical proficiency in answering the test in mathematics.

Mathematical Proficiency. This refers to the complete aspects of expertise, competence, knowledge, and facility necessary for anyone to learn mathematics successfully (Kilpatrick, 2001). It has five components, namely: conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition.

Motivation. This refers to a student's willingness, need, desire and compulsion to participate in, and be successful in the learning process (Bomia, Beluzo, Demeester, Elander, Johnson, and Sheldon, 1997). In this study, motivation describes what drives to learn with emphasis on goal orientation, task value, and self – efficacy.

Parental Involvement in Child's Education. This refers to activities like when parents talk to their children about school, help them with their homework, expect them to do well, monitor their whereabouts, make sure their out – of – school activities are constructive and help them plan for high school. In this study, it is one of the dimensions of student background, a social – contextual construct.

Parsimony. This refers to the principle that guides the selection of the regression model with the fewest independent variables that can predict the dependent variable adequately (Berenson, et al., 2006). In this study, this principle was employed using Backward Elimination Method, which is largely a trial – and – error process for finding the best regression estimates starting with a regression equation including all the independent variables and then deletes, one at a time, those that do not contribute significantly.

Procedural Fluency. This refers to knowledge of procedures, knowledge of when and how to use them appropriately, and skill in performing them flexibly, accurately, and efficiently (Kilpatrick, 2001). In this study, it is one of the five strands that are interwoven and interdependent in the development of proficiency in mathematics.

Productive Disposition. This refers to the tendency to see sense in mathematics, to perceive it as both useful and worthwhile, to believe that steady effort in learning mathematics pays off, and to see oneself as an effective learner and doer of mathematics (Kilpatrick, 2001). In this study, it is one of the five strands that are interwoven and interdependent in the development of proficiency in mathematics.

Psychological Constructs. This refers to the set of variables of this study describing the psychological profile of the participants. These variables are curiosity and motivation.

School's Support Facilities. These refer to the things that enable the teacher to do his/her work very well and helping the learners to learn effectively. These include laboratories, workshops, libraries, and others (Lawanson and Gede, 2011). In this study, it is one of the dimensions of school background, a social – contextual.

School's Academic Programs in Mathematics. These refer to the programs that could help learners improve their performance in Mathematics, whether for advancement or for remediation. In this study, it is one of the dimensions of school background, a sociological construct.

Social – Contextual Constructs. These refer to the variables of this study describing the profile of the respondents. These variables are the student background and school background.

Strategic Competence. This refers to the ability to formulate mathematical problems, represent them, and solve them. This strand is similar to what has been called problem solving and problem formulation in the literature of mathematics education and cognitive science, and mathematical problem solving, in particular, has been studied extensively (Kilpatrick, 2001). In this study, it is one of the five strands that are interwoven and interdependent in the development of proficiency in mathematics.

Chapter II

REVIEW OF RELATED LITERATURE

This chapter presents the related literature. The literatures are grouped into concepts or variables of interest in the present study: mathematical proficiency, student and school backgrounds, curiosity, and motivation.

On Mathematical Proficiency

Recognizing that no term captures completely all aspects of expertise, competence, knowledge, and facility in mathematics, Kilpatrick et al. (2001) have chosen mathematical proficiency to capture what they believe is necessary for anyone to learn mathematics successfully. Mathematical proficiency has five components, or strands: (1) conceptual understanding, (2) procedural fluency, (3) strategic competence, (4) adaptive reasoning, and (5) productive disposition. These strands are not independent; they represent different aspects of a complex whole.

The five strands are interwoven and interdependent in the development of proficiency in mathematics. Mathematical proficiency is not a one – dimensional trait, and it cannot be achieved by focusing on just one or two of these strands. Some researchers argue that helping children acquire mathematical proficiency calls for instructional programs that address all its strands. As they go from pre-kindergarten to eighth grade, all students should become increasingly proficient in mathematics. That proficiency should enable them to cope with the mathematical challenges of daily life and enable them to continue their study of mathematics in high school and beyond. The five strands provide a framework for discussing the knowledge, skills, abilities, and beliefs that constitute mathematical proficiency. This framework has some similarities with the one used in the recent mathematics assessments by the National Assessment of Educational Progress (NAEP), which features three mathematical abilities (conceptual understanding, procedural knowledge, and problem solving) and includes additional specifications for reasoning, connections, and communication.

The strands echo components of mathematics learning that have been identified in materials for teachers. At the same time, research and theory in cognitive science provide general support for the ideas contributing to these five strands. Fundamental in that work has been the central role of mental representations. How learners represent and connect pieces of knowledge is a key factor in whether they will understand it deeply and can use it in problem solving. Cognitive scientists have concluded that competence in an area of inquiry depends upon knowledge that is not merely stored but represented mentally and organized (connected and structured) in ways that facilitate appropriate retrieval and application. Thus, learning with understanding is more powerful than simply memorizing because the organization improves retention, promotes fluency, and facilitates learning related material. The central notion that strands of competence must be interwoven to be useful reflects the finding that having a deep understanding requires that learners connect pieces of knowledge, and that connection in turn is a key factor in whether they can use what they know productively in solving problems.

Furthermore, cognitive science studies of problem solving have documented the importance of adaptive expertise and of what is called *metacognition:* knowledge about one's own thinking and ability to monitor one's own understanding and problem-solving activity. These ideas contribute to what we call strategic competence and adaptive reasoning. Finally, learning is also influenced by motivation, a component of productive disposition.

Although there is not a perfect fit between the strands of mathematical proficiency and the kinds of knowledge and processes identified by cognitive scientists, mathematics educators, and others investigating learning, the strands are reflecting a firm, sizable body of scholarly literature both in and outside mathematics education.

Conceptual Understanding

Conceptual understanding refers to an integrated and functional grasp of mathematical ideas (Kilpatrick, et al., 2001). Students with conceptual understanding know more than isolated facts and methods. They understand why a mathematical idea is important and the kinds of contexts in which is it useful. They have organized their knowledge into a coherent whole, which enables them to learn new ideas by connecting those ideas to what they already know. Conceptual understanding also supports retention. Because facts and methods learned with understanding are connected, they are easier to remember and use, and they can be reconstructed when forgotten. If students understand a method, they are unlikely to remember it incorrectly. They monitor what they remember and try to figure out whether it makes sense. They may attempt to explain the method to themselves and correct it if necessary. Although teachers often look for evidence of conceptual understanding in students' ability to verbalize connections among concepts and representations, conceptual understanding need not be explicit. Students often understand before they can verbalize that understanding.

A significant indicator of conceptual understanding is being able to represent mathematical situations in different ways and knowing how different representations can be useful for different purposes. To find one's way around the mathematical terrain, it is important to see how the various representations connect with each other, how they are similar, and how they are different. The degree of students' conceptual understanding is related to the richness and extent of the connections they have made.

Students' understanding of mathematical concepts is intimately tied to instruction: however, the influence of instruction is not long lasting. This was the phenomenon Katsberg (2002) explained when he began his study Understanding Mathematical Concepts: The Case of the Logarithmic Function. As a teacher, Katsberg was unable to see the variables at play in the students' understanding. It was mystifying. The findings in his study provided him with an explanation for what he experienced. They have also suggested to help his students understand mathematical concept, he found ways on how to alter their beliefs about understanding and mathematics while providing opportunities for them to use their ways of knowing explore mathematical concepts.

As a researcher, Katsberg examined questions that suggested some answers but raised many more questions. Do students' beliefs about mathematics and understanding provide a framework for their beliefs about a mathematical concept? Is students' understanding of different mathematical concepts composed of the same categories of beliefs? How is the understanding of students' who built their beliefs using their ways of knowing different from the understanding of the students in this study? Answers to such questions might benefit researchers, teachers, and students.

Cotton (2008) in his study Mathematical Communication, Conceptual Understanding, and Students' Attitudes toward Mathematics found out that challenging her students to communicate mathematics, both orally and in writing, deepened her students' understanding of the mathematics. Levels of understanding deepened when a variety of methods were presented and discussed where students could "grab onto" the ideas that best suited them. Deeper understanding occurred when students were probed with questions that made them reflect on their learning and reevaluate their reasoning. This occurred when students were expected to write more than one draft to math journals. By making students aware of their understanding through communicating orally and in writing, students realized that true understanding does not come from merely completing homework problems, but from evaluating and reevaluating their own and other's ideas and reasoning.

These conclusions are consistent with the research done by Wood, Cobb and Yackel's (1991), as cited by Kilpatrick, et al. (2001). Teachers realized in this study that they had to create opportunities for learning in which the students expressed their mathematical thinking, as well as listened to others. Just as what was revealed in Cotton's research, the authors of this study concluded that by listening to other's thinking, students reconstructed their own thinking and deepened their understanding. Teachers in Wood et al.'s study also believed the teachers' understanding of students deepened from listening to their students.

In Wood's (1999), as cited by Kilpatrick, et al. (2001), 18 – month investigation in which students' disagreement was resolved by argumentation, students were able to experience mathematics as a subject that relies on reasoning for the justification of ideas. Students were expected to follow the thinking and reasoning of others, then voice their disagreements. Challenging one's reasoning was an indication of deeper understanding. This occurred with my students as well. However, Cotton was not certain that the argumentation always resulted in deeper understanding for all students. Often times, my students commented that they were more confused at the end of the debate. These situations were beneficial to student understanding, but needed to be addressed by the teacher to clarify any misunderstanding. Overall, Cotton's research suggested that deeper mathematical understanding occurred when my students collaborated on ideas and constructed meaning through homework presentations and journal writing.

Procedural Fluency

Procedural fluency refers to knowledge of procedures, knowledge of when and how to use them appropriately, and skill in performing them flexibly, accurately, and efficiently (Kilpatrick, et al., 2001). In the domain of number, procedural fluency is especially needed to support conceptual understanding of place value and the meanings of rational numbers. It also supports the analysis of similarities and differences between methods of calculating. These methods include, in addition to written procedures, mental methods for finding certain sums, differences, products, or quotients, as well as methods that use calculators, computers, or manipulative materials such as blocks, counters, or beads.

Students need to be efficient and accurate in performing basic computations with whole numbers ($6 + 7$, $17 - 9$, 8×4, and so on) without always having to refer to tables or other aids. They also need to know reasonably efficient and accurate ways to add, subtract, multiply, and divide multi – digit numbers, both mentally and with pencil and paper. A good conceptual understanding of place value in the base-10 system supports the development of fluency in multi – digit computation. Such understanding also supports simplified but accurate mental arithmetic and more flexible ways of dealing with numbers than many students ultimately achieve.

Connected with procedural fluency is knowledge of ways to estimate the result of a procedure. It is not as critical as it once was, for example, that students develop speed or efficiency in calculating with large numbers by hand, and there appears to be little value in drilling students to achieve such a goal. But many tasks involving mathematics in everyday life require facility with algorithms for performing computations either mentally or in writing.

In addition to providing tools for computing, some algorithms are important as concepts in their own right, which again illustrates the link between conceptual understanding and procedural fluency. Students need to see that procedures can be developed that will solve entire classes of problems, not just individual problems. By studying algorithms as “general procedures,” students can gain insight into the fact that mathematics is well structured (highly organized, filled with patterns, predictable) and that a carefully developed procedure can be a powerful tool for completing routine tasks.

It is important for computational procedures to be efficient, to be used accurately, and to result in correct answers. Both accuracy and efficiency can be improved with practice, which can also help students maintain fluency. Students also need to be able to apply procedures flexibly. Not all computational situations are alike. For example, applying a standard pencil – and – paper algorithm to find the result of every multiplication problem is neither necessary nor efficient. Students should be able to use a variety of mental strategies to multiply by 10, 20, or 300 (or any power of 10 or multiple of 10). Also, students should be able to perform such operations as finding the sum of 199 and 67 or the product of 4 and 26 by using quick mental strategies rather than relying on paper and pencil. Further, situations vary in their need for exact answers. Sometimes an estimate is good enough, as in calculating a tip on a bill at a restaurant. Sometimes using a calculator or computer is more appropriate than using paper and pencil, as in completing a complicated tax form. Hence, students need facility with a variety of computational tools, and they need to know how to select the appropriate tool for a given situation.

Strategic Competence

Strategic competence refers to the ability to formulate mathematical problems, represent them, and solve them (Kilpatrick, et. al., 2001). This strand is similar to what has been called problem solving and problem formulation in the literature of mathematics education and cognitive science, and mathematical problem solving, in particular, has been studied extensively.

Although in school, students are often presented with clearly specified problems to solve, outside of school they encounter situations in which part of the difficulty is to figure out exactly what the problem is. Then they need to formulate the problem so that they can use mathematics to solve it. Consequently, they are likely to need experience and practice in problem formulating as well as in problem solving. They should know a variety of solution strategies as well as which strategies might be useful for solving a specific problem. For example, sixth graders might be asked to pose a problem on the topic of the school cafeteria. Some might ask whether the lunches are too expensive or what the most and least favorite lunches are. Others might ask how many trays are used or how many cartons of milk are sold. Still others might ask how the layout of the cafeteria might be improved.

With a formulated problem in hand, the student's first step in solving it is to represent it mathematically in some fashion, whether numerically, symbolically, verbally, or graphically. Fifth graders solving problems about getting from home to school might describe verbally the route they take or draw a scale map of the neighborhood. Representing a problem situation requires, first, that the student build a mental image of its essential components. Becoming strategically competent involves an avoidance of "number grabbing" methods (in which the student selects numbers and prepares to perform arithmetic operations on them) in favor of methods that generate problem models (in which the student constructs a mental model of the variables and relations described in the problem). To represent a problem accurately, students must first understand the situation, including its key features. They then need to generate a mathematical representation of the problem that captures the core mathematical elements and ignores the irrelevant features. This step may be facilitated by making a drawing, writing an equation, or creating some other tangible representation.

As revealed in the study Problem Solving and Computational Skill: Are They Shared or Distinct Aspects of Mathematical Cognition? (Fuchs, et al., 2010, as cited by Kilpatrick, et al., 2001), the major distinction between computation and problem solving is the addition of linguistic information that requires children to construct a problem model. Whereas a computation problem is already set up for solution, a word problem requires students to use the text to identify missing information, construct the number sentence, and derive the calculation problem for finding the missing information. This transparent difference would seem to alter the nature of the task, but no studies have examined how difficulty in one subdomain corresponds to difficulty in the other and whether students' cognitive characteristics differ as a function of where the mathematics difficulty resides.

By contrast, a related literature does focus on the interplay between math and reading. In these studies, math difficulty typically is defined on a broad measure tapping multiple aspects of performance, then subgroups are formed to determine how performance on mathematics domains differs with or without concurrent reading difficulty. Research has shown that students with difficulty in both math and reading (usually defined in terms of word recognition) experience more pervasive deficits in computation (e.g., Jordan & Hanich, 2000, as cited by Kilpatrick, et al., 2001) and problem solving (e.g., Fuchs & Fuchs, 2002; Hanich, Jordan, Kaplan, & Dick, 2001; Jordan & Hanich, 2000, as cited by Kilpatrick, et al., 2001). This may occur due to a different pattern of underlying deficits in domain-general abilities associated with comorbidity. Other work (e.g., Jordan, Hanich, & Kaplan, 2003; Landerl, Began, & Butterworth, 2004, as cited by Kilpatrick, et. al., 2001), however, has shown that students with general math difficulty, with and without reading problems, experience comparable deficits on number combinations. An older body of research suggested that specific math difficulty, usually defined as performance on a broad computational task, is associated with difficulties in nonverbal processing (spatial cognition, working memory) and procedural knowledge (Geary, 1993; Rourke & Finlayson, 1978, as cited by Kilpatrick, et al., 2001); concurrent reading and math difficulties reflect more pervasive language and working-memory problems.

Adaptive Reasoning

Adaptive reasoning refers to the capacity to think logically about the relationships among concepts and situations (Kilpatrick, et al., 2001). Such reasoning is correct and valid, stems from careful consideration of alternatives, and includes knowledge of how to justify the conclusions. In mathematics, adaptive reasoning is the glue that holds everything together, the lodestar that guides learning. One uses it to navigate through the many facts, procedures, concepts, and solution methods and to see that they all fit together in some way, that they make sense. In mathematics, deductive reasoning is used to settle disputes and disagreements. Answers are right because they follow from some agreed upon assumptions through series of logical steps. Students who disagree about a mathematical answer need not rely on checking with the teacher, collecting opinions from their classmates, or gathering data from outside the classroom. In principle, they need only check that their reasoning is valid.

Many conceptions of mathematical reasoning have been confined to formal proof and other forms of deductive reasoning. Our notion of adaptive reasoning is much broader, including not only informal explanation and justification but also intuitive and inductive reasoning based on pattern, analogy, and metaphor. As one researcher put it, "The human ability to find analogical correspondences is a powerful reasoning mechanism."30 Analogical reasoning, metaphors, and mental and physical representations are "tools to think with," often serving as sources of hypotheses, sources of problem-solving operations and techniques, and aids to learning and transfer.

Some researchers have concluded that children's reasoning ability is quite limited until they are about 12 years old. Yet when asked to talk about how they arrived at their solutions to problems, children as young as 4 and 5 display evidence of encoding and inference and are resistant to counter suggestion. With the help of representation-building experiences, children can demonstrate sophisticated reasoning abilities. After working in pairs and reflecting on their activity, for example, kindergartners can "prove" theorems about sums of even and odd numbers. Through a carefully constructed sequence of activities about adding and removing marbles from a bag containing many marbles, second graders can reason that 5 + (-6) = -1. In the context of cutting short bows from a 12-meter package of ribbon and using physical models to calculate that 12 divided by 1/3 is 36, fifth graders can reason that 12 divided by 2/3 cannot be 72 because that would mean getting *more* bows from a package when the individual bow is *larger*, which does not make sense. Research suggests that students are able to display reasoning ability when three conditions are met: They have a sufficient knowledge base, the task is understandable and motivating, and the context is familiar and comfortable.

As mentioned by Sumpter (2013) on her study Mathematical Reasoning at Preschool Level, Mathematical reasoning is a part of several frameworks (e.g. NCTM, 2000) from preschool level all the way up to upper secondary school level. One of the goals that preschools should aim for is that children “develop their mathematical skill in putting forward and following reasoning”. This is a rather challenging goal especially considering that Swedish children struggle with mathematical reasoning and problem solving later, for instance in international test such as TIMSS (Skolverket, 2012). Despite this central role, there are not many frameworks that aim to characterize reasoning in detail (Lithner, 2008). Most often, the concept reasoning is used to describe a reasoning of high quality that is seldom defined.

Sumpter (2013) added that for young children, mathematical reasoning is often related to oral language skills (Charlesworth, 2005). One way of studying reasoning is to look at argumentation. We can, for instance, look at individual’s argumentation and different choices made when solving tasks e.g. Lithner (2008) or Sumpter (2013). This is fruitful when you want to study different types of reasoning produced by individuals in task solving such as imitative reasoning and creative mathematical founded reasoning (Lithner, 2008). However, it is plausible to expect other forms of reasoning generated when preschool children are trying to solve mathematical tasks and exercises, mainly because of different contexts where activities are taking place.

Productive Disposition

Productive disposition refers to the tendency to see sense in mathematics, to perceive it as both useful and worthwhile, to believe that steady effort in learning mathematics pays off, and to see oneself as an effective learner and doer of mathematics (Kilpatrick, et. al., 2001). If students are to develop conceptual understanding, procedural fluency, strategic competence, and adaptive reasoning abilities, they must believe that mathematics is understandable, not arbitrary; that, with diligent effort, it can be learned and used; and that they are capable of figuring it out. Developing a productive disposition requires frequent opportunities to make sense of mathematics, to recognize the benefits of perseverance, and to experience the rewards of sense making in mathematics.

A productive disposition develops when the other strands do and helps each of them develop. For example, as students build strategic competence in solving non – routine problems, their attitudes and beliefs about themselves as mathematics learners become more positive. The more mathematical concepts they understand, the more sensible mathematics becomes. In contrast, when students are seldom given challenging mathematical problems to solve, they come to expect that memorizing rather than sense making paves the road to learning mathematics, and they begin to lose confidence in themselves as learners. Similarly, when students see themselves as capable of learning mathematics and using it to solve problems, they can develop further their procedural fluency or their adaptive reasoning abilities. Students' disposition toward mathematics is a major factor in determining their educational success. Students who view their mathematical ability as fixed and test questions as measuring their ability rather than providing opportunities to learn are likely to avoid challenging problems and be easily discouraged by failure.

On Social – Contextual Constructs

Social – contextual factors usually take many forms and may help explain why human behavior goes wrong - or right, for that matter. Social – contextual factors reflect the region and socio-economic background from which one came from. These factors help shape thoughts, beliefs and actions. Examples are family, educational setting, university setting, friendships, religion (atheism and agnosticism are religions), peer pressures, exposure to violence, natural disaster or other trauma, diglossia (multi-language and multi-cultural exposure), administrations and offices, etc.

Two principal agencies, the family and the school powerfully shape children's learning experiences. The influence of these two agencies is constrained by the wider social and cultural systems into which they are embedded. There is great diversity in cultural backgrounds, social conditions, family arrangements and school organization. These two factors have been going through constant modifications (Reigeluth et al., 2005).

Students between the ages of 5 and 18 years of age are expected to learn in school. It is their primary job in society, and it's possibly the one thing that will prepare them to become productive members in their adult years. What they learn will also determine the choice they will make when they enter the workforce or continue onto higher education (Adelman et al., 2010).

Adelman et al. (2010) found out in his study of the factors affecting student proficiency in mathematics that in order for students to learn, there are several factors that must be considered. Most of these factors are external; they deal with social or cultural values. Also, it may be determined by the school's environment as well as the teachers and administrators.

Hakuta, et al. (2004) revealed in her study that variables in education may affect how second language learners acquire the new language. The socioeconomic variable, which may be an indicator of formal education opportunities, is significant. Academic language proficiency is much more difficult to obtain than social fluency; therefore students benefit from continuing to develop academically in their first language to improve success in the second language.

De Serf (2002) asked in her study The Effects of Family, Social, and Background Factors on Children's Proficiency in Mathematics the following questions: do some children have advantages that are not available to other children with differing backgrounds? In educational and economic studies, it has been found that background variables including family income, family type, family size, and parents' education are determinants of the amount and quality of education children receive over their lifetime (Rosetti et al., 2000). It is evident that familial and parental factors can either benefit or harm the chances of children receiving an education and excelling in a scholastic environment. More importantly to this paper, the disparity in educational levels among children and adults of different racial backgrounds has led scholars to question whether the background variables mentioned above have different effects dependent on specific racial groups.

According to Atanda et al. (2011) some of the reasons attributed to the observed poor achievement in Mathematics as submitted by scholars include; shortage of qualified Mathematics teachers, poor facilities, equipment and instructional materials for effective teaching, use of traditional chalk and talk methods, large pupils to teacher ratio and mathematics phobia/fright, limited background preparation in Mathematics, lack of Mathematics teaching equipment and materials, fright and anxiety, low level of interest and some government policy, lack of problem solving abilities, self-concept and achievement motivation.

Education is an extremely important determinant in earnings. This fact is why education has become increasingly important to future generations. The job opportunities once available to less educated individuals are becoming scarce as more employers are raising their employment standards. College graduates are replacing employees with high school degrees. As the job market changes, individuals of all races and backgrounds should have the skills, education, and opportunities to compete at the same levels (De Serf, 2002).

Kupari (2006) analyzed the relationships between student, teacher and school background factors and mathematics achievement in Finland. The study was based on the TIMSS 1999 data and totally 24 variables were analyzed by using two-level HLM-models. The main results of this study showed that altogether eight variables had a statistically significant effect on students' achievement in mathematics. The student's self-concept in mathematics was found to have a particularly strong (reciprocal) association with achievement. In this short review, they deliberately concentrate on the background variables which have proven their significance in the national context and received strong support in the recent research literature as well.

Also. Kupari cited that the influence of *family background and socioeconomic status* in particular on mathematics achievement has been of great interest for a long time. The results from various studies have shown that the home background of students in schools is correlated to their mathematics achievement in school. The study of Brese & Mirazchiyski (2005), as cited by Kupari (2006) focused on the TIMSS 2004 and PISA 2005 studies and covered five aspects of home background: home possessions, immigration status of students and their parents, language use at home, parents' education and parents' employment situation. Their results revealed that there were quite a few variables which showed strong or moderate association with mathematics achievement, and they were parents' education, number of books at home, number of students' own books and computer at home.

The study of Alokan et al. (2013) revealed that there is a significant difference between the academic performance of students from parents who are highly educated and students from parents who are not highly educated. The probable explanation is that parents with high level of education and who know the importance of education would provide their children with necessary learning facilities and also assist their children with school work. Well educated people usually have small families. A parent with a small family will not only find it easy to provide for the physical needs of the child but will also be in a position to give him/her attention, encouragement, stimulation and support with his/her school work. This could have a motivating effect on a child from the small family in comparison with a child from a large family where the parents are always busy trying to find ways of meeting the basic needs of the family.

On the other hand, their study also showed that that there is a significant difference between the academic performance of students with study facilities at home and students without study facilities at home. A child whose effort to do well in school is supplemented by the provision of learning facilities at home would tend to do well and have high academic performance. This is more so when the parents of such child encourage him/her to make use of the study facilities.

Student Background

The research of Desforges and Abouchaar (2003) established that parental involvement has a significant effect on children's achievement and adjustment even after all other factors (such as social class, maternal education and poverty) have been take out of the equation between children's aptitudes and their achievement. Differences in parental involvement have a much bigger impact on achievement than differences associated with the effects of school in the primary age range. Parental involvement continues to have a significant effect through the age range although the impact for older children becomes more evident in staying on rates and educational aspirations than as measured achievement.

Of the many forms of parental involvement, it is the 'at – home' relationships and modeling of aspirations which play the major part in impact on school outcomes. Involvement works indirectly on school outcomes by helping the child build a pro-social, pro-learning self – concept and high educational aspirations. Research revealed large differences between parents in their levels of involvement. Differences are associated with the parents' values or feelings of self – confidence or effectiveness. Some parents do not see it as the part of their 'role' to be a partner in education. Others would like to participate but do not feel up to it. Yet others are put off involvement by memories of their own school experience or by their interactions with their children's teachers or by a combination of both (Desforges & Abouchaar, 2003).

Growing up in a cognitively stimulating home predicts children's immediate and longer-term academic development (Crosnoe & Cooper, 2010, as cited by Sonnenschein & Galindo, 2013). The home learning environment has been studied in different ways- -as a composite of exposure to artifacts, experiences and interactions, and as exposure to a specific variable (e.g., assistance with homework, parental expectations). This study considers the role of the home environment through children's participation in learning activities, parents' provision of learning tools (e.g., computers), parents' involvement at school and expectations for their children's current and future learning. Although young children's environments may provide many opportunities for the acquisition of early math proficiency (Ginsburg, Lee, & Boyd, 2008), they are particularly interested in documenting which experiences are most important, and whether this differs across groups of children. Accordingly, they took a broad-based approach to documenting home learning indicators.

While, Tuncay Saritas and Omur Akdemir (2009) in their study *Identifying Factors Affecting the Mathematics Achievement of Students for Better Instructional Design* mentioned that Parents' educational level has been shown to be a factor in academic achievement. Parents serve as a role model and a guide in encouraging their children to pursue high educational goals and desires by establishing the educational resources on hand in the home and holding particular attitudes and values towards their children's learning. In this case, the educational attainment of parents serve as an indicator of attitudes and values which parents use to create a home environment that can affect children's learning and achievement.

A number of studies indicated that student achievement is correlated highly with the educational attainment of parents (Saritas & Akdemir, 2009). For instance, according to Campbell, Hombo, & Mazzeo (2000) as mentioned by Saritas and Akdemir (2009), students whose parents had less than high school education obtained lower grades in mathematics than those whose parents had higher levels of education. Research has shown that parents’ educational level not only impact student attitudes toward learning but also impact their math achievement scores.

The knowledge of what specific home-based activities foster children’s math proficiency is still fairly limited. However, we know that playing math-related board and card games and helping with cooking and shopping positively predicts numeracy skills (Ramani & Siegler, 2014).

A recent line of research has shown the relation between children’s language skills and math proficiency (Garnier et al., 2007). Relatedly, Davis – Kean (2005) found that the frequency of engagement in reading predicted the reading and math proficiency of Black and Latino children 8 through 12 years of age. Engaging in reading activities increases children’s vocabulary which improves their understanding of the instructional language teachers’ use when teaching math (Sonnenschein et al., 2013). Accordingly, we documented children’s *reading learning activities* (frequency with which the child looked at book alone or with others).

General learning activities was also documented which included a range of activities (e.g., play games or do puzzles, talk about nature or do science projects), available through daily or recurrent experiences at home, which might broaden a child's general knowledge base and, hence, math knowledge and skills (Ginsburg et al., 2008).

Crosnoe and Cooper (2010), as cited by Sonnenschein & Galindo (2013), using the ECLS-K dataset, found that children who had access to cognitively stimulating materials or learning tools (e.g., computers) had higher math and reading proficiencies; access to such materials at home mediated the association between economic disadvantage and achievement. In addition to this, the study of Ku, Chen, Wu, Lao, Tak, and Chan (2013) indicated that both high – ability and low – ability students with the Game – Based Learning approach gained significant improvement on their confidence toward mathematics. In contrast, students with the paper – based setting did not show a significant improvement on their confidence toward mathematics due to a significant decrease of confidence toward mathematics from low – ability students. Regarding performance, students in both conditions gained significant improvements in their performance; however, the students with the digital game – based setting gained more improvement than their peers with the paper – based setting. Furthermore, the results showed that high – ability students in both groups attained a comparable level of performance while the low – ability students in the game – based condition gained more improvement in their performance than those in the paper – based condition.

The study of De Castro et al., (2014) tested whether a fun virtual environment can improve math proficiency levels and motivate children with difficulties in math to confront challenges involving mathematical skills. According to the literature, strategies embedded in entertaining games appear to motivate children more than those normally used in educational teaching games, suggesting that using entertaining game strategies could result in more efficient teaching. The results showed that the objective of the virtual environment was achieved. Statistical analysis of the results showed that the virtual environment helped significantly improved the scores on the post-test of the experimental group, whereas the control group did not improve their scores. The improvement in scores for children who had computer-based reinforcement compared with children who had reinforcement using traditional teaching confirmed that learning and training can change the human brain and generate measurable benefits for the children. The computer is an instigating, attractive and stimulating tool, in opposition to the use of notebook and blackboard of what children are used to. Thus, it is believed that using computer games in the teaching methods can stimulate the intellectual autonomy growth of children, since some students that are difficult to motivate in the classroom or that have difficulty to perform certain tasks in traditional classes, surprisingly and actively participate in the teaching strategies that include ludic methods (plays and games) and/or the use of computer.

In addition, using social media for educational purposes can be beneficial for student learning in multiple ways. As cited by Tarantino et al., (2013), social media enhances peer interactions, which can bridge diversity in the classroom and establish open lines of communication between students and educators). Social media also facilitates discussion and knowledge transfer between students, creating a deeper sense of understanding of the course material (Yu, et al., 2010). Thus, students who use social media are able to move beyond the memorization of material and create products that represent their own voices (. Finally, social media can aid in the achievement of both general and content specific student learning outcomes. Therefore, overall student learning can increase when educators incorporate social media into academic course content.

Parents' involvement at school, regardless of their racial/ethnic group, is associated with children's academic development (Galindo & Sheldon, 2012). Galindo and Sheldon (2012**)** found that parents' involvement at school positively predicted growth in children's math scores in kindergarten. Lee and Bowen (2006) found that involvement at school significantly predicted Black, Latino, and White third through fifth graders' academic competencies. However, Black and Latino parents are less involved in their children's schools than are White middle-income parents (Lee & Bowen, 2006). We documented whether parents attended various school events, volunteered at the school or in the classroom, and met with the teacher.

Parents' expectations for their children's academic progress and achievement serve as an indicator of the family norms and values associated with schooling (Galindo & Sheldon, 2011). There are differences, however, across racial/ethnic groups in the expectations parents have for their children (Suizzo & Stapleton, 2007), and in the relation between parents' expectations and children's achievement (Yamamoto & Holloway, 2010). Suizzo and Stapleton (2007), after controlling for mother's educational level, found that Black and Latino mothers of kindergartners expressed higher educational expectations than White mothers. Yamamoto and Holloway (2010) suggested that the relation between parents' educational expectations and children's educational outcomes is stronger for Whites than racial/ethnic minorities. They proposed that such relations are mediated by children’s motivation and sense of competency, parental involvement, and teachers’ expectations, and the relations may differ among racial/ethnic groups.

These studies explore parental expectations in two ways. It documents parents’ future educational expectations, a metric commonly used by others (Jeynes, 2005) that assesses the highest educational level parents expect their children to attain. We also consider current expectations, what skills parents expect their children to display in kindergarten. This more proximal measure may have stronger relations with current parent/child interactions and, therefore, with children’s achievement.

According to The Heritage Foundation (2015), children who do not live in intact families tend to be less proficient in math and science. Compared with peers in intact families, children in single – parent families, stepparent families, or non-parent guardian families scored, on average, lower on math and science achievement tests, according to a large international survey. Family resources (e.g., number of books in the home, number of possessions, immigrant status, and household size) only partially explained the relationship between family structure and math and science achievement.

Additionally, the result of the study of Ushie, Emeka, Owolabi, and Ononga (2012) revealed that the academic performance of students from single parent families and their counterparts from two parent families does not vary. This is because most single parent families are able to meet up with the educational needs of their children; in such home, the father or mother could be more concerned about the needs of the child since the second partner is not available. This is implies that the performance of students depends on their individual build up and aspirations in life, as students from single parent families compete and even do perform better in most cases than their counterpart from two parent families. As such, the father or mother though over burden and under immense home demands, keeps to time and tries to be at home with the children mostly at their adolescents. Perhaps, depending on the income, most children from single parent homes are sometimes sent to boarding schools, and all their needs provided. This result though contradicts findings in the literature, but somehow confirms the findings of Uwaifo (2008), as cited by Fonteboa (2012), that children raised in two – parent family structure are often stable emotionally and they suffer less emotional problems thereby making them less anxious in the pursuit of their academic work. However, he noted that this situation might not be true all the time since there are some children in single parent family structures who still perform academically better than children from two parent family structure.

School Background

Although researches have considered aspects of schooling and racial/ethnic issues (Parke & Kanyongo, 2012), there is little research investigating differences in classroom practices across racial/ethnic or other demographic groups (Chang, 2003). Existing research has focused mainly on children with different language backgrounds and supports the need for further investigation (Waxman, Padron & Lee, 2014). This study explored also the class size, remediation program in mathematics, ability grouping, classroom composition, and support facilities.

Many researchers and studies explored the effects of small class on students in the primary grades. Mosteller, as cited by Kornfeld (2010), proposed factors that made it likely that younger students benefited from smaller class size. When children first came to school, they were confronted with many changes and much confusion, entering this new setting from a variety of homes and circumstances. Many needed training in paying attention, carrying out tasks, and interacting with others in a working situation. In other words, when children start school, they have to learn to cooperate with others and generally become oriented to being students.

Biddle and Berliner (2002) offered tentative theories to explain why small classes had impressive effects in the early grades. This was when youngsters were first learning the rules of school and forming ideas about whether they can cope with education. Since there was more one-to-one interaction in smaller classes, teachers learned more about individual students. This translates into helping students develop more useful habits and ideas about themselves. Additionally, teachers in small classes had higher morale and thus created a more supportive learning environment.

Results of the study of Adams (2011), consistent with previous research, suggest that remedial math courses can affect test scores positively. Principal interviews provided insight to the structure and content of remedial math courses used in this study. The principals' responses to interview questions suggested common elements within each remedial course. The major implication for teachers of remedial math courses is to use organization, affiliation, and product-focus lessons. Implementing these strategies either singularly or in combination has the potential for strengthening math ability and increasing math scores. These components may have contributed to the success of remedial math courses as research is available that reveals the importance of these components in remediation.

Organization of knowledge was one common strategy principals revealed as part of the remedial math course. Organization of knowledge can be both physical and mental. For example, in remedial math, teachers may assist students in organizing their notebook or they may assist students in understanding how to correctly subtract multi-digit problems by aligning numbers. Organization of knowledge is a math strategy that is often associated with math achievement in remedial programs (Williamson et al., 2004).

On the other hand, the study of James and Folorunso (2012) revealed that feedback and remediation would afford learners opportunity to go through the appropriate answers thereby providing further insight on the content which would also induce improved performance in subsequent attempts. In fact, the study showed that a combination of feedback with remediation would be more effective in facilitating students' learning in junior secondary school mathematics. The findings of the study further revealed that gender and socio–economic status of students were found to exert no significant effect on learners' cognitive attainment in junior secondary school mathematics.

The study recommended that mathematics teachers in junior secondary school need to motivate their students and help them to build positive attitude towards mathematics by providing the learners with regular diagnostic tests and adequate feedback with necessary remediation. The present system of continuous testing without feedback or remediation in our schools should be discontinued by the teacher. School administrators should allow and provide necessary incentives for teachers to attend seminars, workshops, conferences and in – service programs to keep them abreast of current research findings in teaching strategies and methodologies in order to enhance their effectiveness. Head teachers should emphasize to their teachers on regular basis the need for formative test with adequate feedback and remediation. Finally, effective feedback and remediation require extra effort and time and with the current population explosions in our schools, government should employ more mathematics teachers to handle the teaching of mathematics with regular assessment and remediation to be provided the learners.

Grouping of students with similar needs developed affiliation in the remedial math courses examined in this study. All students in the remedial math class were missing skills necessary to meet their grade – level math standards. Affiliation is another theme that can be found in research as an effective method of instruction and remediation (Adams, 2011). Affiliation involves interaction between students and their peers and teachers. Through this interaction, students are able to develop understanding of important concepts and create connections to assist them in effectively learning the material. Affiliation is important in remedial programs. The students who needed remediation did not fully understand and make connections to the material being taught. Affiliation can assist in making these connections, making remediation successful (Hoffman & Brahier, 2008).

The significance of compositional results at the school and classroom levels is well-documented. Children in schools with a lower concentration of minority children or with a larger concentration of high-SES students have higher test scores (Ready &

Silander, 2011). Hoxby (2000) found that the achievement level of their classroom peers affected individual children's achievement. Relatedly, Hanushek, Kain, Markman, and Rivkin (2003) found comparable positive effects of classroom achievement levels on the achievement of children at different levels of the achievement distribution. Accordingly, we investigated whether the percentage of children with proficient math skills influenced children's math skills and whether this varied with children's race/ethnicity and math proficiency level.

Tuncay Saritas and Omur Akdemir (2009) in their study *Identifying Factors Affecting the Mathematics Achievement of Students for Better Instructional Design* mentioned school facilities could be an important factor in student achievement. In fact, identifying factors related to the school facilities has become a research focus among educational practitioners. For instance, researchers found a negative impact on student achievement where deficiencies of school features or components such as laboratories, library, and function halls. In terms of the condition of school building, Cash (2003), as cited by Saritas and Akdemir, found student achievement scores in standard buildings to be lower than the scores of students in above standard buildings. In addition, Rivera – Batiz and Marti (2005) conducted multiple regression statistical analysis to examine the relationship between overcrowded school buildings and student achievement. The findings indicated that a high population of students had a negative effect on student achievement.

In addition, Atanda, et al. (2011) mentioned in their study several studies revealed that there is a significant relationship between library and students' performance in mathematics. For instance, Keith (2004) in his study found that the size of a library media program as indicated by the size of its staff and collection is the best school predictor of mathematics achievement of students. In addition, the instructional role of the library media specialist shapes the collection and in turn academic achievement. Finally, the degree of collaboration between library media specialist and classroom teacher is affected by the ratio of teachers to pupils. In a related study, Waldman (2003) discovered that students visit library for different purpose. This purpose therefore will have strong influence on their performance in mathematics.

On Curiosity

"The fuels of enthusiasm and growth are curiosity and challenge", said John Keller, Florida State University.

Renner (2006) reported that curiosity has been conceptualized as desire for new information and knowledge. Given the importance of curiosity for learning and development, personality theorists developed various measures to assess individual differences in curiosity. Most current measures for that curiosity explore the desire to gain knowledge or sensory experience (e.g., interest in intellectual conundrums or interest in new sights and sounds), but these instruments do not measure social curiosity, defined as an interest in how other people behave, think, and feel. However, social curiosity is important for the building and use of social networks and relationships, which has been suggested as a central human task (Pickett, Gardner, & Knowles, 2004, as cited by Renner, 2006).

It has long been the tradition to distinguish among various facets of curiosity rather than viewing it as a monolithic construct. For instance, Berlyne (1954), as cited by Renner (2006), already drew a distinction between perceptual and epistemic curiosity. Building on this conception, interest in curiosity has recently gained momentum, as shown by the development of new scales to assess its various facets. For instance, perceptual curiosity refers to the acquisition of new information by sensory stimulation (e.g., sights, sounds, odors) and is assessed by the recently developed Perceptual Curiosity scale (Collins, Litman & Spielberg, 2004). Another facet of curiosity refers to the tendency to seek out opportunities for acquiring facts, knowledge, and ideas, which is measured by the Epistemic Curiosity Inventory (Litman & Spielberg, 2003). Of interest, the correlation of perceptual and epistemic curiosity is moderate, supporting the nation of distinct dimensions of curiosity.

While many of these researchers have attempted to define curiosity, there exists no widely accepted definition at the present time. Curiosity has been viewed as a very important part of the learning process. It is thought to be a strong motivator for learning. Several researchers have attempted to relate curiosity to various measures of academic achievement, learning performance, and understanding (Unal, 2005).

According to Stumm, Hell, and Chamorro – Premuzic (2011), curiosity may have killed the cat, but it's good for the student. That's the conclusion of their new study published in *Perspectives in Psychological Science*, a journal of the Association for Psychological Science. The authors show that curiosity is a big part of academic performance. In fact, personality traits like curiosity seem to be as important as intelligence in determining how well students do in school. Furthermore, they indicated that intelligence is important to academic performance, but it's not the whole story. Everyone knows a brilliant kid who failed school, or someone with mediocre smarts who made up for it with hard work. So psychological scientists have started looking at factors other than intelligence that make some students do better than others.

One of those is conscientiousness – basically, the inclination to go to class and do your homework. People who score high on this personality trait tend to do well in school. "It's not a huge surprise if you think of it, that hard work would be a predictor of academic performance" (Stumm, Hell, and Chamorro – Premuzic, 2011).

Stumm and her coauthors wondered if curiosity might be another important factor. "Curiosity is basically a hunger for exploration," (Stumm). "If you're intellectually curious, you'll go home, you'll read the books. If you're perceptually curious, you might go traveling to foreign countries and try different foods." Both of these, she thought, could help you do better in school.

The researchers performed a meta-analysis, gathering the data from about 200 studies with a total of about 50,000 students. They found that curiosity did, indeed, influence academic performance. In fact, it had quite a large effect, about the same as conscientiousness. When put together, conscientiousness and curiosity had as big an effect on performance as intelligence.

In mathematics, especially in determining mathematical proficiency, the importance of understanding the concepts has been recognized. Solving mathematical problems starts with reading the problem and analyzing it, determining what is given and what is being asked (conceptual understanding). Maw and Maw's (1972) findings, as cited by Unal (2005), open up another dimension of the role of curiosity on gaining proficiency in mathematics, since high curious students can comprehend more than low curious students, and comprehending the mathematical problem has effects on success on solving mathematical problems. Unfortunately there is no empirical study to say that high curious students have higher mathematical proficiency than low curious students in mathematics (Unal, 2005).

Lastly, the results of the study of add a layer of complexity to studies that find curiosity as a facilitator of learning and academic achievement in youth (Wavo, 2004). The most successful outcomes were found for students possessing high curiosity in schools perceived as valuing, succeeding at, and supportive of academic challenges and success. People derive the most positive experiences in environments that are a greater fit with their dominant personality traits and the most negative experiences when they are in environments that run counter to these sensitivities and goals (Pervin, 1968, as cited by Kashdan & Mantak, 2007).

On Motivation

Motivation refers to a student's willingness, need, desire and compulsion to participate in, and be successful in the learning process (Yunus & Ali, 2009). Middleton and Spanias (1999), as cited by Yunus & Ali (2009), viewed motivation as reasons individuals have for behaving in a given situation. A more comprehensive definition was provided by Ames (1992), as cited by Doronila (2012), who stated that motivation exists as part of one's goal structures, one's beliefs about what is important and it determines whether or not one will engage in a given pursuit. Skinner and Belmont (1991), as cited by Doronila (2012), explained that students who are motivated to engage in school "select tasks at the border of their competencies, initiate action when given the opportunity, and exert intense effort and concentration in the implementation of learning tasks; they show generally positive emotions during ongoing action, including enthusiasm, optimism, curiosity, and interest".

According to Middleton and Spanias (1999), research indicates that high level proficiency in mathematics is a powerful influence on the motivation to achieve. As indicated by Dickson and Butt (1989), as cited by Middleton & Spanias (1999), students will find a mathematical task more enjoyable when they have moderately high probability of success as compared to one with a lower chance of success.

Motivation contributes to the ability to enhance mathematical proficiency. Based on several models, O'Neil & Schacter (1997), as cited by Doronila (2012) developed the CRESST model of solving mathematical problems that incorporates four elements: content understanding, problem - solving strategies, metacognition and motivation. In their model, motivation is composed of self - efficacy, effort and worry. Yunus & Ali (2009) reported that several researches showed that high worry is associated with low mathematical proficiency. On the other hand, studies such as of Wigfield and Meece (1988), as cited by Doronila (2012), showed that there is no relationship between worry and proficiency. Although worry can trigger negative effects on learning, depending on the degree of worry, it could also contribute to positive antecedent to high mathematical proficiency. It may trigger positive outcomes, in terms that it will drive students to work harder if their worries drive as a challenge to exhibit better proficiency.

Effort is synonymous to motivation. An individual who shows greater effort is considered to be motivated, whilst one who is motivated will also show greater effort, thus contributing to enhanced proficiency in mathematics (Yunus & Ali, 2009).

In addition, the result of the study of Tella (2007) showed that secondary school students differ significantly in their academic achievement based on the extent to which they are motivated. The results reveal that highly motivated students perform better academically than the lowly motivated students. This finding corroborates that of Bank and Finlapson’s (1980), as cited by Tella (2007), finding who stressed that successful students have significant higher motivation for achievement than unsuccessful students. Similarly, the report by John (1996), as cited by Tella (2007), that academic achievement is highly correlated with student’s motivation lends a good support to the present findings. With reference to the position of (Ayotola, 1998), as cited by Tella (2007), that when pupils express lack of interest in the subject, it affects the way they react or listen to the teacher. It can be said therefore that interest and attitude of learner towards a particular subject matters a lot. This is because these two constructs according to the author are high motivating factor which can lead to better achievement on the part of the learner. Good attitude and better interest learners display particularly in Mathematics serve as an encouragement even to the teacher. And this can help the teacher a lot to disseminate his teaching to the best of his ability and knowledge making use of all available resources rather than resorting to the use of chalk and talk when learners show no interest or negative attitude.

Synthesis

Based on this review, the constructs student background, school background, and curiosity all play significant roles in influencing mathematical proficiency. This review of related literature and studies has given the researchers insights into the problem identified at the outset. Looking back on the aforementioned literature, the present study is similar to most of the works done already in the past. The key point that makes this study different is that it brings together the four variables, student background, school background, curiosity and motivation, into one holistic way of investigating their relations to each other and to mathematical proficiency with strands namely conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition.

Mathematical proficiency has become the key element of this study because it has been given special attention as to whether the aforementioned variables explain a significant portion of it. As mentioned in the literature, these variables contribute to mathematical proficiency, and so this study was geared towards developing a model that would show how they intertwine in the process of reaching success or failure in attaining mathematical proficiency.

Chapter III

METHODOLOGY

This chapter presents the research design, target participants, research locale, the instruments, data collection procedures, and data analysis and interpretation.

Research Design

This study is descriptive – correlational in nature. Descriptive research design is a scientific method which involves observing and describing the behavior of a subject without influencing it in any way. It is concerned with the description of data and characteristics about a population. It also concerns the existing distribution of the variables (Valdez, 2012). It involves the use of investigatory and exploratory measures to describe the quantitative evidences, usually one variable at a time (univariate).

On the other hand, correlational research design investigates the relations between two variables (bivariate) or three or more variables (multivariate) in order to see how they "go together" statistically, how they are associated (Vogt, 2007). From the merging of descriptive and correlational designs, this study proceeds to theory – building design.

Figure 4 is the outline of the research design. It presents the variables investigated, both constructs and their indicators or dimensions and the research procedure.

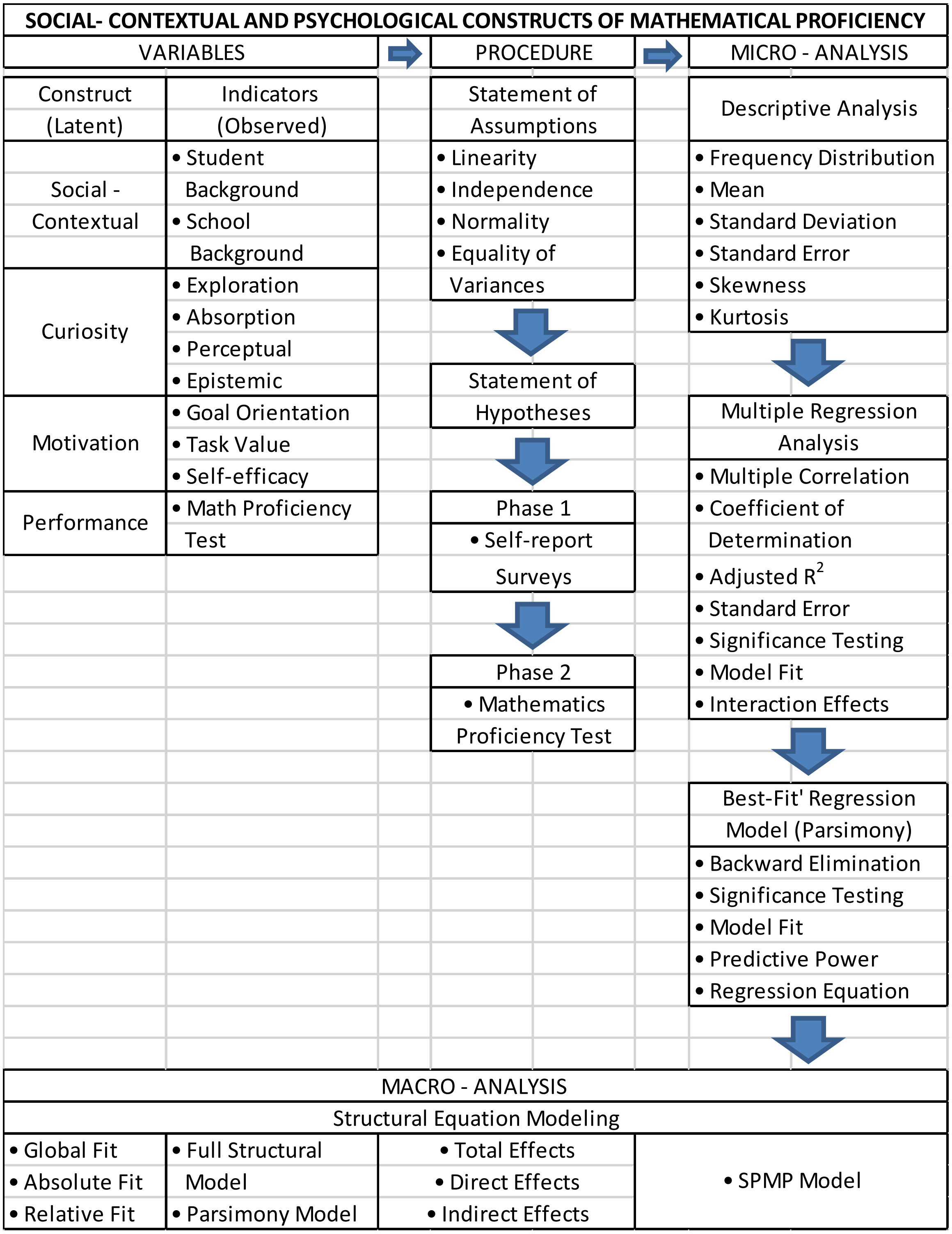


Figure 4. Research Design

The building of theory occurred in two major stages – the descriptive stage and the normative stage (Carlile & Christensen, 2004). In this study, the descriptive stage of theory – building is the micro level analysis, which is necessary because researchers must pass through it in order to develop normative theory. Descriptive theory – building typically categorized the attributes of the phenomena. Likewise, correlations between attributes and outcomes were hypothesized and quantified through techniques such as regression analysis. From descriptive stage, the study moved beyond statements of correlation to define what causes the outcome of interest. With the understanding of causality, the theory was improved by following the same three steps that were used in the descriptive stage. Hypothesizing that the statements of causality are correct, it was cycled deductively to the descriptive stage to test the causal statement.

In this study, hypotheses and assumptions are sets of statements that were tested to draw substantive interpretation of the theoretical models. Modeling in this study, particularly regression and structural equation modeling, is a necessity in building a theory. Hypotheses are individual empirically testable conjectures; while the theory is a collection of hypotheses that are logically linked together into a coherent explanation of some aspect of reality and which had individually or jointly received some empirical support.

Table 3 presents the 7 regression models that were analyzed in this study viewed at seven different perspectives.

Table 3
Predictor and Criterion Variables in Each Perspective of Regression Analysis

Perspective of Analysis	Model	Predictors (Independent Variables)	Criterion (Dependent Variables)
First	Model 1	Student Background School Background Curiosity Motivation	Conceptual Understanding
Second	Model 2	Student Background School Background Curiosity Motivation	Procedural Fluency
Third	Model 3	Student Background School Background Curiosity Motivation	Strategic Competence
Fourth	Model 4	Student Background School Background Curiosity Motivation	Adaptive Reasoning
Fifth	Model 5	Student Background School Background Curiosity Motivation	Productive Disposition
Sixth	Model 6	Student Background School Background Curiosity Motivation	Mathematical Proficiency
Seventh	Model 7	Conceptual Understanding Procedural Fluency Strategic Competence Adaptive Reasoning Productive Disposition	Mathematical Proficiency

The sixth perspective of analysis using overall constructs was employed to answer the questions about the effects of interaction among variables using analysis of covariance (ANCOVA) as statistical tool. ANCOVA is necessary because regression analysis doesn’t answer questions about the effects of interaction, which is another important element of this exploratory research.

Participants of the Study and Research Locale

The participants in this study were the 645 sixth grade pupils of the Unified Schools of the Archdiocese of Lipa (USAL), Batangas, Region IV – A, Philippines. They are those who are enrolled in the school year 2014 – 2015. Table B shows the list of member schools of USAL in Batangas.

Thirteen catholic schools in the province were chosen for this study (see Table 4). Quantitative data was collected during the third quarter of the school year 2014 – 2015. All sixth grade pupils who are enrolled in that school year were automatically become part of the research population.

Table 4
Unified Schools of the Archdiocese of Lipa (USAL) Offering Sixth Grade Program in the Batangas Province, Philippines

School	Acronym	No. of Participants	Location
Academia De San Francisco Javier	ADSFJ	18	Nasugbu, Batangas
Academia De San Isidro Labrador	ADSIL	7	San Luis, Batangas
Escuela Sagrada Familia	ESF	29	Luyos, Tanauan City
Our Lady of Caysasay Academy	OLCA	222	Taal, Batangas
Our Lady Of Peace Academy	OLPA	25	Tuy, Batangas
San Guillermo Academy	SGA	38	Talisay, Batangas
St. Isidore Catholic School	SICS	33	Cuenca, Batangas
St. Mary's Educational Institute	SMEI	54	Lemery, Batangas
St. Michael Archangel Parochial School	SMAPS	14	Lobo, Batangas
St. Therese Catholic School of Batangas	STCSB	13	Calaca, Batangas
St. Raphael Archangel Parochial School	SRAPS	31	Sto. Tomas, Batangas
St. Thomas Academy	STA	22	Bauan, Batangas
Sta. Teresa College	STC	139	

The Unified Schools of the Archdiocese of Lipa (USAL) and Lipa Diocesan Catholic Schools Association (LIDICSA) are located in the different municipalities of the province of Batangas, Region IV – A, Philippines. The map of Batangas Province is shown below.

Figure 5. Political Map of Batangas Province, Region IV – A, Philippines

Research Instruments

Various research instruments were used in this study. Most of these instruments were originally standardized by the author. Others were validated by Doronila (2012) and were adapted in this research to fit in mathematics education and the target participants.

After careful study of the original instruments, all the items were stated and aligned to the objectives of the study. Verbal elements of the items, particularly phrasing and wording, were modified to explicitly measure the constructs in the context of mathematical proficiency so that the analysis of the results are more explicit and particular to the purpose required within this research. The following are brief descriptions of all instruments used in this study.

1. ***Student – School Profile (SSP)***. This is a questionnaire that was used to describe the profile of the participants in terms of student background and school background (Appendix E). This was validated by the experts in the field (1 psychologist, 2 sociologists, 1 mathematics educator, and 2 dissertation advisers). These experts helped improve the items that were found weak, doubtful, imprecise, and inappropriate in measuring the sociological construct. Using the Validation Rubric for Expert Panel, these experts graded the instrument 4.0, that is, the instrument exceeds expectations. Frequency and percentage was used to describe the social nature of the participants in this study. This 18 – item instrument is composed of two parts, Part I – Student Background and Part II – School Background. Part I is composed of the items: number of household members, father's level of education, mother's level of education, access to educational technology, level of performance in English, family formation, and level of parental involvement in child's education. Part II is composed of the items: class size, background attributes of mathematics teacher (area of specialization, number of years spent in teaching, educational qualifications, level of seminars/workshops

attended, nature of participation in seminars/workshops, honors and awards received, and work values), ability grouping, school's support facilities, and school's academic programs in mathematics.

2. ***Curiosity Inventory (CI)***. The Curiosity Inventory (CI) was used to describe pupils' curiosity of learning mathematics. This adopted instrument has a Cronbach's alpha of 0.939. Items in this 30 – item instrument (Appendix F) were modified and combined form of Epistemic Curiosity Inventory by Litman and Spielberger (2003), Perceptual Curiosity Inventory by Collins, Litman, and Spielberger (2004), and Curiosity and Exploration Inventories I and II by Kashdan, et al. (2004, 2009). This instrument has four dimensions, namely: epistemic curiosity, perceptual curiosity, exploration, and absorption. This instrument assesses feelings about mathematical stimuli that activate cognitive processes (epistemic curiosity); sensory mathematical stimuli (perceptual curiosity); appetitive strivings for novelty (exploration); and full engagement in specific activities (absorption). It also measures students' tendency to seek out opportunities for acquiring facts, knowledge, and ideas in mathematics. Scores for the individual subscales was computed by taking the mean of the items within the subscale. Total sum of the subscales gave the motivation scores.

3. ***Motivation for Learning Inventory (MLI)***. This is another instrument that was adopted by the researcher. MLI has a Cronbach's alpha of 0.93.This 30 – item, self – report instrument (Appendix G) was developed adapting and modifying the items

from the motivation scales section of the Motivated Strategies for Learning Questionnaire (MSLQ) by Pinrich, et al. (1991). The MSLQ's six dimensions within the motivation section are intrinsic goal orientation, extrinsic goal orientation, task value, control of learning beliefs, self – efficacy for learning performance, and test anxiety. However after two trial runs, some of the items were omitted and some were revised, and the items were classified into final three dimensions: goal orientation, task value, and self – efficacy. Scores for these dimensions was computed by taking the mean of the items within that subscale. Total sum of the subscales gave the motivation scores.

4. ***Mathematical Proficiency Test (MPT)***. Mathematical Proficiency Test (MPT) was developed to determine the level of mathematical proficiency of the participants. The test items were chosen carefully to avoid bias among participants who have different social organizations. The content of the MPT was validated by five experts in the field, including 2 dissertation advisers. Originally having 150 items, the revised MPT has 100 items and was first administered to a group of ten sixth grade pupils to determine its readability, suitability of language, format and time allotment. After incorporating the results, the test was administered to fifty students for item analysis. After it was run for item analysis, the MPT has final 50 – item multiple choice items deleting those that are difficult and easy items. The final MPT was administered to a group of 40 – sixth grade pupils to measure its reliability. After a test – retest, it was found out that the test has a very remarkable consistency ($r = 0.81$).This test (Appendix H) consists of 50 – item multiple choice

items. Participants were asked to answer the test in 30 – 45 minutes. The items were grouped into four parts: conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition.

Data Collection Procedure

The primary purpose of this study was to examine the sociological and psychological constructs that influence mathematical proficiency of sixth grade pupils. The constructs that were of primary interest are the sixth grade pupils' *student background, school background, curiosity, and motivation* captured by means of quantitative data. Quantitative data was collected through survey instruments and proficiency test.

To answer the problems stated in Chapter I, a two – phase scheme of data collection was utilized. Table 5 presents the phases of data collection with the instruments or procedure used in each phase.

Table 5
Phases of Data Collection

Phase	Phase I	Phase II
Instruments and Procedure	A. Student Background • Student – School Profile (SSP) B. School Background • Student – School Profile (SSP) C. Curiosity • Curiosity Inventory (CI) D. Motivation • Motivation for Learning Inventory (MLI)	A. Mathematical Proficiency Test • Conceptual Understanding • Procedural Fluency • Strategic Competence • Adaptive Reasoning • Productive Disposition

Generally, the first and second phases are about collecting various quantitative data using different instruments. The first phase is named as the “survey phase” and the second phase as “proficiency test phase”.

In collecting the data, a letter asking permission to conduct research in the member schools of USAL was secured from its president. Then, another set of letters asking permission to collect data was secured from the principals of the 13 member schools of USAL. The researcher had the chance also to talk with the Mathematics VI teachers of the participating schools to discuss with them the guidelines (see Appendix d) on how to administer the test and the questionnaires. Results were immediately retrieved by the researcher for presentation, analysis, and interpretation.

Data Analysis Procedure

This study gathered quantitative data. Descriptive statistics were reported through measures of position. The responses of the pupils in the instruments were initially analyzed through the scoring guides and interpretation of results based on the guidelines set by the original authors. The scoring guides are written at the end of every instrument (see Appendices).

The instruments used in Phase I yielded data based on a five – point Likert scale and the following was used as the guide in interpreting the means:

4.51 ~ 5.00	-	Strongly Agree (or its equivalent)
3.51 ~ 4.50	-	Agree (or its equivalent)

2.51 ~ 3.50	-	Neutral (or its equivalent)
1.51 ~ 2.50	-	Disagree (or its equivalent)
1.00 ~ 1.50	-	Strongly Disagree (or its equivalent)

The participants' psychological profile was classified accordingly based on a three – level categorization. The following guide was used in assigning their levels in all its dimensions.

3.67 ~ 5.00	-	High (or its equivalent)
2.34 ~ 3.66	-	Average (or its equivalent)
1.00 ~ 2.33	-	Low (or its equivalent)

The participants' level of proficiency was determined accordingly based on a five - level categorization. The following guide was used in assigning their levels in all its strands.

89 ~ 98	-	Very High
84 ~ 88	-	High
78 ~ 83	-	Average
72 ~ 77	-	Low
60 ~ 71	-	Very Low

It should be noted that there were seven perspectives of regression analysis conducted in this study (see Table 3). To analyze the quantitative data that was gathered in Phases I and II, the statistical packages SPPSS (Statistical Package for the Social Sciences) and AMOS (Analysis of Moment Structures) was used. SPSS is a computer program that provides detailed analysis options to look deeper into the data and spot trends that might not have been noticed. One can test out hundreds of different variables to see how figures or performance would change under different circumstances, while the application contains multiple advanced features that allow one to get the maximum analysis from the data.

On the other hand, AMOS is an add – on module for SPSS. It is designed primarily for structural equation modeling, path analysis, and covariance structure modeling, though it may be also used to perform linear regression analysis, ANOVA and ANCOVA. It features an intuitive graphical interface that allows the analyst to specify models by drawing them. It also has a built – in bootstrapping routine and superior handling of missing data. With SPSS – AMOS, one can specify, estimate, assess, and present his model in an intuitive interface to show hypothesized relationships among variables. Alternatively, SPSS – AMOS offers non – graphical method to specify models. SPSS – AMOS is the perfect tool for a variety of purposes.

This study utilized a more comprehensive methodology called structural equation modeling (SEM), sometimes called confirmatory factor analysis. Vogt (2007) pointed out that SEM is the design one needs when he has formulated a model or a theory to test. With SEM, one can tinker and adjust the model to make it work better. This method was adopted because, theoretically, the sociological and psychological constructs all influence mathematical proficiency, but confirmatory analysis such as SEM improves the acceptability of the model or theory. Specifically, this method uses (1) regression analysis for measuring the relations among variables; (2) factor analysis to improve the measurement of the variables; and (3) causal modeling combined with regression to yield a way to picture and test regression models called path analysis.

Table 6 presents the problems stated in Chapter I, their corresponding hypotheses and the necessary statistical tools that the researcher will use in the analysis. The null hypotheses are to be tested at 0.05 level of significance.

Table 6
Statistical Hypotheses and Tools in the Present Study

Problems	Statistical Hypotheses	Statistical Tools
1. How may the sixth grade pupils be described in terms of **1.1 Student background;** **1.2 School background;** **1.3 Curiosity and** **1.4 Motivation?** **2. What is the level of pupils' mathematical proficiency in terms of** **2.1 Conceptual Understanding;** **2.2 Procedural Fluency;** **2.3 Strategic Competence;** **2.4 Adaptive Reasoning and** **2.5 Productive Disposition?**	None	Mean Standard Deviation Standard Error Skewness Kurtosis
3. Which social – contextual constructs significantly influence mathematical proficiency?	Student background and school background do not significantly influence mathematical proficiency.	Multiple Linear Regression and Backward Elimination Method
4. Which psychological factors significantly influence mathematical proficiency?	Curiosity and motivation do not significantly influence mathematical proficiency.	Multiple Linear Regression and Backward Elimination Method
5. Are the interactions between the social – contextual and psychological constructs statistically significant?	Student background, school background, curiosity, and motivation altogether do not significantly interact to one another.	Analysis of Covariance
6. What model(s) can be proposed to describe the social – contextual and psychological composition of sixth grade pupils' mathematical proficiency?	None	Structural Equation Modeling

It is assumed that the data were gathered from a normally distributed population, and that the relationship between the dependent variable and the independent variables is linear. Statistical tools were used to test these assumptions.

In the regression analyses, when the coefficients of the predictors had insignificant contributions in explaining the criterion variable, then the principle of parsimony was employed. Berenson, et. al. (2006) suggests that this principle guides the selection of the regression model with the fewest independent variables that can predict the dependent variable adequately. In other words, it guides the selection of the least complex regression model.

Among the methods that can be used to apply the parsimony principle, Backward (elimination) Method is chosen for this study. This method was deemed to be more conservative stepping method in selecting statistically significant predictors and is also available in SPSS 20. It is largely a trial – and – error process for finding the best regression estimates and is similar to the Stepwise Method; in that it starts with a regression equation including all the independent variables and then deletes, one at a time, those that do not contribute significantly. Most researchers rather preferred Stepwise Method because of its ability to add or delete variables at each stage; whereas in Backward Method, once a variable is deleted, the action cannot be reversed at a later stage. However, Backward Method is preferred over Stepwise Method because according to Hair (2010) in stepwise procedure a regression model is developed with the fewest number of statistically significant independent variables and maximum predictive accuracy and in so doing, the regression model can be markedly affected by issues of multicollinearity, and the researcher relinquishes control over the formation of the model and runs a higher risk of decreased generalizability. Thus, backward procedure is chosen every time the principle of parsimony is being called for.

Also, in regression analysis, the tests for four assumptions are also necessary to the validity of any conclusions reached. The assumptions of regression, known by the acronym LINE, are Linearity, Independence of errors, Normality of error, and Equal variance of errors.

The first assumption, linearity, states that the relationship between variables is linear. The second assumption, independence of errors, requires that errors are independent from one another. This assumption is particularly important when data are collected over a period of time, where the errors for a specific time period time are often correlated with those of the previous time period. The third assumption, normality of error, requires that errors are normally distributed at each value of the independent variables. The fourth assumption, equal variance or homoscedasticity, requires that the variance of errors are constant for all values of the independent variables (Berenson, et al., 2006).

Chapter IV

PRESENTATION, ANALYSIS, AND INTERPRETATION OF DATA

This chapter presents the data and the corresponding analyses and interpretation based on the specific problems previously raised in this study. The data presented in this chapter were taken from 645 sixth grade pupils and 15 Mathematics VI teachers of the Unified Schools of the Archdiocese of Lipa (USAL) in Batangas, Region IV – A.

Social – Contextual and Psychological Profile of Sixth Grade Pupils

The first two sections of this chapter were intended to answer the first problem.

Problem 1. How may the sixth grade pupils be described in terms of

1.1 Social – Contextual Constructs

1.1.1 Student Background;

1.1.2 School Background;

1.2 Psychological Constructs

1.2.1 Curiosity in Mathematics and

1.2.2 Motivation in Mathematics?

This section presents set of tables and discussions (to answer Problem 1, 1.1 to 1.2) of the sixth grade pupils profile on each dimension of social - contextual and psychological constructs.

In the 18 – item Student – School Profile (SSP),individual participants were profiled in terms of Student Background namely number of household members, father's level of education, mother's level of education, access to educational technology, level of performance in English, family formation, and level of parental involvement in child's education.

Participants were also profiled in terms of School Background namely classroom size, background attributes of mathematics teacher, ability grouping, school's support facilities, and school's academic programs in mathematics. Background attributes of mathematics teacher was further described in terms of area of specialization, number of years spent in teaching, educational qualifications, honors and awards received, level of seminars/workshops attended, nature of participation in seminars/workshops, and work values. Table 7 to Table 24 present the distribution of participants according to their sociological constructs.

Table 7
Frequency Distribution of Sixth Grade Pupils' Profile in Terms of Number of Household Members

Number of Household Members	n	%
13 and Above	12	1.86
10 – 12	13	2.02
7 – 9	67	10.39
4 – 6	422	65.43
1 – 3	131	20.31
Overall	**645**	**100.00**

Shown in Table 7 are the frequency and percentage distributions of the respondents' number of household members. It is notable that most of the respondents have 4 – 6 household members. This indicates that most of the families of the respondents have modern parents who considered family planning as an avenue to provide all the needs of their children. This is further supported by many respondents with 1 – 3 household members.

Table 8 presents the respondents' frequency and percentage distributions of their fathers' level of education. Generally, majority of the respondents have fathers who completed a college degree.

Table 8
Frequency Distribution of Sixth Grade Pupils' Profile in Terms of Father's Level of Education

Level of Education	n	%
Doctorate Degree (Completed)	16	2.48
Doctorate Degree (Not /Completed)	5	0.78
Master's Degree (Completed)	46	7.13
Master's Degree (Not Completed)	8	1.24
College (Completed)	395	61.24
College (Not Completed)	79	12.25
High School (Completed)	58	8.99
High School (Not Completed)	31	4.81
Grade School (Completed)	5	0.78
Grade School (Not Completed)	2	0.31
Overall	**645**	**100.00**

Statistics pointed out that most of the respondents have heads of the family who are professionals and can get white – collar jobs. It is also noticeable that 27.14% of the heads of the family are undergraduates and 11.63% of them attended advanced studies.

Table 9
Frequency Distribution of Sixth Grade Pupils' Profile in Terms of Mother's Level of Education

Level of Education	n	%
Doctorate Degree (Completed)	15	2.33
Doctorate Degree (Not /Completed)	2	0.31
Master's Degree (Completed)	52	8.06
Master's Degree (Not Completed)	11	1.71
College (Completed)	392	60.78
College (Not Completed)	73	11.32
High School (Completed)	68	10.54
High School (Not Completed)	23	3.57
Grade School (Completed)	8	1.24
Grade School (Not Completed)	1	0.16
Overall	**645**	**100.00**

It can be gleaned from Table 9 the frequency and percentage distributions of the respondents' mothers' level of education. In general, majority of the respondents have mothers who completed a college degree. This statistics pointed out that most of the respondents have mothers that are professionals and can get white – collar jobs.

This table also reveals that 26.83% of the mothers are undergraduates and 12.39% of them attended advanced studies. It can also be inferred that most of female college graduates would like to marry a college graduate too.

As indicated in Table 10, frequency and percentage distributions of respondents' access to educational technology, most of the respondents have access to interactive digital video game and have access to social media such as Facebook, Twitter, Instagram, and others. Respondents reported that almost half of them have access to laptop, a significant number of respondents have access to personal computer, tablet PC, and smartphone. This indicates, in a way, that the number of respondents with access to social media and video games is related to the number of pupils using laptop, personal computer, tablet PC and smartphone.

Table 10
Frequency Distribution of Sixth Grade Pupils' Profile in Terms of Access to Educational Technology

Educational Technology	n	%
Ebook	171	26.51
Laptop	317	49.15
Personal Computer	239	37.05
Podcasting	11	1.71
Interactive Digital Video Game	362	56.12
Social Media	320	49.61
LCD Projector	151	23.41
Tablet PC	221	34.26
Smartphone	287	44.50
Smartboard	20	3.10

It was verified also that the pupils of the 21st century, as young as sixth grade, are very much skilled in using technology. This result is parallel with the fact that majority of the respondents have fathers and mothers who are college graduates who can provide them tools in order to have access on different gadgets and applications.

Table 11 reveals the respondents' profile in terms of level of performance in English. It can be gleaned from the table that majority of the respondents have average level of performance in English which is not that distant from the number of respondents with high level of performance.

Table 11
Frequency Distribution of Sixth Grade Pupils' Profile in Terms of Level of Performance in English

Level	n	%
Very High	79	12.25
High	250	38.76
Average	260	40.31
Low	51	7.91
Very Low	5	0.78
Overall	**645**	**100.00**

This indicates that the respondents are performing in English well. The respondents can demonstrate comprehension and understanding of English language well. This could be attributed to the fact that member schools of USAL are implementing the English Speaking Campaign and are implementing a literature – based reading program.

Table 12 presents the frequency and percentage distributions of the participants' family formation. Generally, the participants are living with both parents. This indicates that both parents are working in the Philippines and are earning enough or more than what they need in order to live.

Table 12
Frequency Distribution of Sixth Grade Pupils' Profile in Terms of Family Formation

Family Formation	n	%
Living with Father Only	37	5.74
Living with Mother Only	123	19.07
Living with Both Parents	315	48.84

Living with Guardian(s)	79	12.25
Living with Siblings Only	50	7.75
Living with Other Relatives Only	41	6.36
Overall	**645**	**100.00**

On the other hand, more than half of the participants are living with mother only, living with guardians, living with their siblings only, and living with other relatives only. These could be attributed to the fact that either fathers or mothers are working abroad or one of the parents are working abroad. Different family structures could mean different things and could bring different effects on the academic performance of the respondents.

Table 13
Frequency Distribution of Sixth Grade Pupils' Profile in Terms of Level of Parental Involvement in Child's Education

Level	n	%
High	414	64.19
Average	224	34.73
Low	7	1.09
Overall	**645**	**100.00**

As revealed in Table 13, a very significant number of the participants have high level of parental involvement in child's education. This could be attributed to the fact that most of the respondents are living with their father and mother. It can be inferred that the percentage of respondents who are living with their parents is less than the percentage of high level of parental involvement in the child's education. This indicates that even if the father, the mother or both parents are working abroad they still find time to talking to their children about school, expecting them to do well in school, monitoring their whereabouts during school days, making sure that their out – of – school activities are useful, helping them plan for high school, and monitoring their assignments and other school tasks. The fact that respondents have access to different social media it is now easier for parents to monitor their child's education.

Table 14
Frequency Distribution of Sixth Grade Pupils' Profile in Terms of Class Size

Class Size	N	%
41 – 45	149	23.10
36 – 40	139	21.55
31 – 35	204	31.63
26 – 30	101	15.66
Below 26	52	8.06
Overall	**645**	**100.00**

Table 14 presents the frequency and percentage distributions of the respondents' profile in terms of class size. As revealed in the table, a great number of the respondents have a class size of 31 – 35. On the other hand, many of the respondents have class size of 41 – 45 and 36 – 40 compared to the number of respondents with class size of 26 – 30 and below 26. This could be attributed to the number of enrollees per member school of USAL, to the class size of other schools around the vicinity of each member school of USAL, and to the recommendation of PAASCU to some member schools of USAL that are accredited and are undergoing accreditation.

As indicated in Table 15, frequency and percentage distributions of respondents' Math teachers' area of specialization, majority of the respondents have Mathematics teachers who specialized in Mathematics.

Table 15
Frequency Distribution of Sixth Grade Pupils' Profile in Terms of Math Teacher's Area of Specialization

Area of Specialization	n	%
Mathematics	517	80.16
Biological Science	68	10.54
Araling Panlipunan	13	2.01
General Education	47	7.29
Overall	**645**	**100.00**

Aside from Mathematics, the respondents have Mathematics teachers who specialized in Biological Science, General Education, and Araling Panlipunan. This indicate that majority of the respondents have Mathematics teachers who know the depth and breadth of the subject. This could be attributed to the high standards of the member schools of USAL in terms of hiring teachers.

Table 16 presents the frequency and percentage distributions of the participants' Mathematics teachers' number of years spent in teaching. Generally, most of the participants have mathematics teachers who spent 20 – 29 years in teaching. This indicates their Math teachers have mastered already the methods, techniques and strategies in teaching Mathematics.

Table 16
Frequency Distribution of Sixth Grade Pupils' Profile in Terms of Math Teacher's Number of Years Spent in Teaching

Number of Years Spent in Teaching	n	%
30 and Above	70	10.85
20 – 29	180	27.91
10 – 14	142	22.02
5 – 9	76	11.78
0 – 4	177	27.44
Overall	**645**	**100.00**

But it is also noticeable that almost same number of participants have Math teachers who are in the field of teaching for less than five years. This indicates that almost every year, some schools are hiring new mathematics teachers. This could be attributed to a phenomenon where teachers from private schools are transferring to public schools for a greener pasture and this is further supported by the small number of mathematics teachers who are teaching for 30 years and above. Young teachers in private catholic schools are increasing while older teachers are decreasing in number.

Table 17
Frequency Distribution of Sixth Grade Pupils' Profile in Terms of Math Teacher's Educational Qualifications

Educational Qualification	n	%
BEED Graduate	58	8.99
BSED Graduate	226	35.04

With MA Units	292	45.27
Completed Academic Requirements in MA	69	10.70
Overall	**645**	**100.00**

It can be gleaned from Table 17 the educational qualifications of the respondents' Math teachers. Majority of the respondents have Math teachers with MA units already. This indicate that most of them have teachers who give value to professional development and believe that it could help improve pupils' performance in Mathematics. A good number of respondents have Math teachers who finished Bachelor of Secondary Education. Some of them specialized in Mathematics while others specialized in Biological Science. This indicates that a BSED Math major teacher has strong foundation in Mathematics but a BSED Biological Science major teacher is a mismatch with regard to Mathematics education. The rest of the respondents have Math teachers who completed academic requirements in MA, usually those who spent 20 years and above in teaching, and Math teachers who finished Bachelor of Elementary Education, usually those who spent teaching from 0 to 4 years.

Table 18
Frequency Distribution of Sixth Grade Pupils' Profile in Terms of Math Teacher's Honors and Awards Received

Honors and Awards Received	n	%
Cum Laude	54	8.37
Honors in HS	111	17.21
Honors in GS	31	4.81
None	449	69.61

Overall	**645**	**100.00**

Table 18 presents the frequency and percentage distributions of the honors and awards received by the Math teachers of the respondents. Less than half of the respondents received academic honors such as cum laude, salutatorian and honorable mention. On the other hand, majority of them have math teachers with no honors and awards received. It shows that academically, the USAL Math teachers have a good set of faculty which is one of the best features of educational institution.

Table 19
Frequency Distribution of Sixth Grade Pupils' Profile in Terms of Math Teacher's Level of Seminars/Workshops Attended

Honors and Awards Received	N	%
National	178	27.60
Regional	63	9.77
Local	404	62.63
Overall	**645**	**100.00**

As presented in Table 19, frequency and percentage distributions of the level of seminars/workshops attended by the Math teachers of the respondents, 100% of the respondents have Math teachers with attendance in seminars/workshops. In general, majority of the respondents' Math teachers attended local seminars/workshops. On the other hand, the remaining percentage of the respondents' Math teachers attended national and regional seminars/workshops. These teachers are usually middle managers who need trainings in order to enrich not only their role as subject teachers but also as subject coordinators or assistant principal who will train teachers under their department. These indicate that member schools of USAL (Grade School Department) were used to sending the Math teachers to seminars/workshops to gain new knowledge, techniques and practices.

Table 20
Frequency Distribution of Sixth Grade Pupils' Profile in Terms of Math Teacher's Nature of Participation in Seminars/Workshops

Nature of Participation in Seminars/Workshops	n	%
Participant	645	100.00
Overall	**645**	**100.00**

Table 20 reveals that 100% of the respondents have Math teachers who participated as participants in the seminars/workshops they attended. This indicates that all of the Math teachers needed knowledge, techniques and practices more than what they can share as speakers, panel reactors, and commentators.

Table 21 presents the work values of the respondents' Math teachers. In general, the Math teachers reported that they have very satisfactory work values such as: sense of responsibility, initiative, punctuality, orderliness, commitment, loyalty, determination, cooperativeness, industry, cheerfulness, compassion, sincerity, foresight, composure and sense of humor. These are important characteristics of mathematics teachers according to Barr (2007). This indicates that a Mathematics teacher to be effective should possess work values that are very satisfactory.

Table 21
Frequency Distribution of Sixth Grade Pupils' Profile in Terms of Math Teacher's Work Values

Work Values	5	%	4	%	3	%	2	%
Resourcefulness	7	1.09	270	41.86	335	51.94	33	5.12
Sense of Responsibility	25	3.88	533	82.64	33	5.12	54	8.37
Creativity	58	8.99	168	26.05	386	59.84	33	5.12
Initiative	85	13.18	482	74.73	78	12.09	0	0.00
Punctuality	79	12.25	366	56.74	200	31.01	0	0.00
Orderliness	61	9.46	330	51.16	254	39.38	0	0.00
Commitment	123	19.07	489	75.81	33	5.12	0	0.00
Loyalty	101	15.66	497	77.05	47	7.29	0	0.00
Determination	85	13.18	482	74.73	78	12.09	0	0.00
Cooperativeness	20	3.10	415	64.34	210	32.56	0	0.00
Industry	7	1.09	574	88.99	64	9.92	0	0.00
Cheerfulness	174	26.98	300	46.51	171	26.51	0	0.00
Achievement – Oriented	70	10.85	164	25.43	378	58.60	33	5.12
Compassion	154	23.88	457	70.85	33	5.12	0	0.00
Sincerity	38	5.89	574	88.99	33	5.12	0	0.00
Foresight	156	24.19	360	55.81	129	20.00	0	0.00
Composure	42	6.51	510	79.07	93	14.42	0	0.00
Sense of Humor	199	30.85	250	38.76	196	30.39	0	0.00

On the other hand, the Math teachers reported that they have satisfactory work values such as: resourcefulness, creativity, and achievement – oriented. This can be attributed to the fact that majority of the teachers did not receive honors and awards, since these work values are not beyond what is expected of them to display.

The frequency and percentage distributions of the respondents ability grouping is revealed in Table 22. It is noticeable that majority of the respondents were grouped in terms of academic performance and academic achievement. This indicate that most of the member schools of USAL envisioned to be a leading catholic educational institution that produces academically exemplary individuals.

Table 22
Frequency Distribution of Sixth Grade Pupils' Profile in Terms of Ability Grouping

Ability Grouping	n	%
Academic Performance	376	58.29
Academic Achievement	311	48.22
Subject Proficiency	186	28.84
Character/Conduct	100	15.50

Furthermore, **i**t can be inferred that many of the respondents belong to schools that put much premium on academics. This was supported by a good number of respondents that were grouped according to subject proficiency. Although the member schools of USAL are catholic schools, only few number of the respondents were grouped according to character or conduct.

Table 23
Frequency Distribution of Sixth Grade Pupils' Profile in Terms of School's Support Facilities

School's Support Facilities	n	%
Library	607	94.11
Computer Laboratory	607	94.11
Science Laboratory	513	79.53
Electronic & Media Center	446	69.15
Reading Center	235	36.43
Speech Laboratory	446	69.15
Mathematics Laboratory	38	5.89
EPP Laboratory	540	83.72

As shown in Table 23, majority of the respondents have library and computer laboratory. This indicate that majority of the member schools of USAL believe that printed materials and modern technology could support the academic needs of the students. Also, most of the respondents from member schools of USAL have access to EPP laboratory, science laboratory, electronic and media center, speech laboratory, and reading center. This indicate that most of the member schools of USAL can cater the needs of the respondents in terms of support facilities to improve learning.

Table 24
Frequency Distribution of Sixth Grade Pupils' Profile in Terms of School's Academic Programs in Mathematics

Academic Programs in Mathematics	n	%
Mathematics Remedial Program	414	64.19
Mathematics Enrichment Program	192	29.77
Mathematics Summer Program	343	53.18
MTAP	613	95.04

Table 24 presents the frequency and percentage distributions of the respondents' schools' academic programs in mathematics. Generally, majority of the respondents have MTAP in their respective schools. Mathematics remedial and enrichment programs are being implemented in schools were significant number of respondents belong. These indicate that member schools of USAL perceived the need for giving enhancement and remediation programs in order to address the various needs of their pupils in terms of mathematics education.

The tables that follow present the means and standard deviations of responses of the sixth grade pupils on each indicator of the dimensions of curiosity in relation to mathematics. These dimensions are exploration, absorption, epistemic curiosity, and perceptual curiosity, with unequal number of indicators.

Table 25
Means and Standard Deviations of Responses on Exploration

Indicators	Mean	SD
1. I would describe myself as someone who actively seeks as much information as I can in a new situation.	3.69	0.8
2. I find myself looking for new opportunities to grow as a person (e.g., information, people, and resources).	4.04	0.9
3. I actively seek as much information as I can in new situations.	3.76	0.82
4. I am at my best when doing something that is challenging.	4.24	0.86
5. I am always looking for experiences that challenge how I think about myself and the world.	3.96	0.89
6. I frequently seek out opportunities to challenge myself and grow as a person.	3.94	0.87
Overall	**3.94**	**0.55**

Table 25 presents the results of the Curiosity Inventory (CI) self – report survey on the respondents' personal view of exploration as a factor of curiosity. The six items of this factor indicate personal views about exploration as a form of curiosity not only in mathematics but in general, where the sixth grade pupils report their frequency of appetitive strivings for novelty and challenge as well as awareness and clarity of their emotions with willingness to express positive feelings openly.

Generally, the respondents reported that they 'often' do their best in doing something that is challenging and this makes them look for new opportunities and experiences that will make them grow as a global person. They also reported that they almost often would describe their selves as persons who actively seek as much information as they can in a new situation. There is much evidence that the respondents have similar responses in each of the six indicators that describe their explorative behavior forming one dimension of curiosity.

Table 26
Means and Standard Deviations of Responses on Absorption

Indicators	Mean	SD
1. When I am actively interested in something, it takes a great deal to disturb me.	3.81	1.06
2. Everywhere I go, I am out looking for new things or experiences.	4.20	0.91
3. I like to do things that are little scary.	3.69	1.16
4. I prefer activities that are excitingly unpredictable.	3.79	1.00
5. I am the kind of person who accepts unfamiliar people, events, and places.	3.53	1.07
Overall	**3.80**	**0.61**

Table 26 presents the results of the CI self – report survey on the respondents' personal view of Absorption as a factor of curiosity. The five items of this factor indicate personal views about absorption as a form of curiosity not only in mathematics but in general, where the sixth grade pupils report their frequency of engagement in specific activities as well as the ability to persist or modify pathways to important goals even when confronted with distressing thoughts and feelings.

Generally, the respondents reported that 'often', they are out looking for new things or experiences everywhere they go and it takes a great deal to disturb them when they are actively interested in something especially if the activities are excitingly unpredictable and little scary. They also reported that almost ‘sometimes’, they are the kind of persons who accept unfamiliar people, events, and places. The respondents have varied responses in all items except for the item that everywhere they go, they are out looking for new things or experiences.

Table 27 presents the results of the CI self – report survey on the respondents’ personal view of Epistemic Curiosity as another factor of this psychological construct. The ten items of this factor indicate personal views about epistemic curiosity, where the sixth grade pupils report the frequency of times they desire to engage in experiences that require reasoning in which they respond to stimuli that activate cognitive processes.

Generally, the respondents reported that they ‘often’ enjoy learning about subjects that are familiar to them but if they read something that puzzles them at first they keep on reading until they understand it, just like finding the final solution to an incomplete puzzle because if they will not find the solution they will feel so frustrated. Also, almost ‘sometimes’, they enjoy discussing abstract concepts and can spend hours on a single problem because they just can’t rest without knowing the answer.

Table 27
Means and Standard Deviations of Responses on Epistemic Curiosity

Indicators	Mean	SD
1. Difficult conceptual problems can keep me awake all night thinking about solutions.	3.44	1.18
2. I enjoy learning about subjects that are familiar to me.	4.36	0.84
3. I can spend hours on a single problem because I just can’t rest without knowing the answer.	3.57	1.09
	4.16	0.93

4. If I read something that puzzles me at first, I keep reading until I understand it.	3.48	1.02
5. It bothers me if I come across a word that I don't know, so I will look up its meaning in a dictionary.	3.87	0.95
6. I feel frustrated if I can't figure out the solution to a problem, so I work even harder to solve it.	3.44	0.92
7. I ponder for a long time in an attempt to solve some fundamental problems.	3.46	0.91
8. I am critical of current ideas and theories.	3.55	0.94
9. I enjoy discussing abstract concepts.	3.91	0.98
10. If I am given an incomplete puzzle, I like to try to find the final solution.		
Overall	**3.72**	**0.56**

They also reported that almost often they are critical of current ideas and theories, meaning, they ponder for a long time in an attempt to solve some fundamental problems. For instance, difficult conceptual problems can keep them awake all night thinking about solutions and it bothers them if they come across a word that they don't know, so they will look up its meaning in a dictionary.

The respondents have quite similar responses in all items except for items that difficult conceptual problems can keep them awake all night thinking about solutions, they can spend hours on a single problem because they just can't rest without knowing the answer, and It bothers them if they come across a word that they don't know, so they will look up its meaning in a dictionary, in which there is a little evidence of varied responses.

Table 28 presents the results of the CI self – report survey on the respondents' personal view of Perceptual Curiosity as another factor of this psychological construct.

Table 28
Means and Standard Deviations of Responses on Perceptual Curiosity

Indicators	Mean	SD
1. When someone asks me a riddle, I am interested in trying to solve it.	3.88	1.02
2. When I am given a new kind of arithmetic problem, I enjoy imagining the solutions.	3.50	0.97
3. When I see a complicated piece of machinery, I like to ask someone how it works.	3.98	0.95
4. I enjoy exploring new ideas.	4.30	0.86
5. I find it fascinating to learn new information.	3.94	0.91
6. If I am given an unfamiliar task, I like trying how it gets done.	3.87	0.90
7. When I learn something new, I would like to find out more about it.	4.06	0.89
8. When I see an incomplete puzzle, I like imagining how to solve it.	3.79	0.99
9. I am interested in discovering how things work.	4.20	0.87
Overall	**3.96**	**0.56**

The nine items of this factor indicate personal views about perceptual curiosity, where the sixth grade pupils report the frequency of times they desire to engage in experiences triggered by sensory stimuli, and where they show evidences of a drive aroused by novel stimuli and reduced by continued exposure to these stimuli.

Generally, the respondents reported that they ‘often’ show exploratory behavior like enjoyment in exploring new ideas. For instance, they enjoy discovering how things work, asking how a complicated piece of machinery works, trying how an unfamiliar task gets done, and imagining how to solve an incomplete puzzle or riddle.

Also, they are fascinated to learn new information and finding out more after learning something new. They also reported that they ‘sometimes’ enjoy imagining the solutions of a new kind of arithmetic problem. The respondents have quite similar responses in all items except for items that when someone asks them a riddle, they are interested in solving it.

Table 29
Frequency Distribution of Sixth Grade Pupils' Level of Curiosity

Dimensions	Level					
	Low		Average		High	
	n	%	n	%	n	%
Exploration	2	0.31	163	25.27	480	74.42
Absorption	8	1.24	261	40.47	376	58.29
Epistemic Curiosity	5	0.78	273	42.33	367	56.90
Perceptual Curiosity	2	0.31	182	28.22	461	71.47
Overall	**0**	**0.00**	**218**	**33.80**	**427**	**66.20**

In each factor or dimension of the CI, each sixth grade pupil was classified according to his or her level of curiosity. Table 29 presents the frequency and percentage distribution of the respondents' level of curiosity across its dimensions. This table shows that less than ten respondents have self – reported a simple or low level of exploration, absorption, epistemic curiosity, and perceptual curiosity.

It is interesting to note that in each dimension, majority of the respondents have high level of curiosity, and that in the overall results of Curiosity Inventory (CI), majority of them have high level of curiosity, a good number have average level, and none has low level. It must be noted also that the overall level of a respondent's curiosity is not determined by his levels in the four dimensions, but determined by the individual rating in each item of the CI. Additionally, though majority of the respondents have high level of curiosity in all four dimensions, it is in Exploration that most respondents exhibit high level of curiosity, and it is in Epistemic Curiosity that most of them have average level of curiosity.

The tables that follow, Table 30 to Table 32, present the means and standard deviations of responses of the sixth grade pupils on each indicator of the dimensions of motivation in relation to mathematics, measured through Motivation for Learning Inventory (MLI). These dimensions are goal orientation, task value, and self – efficacy, with equal number of indicators.

Table 30 presents the results of the MLI self – report survey on the respondents' personal view of Goal Orientation as a factor of motivation. The ten items of this factor indicate personal views about goal orientation as a form of motivation not only in learning mathematics but in general, where the sixth grade pupils report their degree of agreement on indicators of motivation that apply to them. Their responses reflect 'motivation to learn', with emphasis on whether they initiate their own learning activities and on whether they maintain a commitment to the process of learning.

Generally, the respondents pointed out that it is 'mostly true' that they want to do their best in a math class because it is important to show their mathematical ability to their family and friends; that when they have the opportunity in a math class, they choose activities that they can learn from, even if the activities don't guarantee a good grade; that they feel confident that they will do well in a math class; that in a math class, they try to set and achieve high standard of excellence; that the content of a math subject relates to their expectations and goals; that the personal uses of math subject are clear to them; and that the amount of work they have to do is appropriate for this type of subject. In other words, the sixth grade pupils have self – set their standards basically anchored on the motivation to show to others, though apparently some of them don't have this motivation, that they can do well in mathematics provided that the amount of work they have to do is appropriate to achieve such goals.

Table 30
Means and Standard Deviations of Responses on Goal Orientation

Indicators	Mean	SD
1. I like math lessons because it really challenges me to learn new things.	3.91	1.0
2. I like math lessons because it arouses my curiosity, even if it is difficult to learn.	3.96	0.94
3. The most satisfying thing for me in a math class is trying to understand the lessons as thoroughly as possible.	4.03	0.85
4. When I have the opportunity in a math class, I choose activities that I can learn from, even if they don't guarantee a good grade.	3.92	0.85
5. I want to do my best in a math class because it is important to show my mathematical ability to my family and friends.	4.14	0.87
6. I feel confident that I will do well in a math class.	3.90	0.88
7. In a math class, I try to set and achieve high standard of excellence.	3.94	0.88
8. The content of a math subject relates to my expectations and goals.	3.90	0.93
9. The personal uses of math subject are clear to me.	3.91	0.88
10. The amount of work I have to do is appropriate for this type of subject.	3.95	0.87
Overall	**3.96**	**0.61**

Likewise, they also pointed out that it is 'mostly true' that they like math lesson because it really challenges them to learn new things. They reported that they like math lessons because it arouses their curiosity, even if it is difficult to learn; and that for them, the most satisfying thing in a math class is trying to understand the lessons as thoroughly as possible. In simple words, the sixth grade pupils exhibit positive attitude and high degree of commitment to the process of learning.

Table 31 presents the results of the MLI self – report survey on the respondents' personal view of Task Value as another factor of motivation. The ten items of this factor indicate personal views about task value as a form of motivation, where the sixth grade pupils, just like in goal orientation, report their degree of agreement on indicators of motivation that apply to them. Their responses reflect their evaluations about the importance and usefulness of the mathematical tasks.

At large, the respondents pointed out in two out of ten indicators of task value that it is almost 'very true' that it is important for them to learn the lessons in a math class and that the math teacher makes the lesson seem important.

Table 31
Means and Standard Deviations of Responses on Task Value

Indicators	Mean	SD
1. It is important for me to learn the lessons in a math class.	4.42	0.80
2. I am very interested in the lessons of a math subject.	3.88	0.98
3. I think the lessons in a math class are useful for me to learn.	4.31	0.89
4. I like mathematics as a subject.	3.92	1.04
5. Understanding the subject matter of mathematics is very important to me.	4.04	0.88
6. The things I am learning in math will be useful to me.	4.29	0.83
7. The math teacher makes the lesson seem important.	4.38	0.82
8. I feel that math gives me a lot of satisfaction.	3.91	0.92
9. I feel satisfied with what I am getting from a math class.	3.81	0.98
10. I find the challenge level in math to be about right: neither too easy, nor too hard.	3.90	0.90
Overall	**4.09**	**0.61**

They reported that it is ‘mostly true’ that math lessons are useful for them to learn, that understanding the subject matter of mathematics is very important to them, and they feel that math gives them a lot of satisfaction. These are some of the reasons why they like mathematics as a subject. In addition to that, they pointed out that it is ‘mostly true’ that math gives them the feeling of satisfaction because the challenge level that it gives is right – not too easy, nor too hard. They too are interested in the math lessons and they are satisfied from what they are getting from them. In other words, they are motivated to learn mathematics simply because they like it and they believe it is important in their daily lives.

Table 32 presents the results of the MLI self – report survey on the respondents’ personal view of Self – Efficacy as another factor of motivation. The ten items of this factor indicate personal views about self – efficacy as a form of motivation, where the sixth grade pupils, just like in Goal Orientation and Task Value, report their degree of agreement on indicators of motivation that apply to them. Their responses reflect their sense of ability to plan and execute actions to achieve an academic goal. Self – efficacy also represents their confidence in their cognitive and learning skills in performing a mathematical task.

By and large, the respondents pointed out that it is ‘mostly true’ that if they will try hard enough, they will be successful in a math class. This is supported by their report that to become successful, which is their primary goal, it is important that they do well in a math class. This shows that they are confident to learn the basic concepts taught in a math class.

Also, they pointed out that it is ‘mostly true’ that considering the difficulty of a math course, the teacher, and my skills, they will do well in a math class; they are confident that they can do an excellent job on the assignments and tests in mathematics and they will receive an excellent grade in a math class; and that they are sure they can master the skills being taught in a math class.

Table 32
Means and Standard Deviations of Responses on Self-Efficacy

Indicators	Mean	SD
1. I believe I will receive an excellent grade in a math class.	3.73	0.96
2. I'm certain I can understand the most difficult lesson presented in a math class.	3.42	1.0
3. I'm confident I can learn the basic concepts taught in a math class.	4.13	0.82
4. I'm confident I can understand the most difficult lesson presented by the teacher in a math class.	3.63	1.0
5. I'm confident I can do an excellent job on the assignments and tests in mathematics.	3.73	0.92
6. I expect to do well in a math class.	4.09	0.89
7. I'm sure I can master the skills being taught in a math class.	3.68	0.93
8. Considering the difficulty of a math course, the teacher, and my skills, I think I will do well in a math class.	3.75	0.88
9. To accomplish my goals, it is important that I do well in math.	4.12	0.89
10. As I am taking a math class, I believe that I can succeed if I try hard enough.	4.14	0.87
Overall	**3.84**	**0.65**

They are also confident that they can understand the most difficult lesson presented by the teacher, but some of them reported that it is 'sometimes true' that they are certain they can understand the most difficult lesson presented in a math class. In other words, the sixth grade pupils are motivated to learn because they have the confidence to do well in any math class.

In each factor or dimension of the MLI, each pre – service mathematics teacher was classified according to his or her level of motivation. Table 33presents the frequency and percentage distribution of the respondents' level of motivation across its dimensions.

Table 33
Frequency Distribution of Sixth Grade Pupils' Level of Motivation

Dimensions	Level					
	Low		Average		High	
	n	%	n	%	n	%
Goal Orientation	6	0.93	188	29.15	451	69.92
Task Value	4	0.62	144	22.33	497	77.05
Self – Efficacy	13	2.02	233	36.12	399	61.86
Overall	**4**	**0.62**	**184**	**28.53**	**457**	**70.85**

It is interesting to note that in each dimension, majority of the respondents have high level of motivation, and that in the overall results of MLI, 70.85% of them have high level of motivation, 28.53% have average level, and less than one percent have low level. It must be noted also that, just like in the CI, the overall level of a respondent's motivation is not determined by his levels in the three dimensions, but determined by the individual rating in each item of the MLI. It must be noted also that among those who have high level of motivation, it is in Task Value that most of them exhibit such level, and among those who have average level of motivation, it is in Self – Efficacy that most of them converge.

Table 34 presents the means, standard deviations, and skewness of the sociological and psychological constructs and their dimensions. It must be noted that only the means and standard deviations of each psychological construct and its dimensions or factors were already presented in the previous tables in the rows labeled ‘overall’.

Table 34
Summary of Descriptive Statistics of the Four Constructs and Their Dimensions

Variables	Mean	Standard Deviation	Skewness
Number of Household Members	3.2155	0.44065	0.941
Father’s Level of Education	2.9767	0.61383	0.215
Mother’s Level of Education	2.9566	0.62403	0.184
Access to Educational Technology	3.2698	0.63912	-0.308
Level of Performance in English	3.7039	0.80992	-0.114
Family Formation	2.9953	0.93166	-0.106
Level of Parental Involvement in Child’s Education	3.8755	0.60751	-0.519
Class Size	3.2527	0.58687	-0.120
Area of Specialization	1.1984	0.39914	1.516
Number of Years Spent in Teaching	3.1085	1.66084	-0.024
Educational Qualifications	3.0295	1.12733	-0.436
Honors and Awards	1.6915	1.07600	1.043
Attendance in Seminars/Workshops	1.6496	0.88361	0.746
Nature of Participation in Seminars/Workshops	2.0000	0.00000	
Work Values	3.8646	0.36545	0.123
Ability Grouping	1.3535	0.67956	2.403
School’s Support Facilities	3.0543	0.52441	0.066
School’s Academic Programs in Mathematics	3.1039	0.56288	0.024
Exploration	3.9393	0.54797	-0.422
Absorption	3.8006	0.60782	-0.397
Epistemic curiosity	3.7237	0.55617	-0.175
Perceptual curiosity	3.9457	0.56222	-0.327
Curiosity	**3.8464**	**0.47461**	**-0.189**
Goal Orientation	3.9558	0.61040	-0.516
Task Value	4.0853	0.60854	-0.740
Self – efficacy	3.8402	0.64605	-0.376
Motivation	**3.9604**	**0.58730**	**-0.557**

As shown in this table, the sixth grade pupils generally have reported clear evidence that their responses in the social – contextual constructs are more varied than in psychological ones. The higher standard deviations of social – contextual constructs tell that the responses of the sixth grade pupils are more spread out than the responses in psychological constructs, which are more clustered together. In other words, the respondents have varied sociological backgrounds but have less varied psychological backgrounds. That is, they differ more in sociological constructs, but they less differ in curiosity and motivation.

The skewness of the ratings of the respondents depicts different pictures for sociological and psychological constructs. Overall, the negative skewness in all dimensions of the psychological constructs under study indicates that the respondents' ratings are more clustered at the right, or at high side of the distribution. In other words, they rarely have pointed out low ratings in any dimensions of the psychological construct. Thus despite variation in their responses, a considerably larger number of them show higher regards to curiosity and motivation. On the other hand, the positive skewness in almost all dimensions of the sociological constructs under study indicates that the respondents' ratings are more clustered at the left, or at low side of the distribution. In other words, they have pointed out the first items of the options in most of the items of the sociological construct.

Level of Mathematical Proficiency

This section presents set of tables and discussions (to answer Problem 2) of the sixth grade pupils' level of mathematical of proficiency in terms of conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition.

Problem 2. What is the level of sixth grade pupils' mathematical proficiency in terms of

2.1 Conceptual Understanding;

2.2 Procedural Fluency;

2.3 Strategic Competence;

2.4 Adaptive Reasoning and

2.5 Productive Disposition?

The following table presents the frequency and percentage distribution of the sixth grade pupils' level of Mathematical Proficiency across its strands namely Conceptual Understanding, Procedural Fluency, Strategic Competence, Adaptive Reasoning, and Productive Disposition.

Table 35
Frequency Distribution of Sixth Grade Pupils' Level of Mathematical Proficiency

Strands	Level									
	Very Low		Low		Average		High		Very High	
	n	%	n	%	n	%	n	%	n	%
Conceptual Understanding	118	18.29	108	16.74	123	19.07	127	19.69	169	26.20
Procedural Fluency	52	8.06	162	25.12	83	12.87	173	26.82	125	19.38
Strategic Competence	72	11.16	192	29.77	82	12.71	100	15.50	199	30.85
Adaptive Reasoning	72	11.16	173	26.82	173	26.82	88	13.64	139	21.55
Productive Disposition	117	18.14	126	19.53	85	13.18	192	29.77	125	19.38
Overall	**123**	**19.07**	**135**	**20.93**	**139**	**21.55**	**123**	**19.07**	**125**	**19.38**

Grouping the respondents into groups was deemed necessary in this study because the objective is to describe the levels of the respondents' mathematical proficiency. The raw scores were first transformed into percentage rating purposely using the formula then the percentage ratings were divided into five sub – groups. It was then found out that, based on the 5 – group decile grouping technique, 8.06% of the respondents have very low level of conceptual understanding, 11.16% of the respondents have very low level of strategic competence and adaptive reasoning, while 18.14% of the respondents have very low level of productive disposition and 18.29% of the respondents have very low level of conceptual understanding.

It is interesting to note that most of the respondents have very high level of conceptual understanding, high level of procedural fluency, very high level of strategic competence, low and average level of adaptive reasoning, and high level of productive disposition. Additionally, in the overall results of MPT, majority of the respondents have average level of proficiency, followed by low level, very high, very low, and high level. It must be noted also, just like in CI, the overall level of a respondents' mathematical proficiency is not determined by his levels in the five strands, but determined by the individual rating in each strand of mathematical proficiency.

Table 36 presents the descriptive statistics such as mean, standard deviation, skewness and kurtosis of scores of sixth grade pupils in the Mathematical Proficiency Test. Based on both tables, Table 35 and Table 36, majority of the participants (21.55%) had scores on the average level which is 80.0806.

Table 36
Descriptive Statistics of Scores in the 50 – Item Mathematical Proficiency Test

Statistic	Value
Mean	80.0806
Standard Deviation	8.76787
Skewness	-0.088
Kurtosis	-0.867

The skewness of scores, very close to zero, indicates that the scores were normally distributed but kurtosis value indicates that majority of the values are widely spread around the mean.

Influence of Social – Contextual and Psychological Constructs to Mathematical Proficiency

This section presents the answers to the research problems 3 and 4. Regression analyses were used to investigate the amount of variation in the criterion variable explained by the predictor variables. One multiple regression analysis was performed each time. The focus of the analysis is on the scores in each dimension or factor of every construct under investigation. For convenience purposes in writing regression equations, both constructs and dimensions were assigned with notations: S_tB for Student Background, S_cB for School Background, *Cu* for Curiosity, *Mo* for Motivation, *CU* for Conceptual Understanding, *PF* for Procedural Fluency, *ST* for Strategic Competence, *AR* for Adaptive Reasoning, *PD* for Productive Disposition, and *MP* for Mathematical Proficiency. This is to note that in each regression analysis, three sections of each table are presented: (a) Model Summary, (b) Analysis of Variance (ANOVA), and (c) Coefficients.

Problem 3. Which social – contextual constructs influence Mathematical Proficiency?

Problem 4. Which psychological constructs influence Mathematical Proficiency?

To answer these questions, the dimensions of student background, school background, curiosity and motivation were used as independent or predictor variables, while conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, productive disposition, and mathematical proficiency were used as dependent or criterion variables.

The regression model for Conceptual Understanding is labeled Model 1. Although the full Model 1 (using Enter Method) is statistically significant in predicting conceptual understanding, it has predictors that are insignificant (see Appendix H). Thus, using Backward Method, insignificant predictors were eliminated. Table 37 presents the result of regression analysis using SPSS 20.

Compared to the full Model 1 in Appendix H, it is shown in Table 37a that the values of the multiple correlation coefficient R, the coefficient of determination R^2, and the Adjusted R^2 all have been reduced. The parsimonious regression Model 1 with nine predictors namely Number of Household Members, Access to Educational Technology, Exploration, Absorption, Epistemic Curiosity, Perceptual Curiosity, Class Size, School's

Support Facilities, and School's Academic Programs in Mathematics, explains 66.7% of the variance of the sixth grade pupils' conceptual understanding.

Table 37
Multiple Regression Analysis of Parsimonious Model 1
(Dependent Variable: Conceptual Understanding)

Table 37a. Model Summary

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate
1	0.817	0.667	0.663	5.39794

Table 37b. ANOVA

Model		Sum of Squares	Df	Mean Square	F	p – value
1	Regression	37112.028	9	4123.559	141.519	0.000
	Residual	18502.468	635	29.138		
	Total	55614.496	644			

Table 37c. Coefficients

	Predictors	B	Std. Error	Beta	t	p – value
I	Intercept	30.591	1.831		16.703	0.000
S_tB_1	Number of Household Members	2.329	0.749	0.110	3.109	0.002
S_tB_4	Access to Educational Technology	-5.472	0.463	-0.376	-11.812	0.000
Cu_1	Exploration	4.171	0.607	0.246	6.870	0.000
Cu_2	Absorption	4.383	0.472	0.287	9.295	0.000
Cu_3	Epistemic Curiosity	10.445	0.704	0.625	14.841	0.000
Cu_4	Perceptual Curiosity	8.593	0.653	0.520	13.168	0.000
S_cB_1	Class Size	-3.739	0.545	-0.236	-6.860	0.000
S_cB_{10}	School's Support Facilities	-4.396	0.560	-0.248	-7.852	0.000
S_cB_{11}	School's Academic Programs in Mathematics	-4.718	0.557	-0.286	-8.475	0.000

The Adjusted R Square, which takes into account the number of variables in the model and the number of participants Model 1 is based on, indicates no overfitting of the model and that the results should be 66.3% generalizable from the perspective of the ratio of observations to variables in the equation (71:1 for the parsimonious Model 1). However, the standard error of the estimate, which represents an estimate of the standard deviation of the actual conceptual understanding values around the regression line has slightly increased to 5.39794, thus thinly enlarged the absolute size of the prediction error when the parsimonious Model 1 is used to predict conceptual understanding. It also indicates that at 95% confidence level, the margin of error for any predicted value of conceptual understanding can be calculated at ±10.58.

Table 37b displays the analysis of variance which provides the statistical test for the overall model fit of the parsimonious Model 1 in terms of the F ratio. Notice that the total sum of squares (55614.496) is equal to the total sum of squares of the full Model 1, the same amount of error that would occur if only the mean of conceptual understanding is used to predict this strand of mathematical proficiency. Using only Number of Household Members, Access to Educational Technology, Exploration, Absorption, Epistemic Curiosity, Perceptual Curiosity, Class Size, School's Support Facilities, and School's Academic Programs in Mathematics reduces this error by 66.73%. Though this reduction is smaller than the 67.06% of the full Model 1, it is still deemed statistically significant with an F ratio of 141.519 and a p – value of less than 0.01. In other words, the parsimonious Model 1 is statistically significant in predicting levels of conceptual understanding when the scores in the Number of Household Members, Access to Educational Technology, Exploration, Absorption, Epistemic Curiosity, Perceptual Curiosity, Class Size, School's Support Facilities, and School's Academic Programs in Mathematics are known. It must be noted that in the parsimonious Model 1, among the four constructs student background, school background, curiosity, and motivation only student background, school background, and curiosity are represented by some dimensions from each one of them. **Therefore, it can be concluded, that a significant portion of the sixth grade pupils' conceptual understanding was explained by the student background, school background and curiosity.**

This implies the level of pupils' ability to understand why a mathematical concept is important and the kinds of contexts in which it is useful is influenced by the number of household members, access to educational technology, curiosity class size. The study of Brembah (2013) indicated that children from small household size have higher academic performance than children with many brothers and sisters because parents who have fewer children invest more money to acquire educational technology, time, emotional and psychic energy, and attention to each child. Access to educational technology, like social media, facilitates discussion and knowledge transfer between students, creating a deeper sense of understanding of the course material according to Yu et al., 2010. Lastly, Unal (2005) open up another dimension of the role of curiosity on gaining proficiency in mathematics since high curious students can comprehend more than low curious students.

Finally, Table 37c presents the regression coefficients *b* and *Beta* of the parsimonious Model 1 whose predictors are Number of Household Members, Access to Educational

Technology, Exploration, Absorption, Epistemic Curiosity, Perceptual Curiosity, Class Size, School's Support Facilities, and School's Academic Programs in Mathematics, all of which have coefficients that are statistically significant at 95% confidence level. Thus, the regression equation of the parsimonious Model 1 is

$$CU = 30.591 + 2.329S_tB_1 - 5.472S_tB_4 + 4.171Cu_1 + 4.383Cu_2 + 10.445Cu_3 + 8.593Cu_4 - 3.739S_cB_1 - 4.396S_cB_{10} - 4.718S_cB_{11}$$

Where CU is the predicted value of Conceptual Understanding

S_tB_1 is the observed value of Number of Household Members

S_tB_4 is the observed value of Access to educational Technology

Cu_1 is the observed value of Exploration

Cu_2 is the observed value of Absorption

Cu_3 is the observed value of Epistemic Curiosity

Cu_4 is the observed value of Perceptual Curiosity

S_cB_1 is the observed value of Class Size

S_cB_{10} is the observed value of School's Support Facilities

S_cB_{11} is the observed value of School's Academic Programs in Mathematics

The regression model for Procedural Fluency is labeled Model 2. Although the full Model 2 (using Enter Method) is statistically significant in predicting procedural fluency, it has predictors that are insignificant (see Appendix I). Thus, using Backward Method, insignificant predictors were eliminated. Table 38 presents the result of regression analysis using SPSS 20.

Table 38
Multiple Regression Analysis of Parsimonious Model 2
(Dependent Variable: Procedural Fluency)

Table 38a. Model Summary

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate
2	0.928	0.861	0.859	4.58336

Table 38b. ANOVA

Model		Sum of Squares	Df	Mean Square	F	p – value
2	Regression	82646.966	8	10330.871	491.779	0.000
	Residual	13360.553	636	21.007		
	Total	96007.519	644			

Table 38c. Coefficients

	Predictors	B	Std. Error	Beta	T	p – value
I	Intercept	2.805	1.507		1.861	0.063
S_tB_4	Access to Educational Technology	-2.959	0.392	-0.155	-7.549	0.000
Cu_1	Exploration	2.833	0.515	0.127	5.504	0.000
Cu_2	Absorption	3.250	0.398	0.162	8.162	0.000
Cu_3	Epistemic Curiosity	4.965	0.584	0.226	8.504	0.000
Cu_4	Perceptual Curiosity	4.633	0.543	0.213	8.536	0.000
S_cB_1	Class Size	11.821	0.461	0.568	25.661	0.000
S_cB_{10}	School’s Support Facilities	-1.542	0.473	-0.066	-3.263	0.001
S_cB_{11}	School’s Academic Programs in Mathematics	-2.069	0.464	-0.095	-4.459	0.000

The Adjusted R Square, which takes into account the number of variables in the model and the number of participants Model 2 is based on, indicates no overfitting of the model and that the results should be 85.9% generalizable from the perspective of the ratio of observations to variables in the equation (80:1 for the parsimonious Model 2). However, the standard error of the estimate, which represents an estimate of the standard deviation of the actual procedural fluency values around the regression line has slightly increased to 4.58336, thus thinly enlarged the absolute size of the prediction error when the parsimonious Model 2 is used to predict procedural fluency. It also indicates that at 95% confidence level, the margin of error for any predicted value of procedural fluency can be calculated at ±8.98.

Table 38b displays the analysis of variance which provides the statistical test for the overall model fit of the parsimonious Model 2 in terms of the F ratio. Notice that the total sum of squares (96007.519) is equal to the total sum of squares of the full Model 2, the same amount of error that would occur if only the mean of procedural fluency is used to predict this strand of mathematical proficiency. Using only Access to Educational Technology, Exploration, Absorption, Epistemic Curiosity, Perceptual Curiosity, Class Size, School's Support Facilities, and School's Academic Programs in Mathematics reduces this error by 86.08%. Though this reduction is smaller than the 86.29% of the full Model 2, it is still deemed statistically significant with an F ratio of 491.779 and a p – value of less than 0.01. In other words, the parsimonious Model 2 is statistically significant in predicting levels of procedural fluency when the scores in the Access to Educational Technology, Exploration, Absorption, Epistemic Curiosity, Perceptual Curiosity, Class Size, School's Support Facilities, and School's Academic Programs in Mathematics are known. It must be noted that in the parsimonious Model 2, among the four constructs student background, school background, curiosity, and motivation only motivation has a zero coefficient. **Therefore, it**

can be concluded, that a significant portion of the sixth grade pupils' procedural fluency was explained by the student background, school background, and curiosity.

This implies that the level of pupils' knowledge of when and how to use them appropriately, and skill in performing them flexibly, accurately, and efficiently is influenced by access to educational technology, curiosity, class size, school's support facilities, and school's academic programs in mathematics. Access to educational technology, like interactive video games according to De Castro (2014), is an instigating, attractive and stimulating tool, in opposition to the use of notebook and blackboard of what children are used to. Thus, it is believed that using computer games in the teaching methods can stimulate the intellectual autonomy growth of children, since some students that are difficult to motivate in the classroom or that have difficulty to perform certain tasks in traditional classes, surprisingly and actively participate in the teaching strategies. Moreover, Litman & Jimerson (2004) noted that curiosity, by discovering new information, may also be rewarding because it dispels undesirable states of ignorance or uncertainty rather than stimulating one's interest. Kornfeld (2010), proposed factors that made it likely that younger students benefited from smaller class size, Saritas and Akdemir (2009) found a negative impact on student achievement where deficiencies of school features or components such as laboratories, library, and function halls, and Adams (2011), consistent with previous research, suggested that remedial math courses can affect test scores positively.

Finally, Table 38c presents the regression coefficients *b* and *Beta* of the parsimonious Model 2 whose predictors are Access to Educational Technology, Exploration, Absorption, Epistemic Curiosity, Perceptual Curiosity, Class Size, School's Support Facilities, and School's Academic Programs in Mathematics, all of which have coefficients that are statistically significant at 95% confidence level. Thus, the regression equation of the parsimonious Model 2 is

$$PF = 2.805 - 2.959S_tB_4 + 2.833Cu_1 + 3.250Cu_2 + 4.965Cu_3 + 4.633Cu_4 + 11.821S_cB_1 - 1.542S_cB_{10} - 2.069S_cB_{11}$$

Where PF is the predicted value of Procedural Fluency

S_tB_4 is the observed value of Access to educational Technology

Cu_1 is the observed value of Exploration

Cu_2 is the observed value of Absorption

Cu_3 is the observed value of Epistemic Curiosity

Cu_4 is the observed value of Perceptual Curiosity

S_cB_1 is the observed value of Class Size

S_cB_{10} is the observed value of School's Support Facilities

S_cB_{11} is the observed value of School's Academic Programs in Mathematics

The regression model for Strategic Competence is labeled Model 3. Although the full Model 3 (using Enter Method) is statistically significant in predicting strategic competence, it has predictors that are insignificant (see Appendix J). Thus, using Backward Method, insignificant predictors were eliminated. Table 39 presents the result of regression analysis using SPSS 20.

Table 39
Multiple Regression Analysis of Parsimonious Model 3
(Dependent Variable: Strategic Competence)

Table 39a. Model Summary

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate
3	0.907	0.823	0.820	4.67843

Table 39b. ANOVA

Model		Sum of Squares	Df	Mean Square	F	p – value
3	Regression	64455.780	9	7161.753	327.204	0.000
	Residual	13898.717	635	21.888		
	Total	78354.496	644			

Table 39c. Coefficients

	Predictors	B	Std. Error	Beta	t	p – value
I	Intercept	2.521	1.585		1.590	0.112
S_tB_4	Access to Educational Technology	-2.679	0.400	-0.155	-6.697	0.000
Cu_1	Exploration	3.747	0.526	0.186	7.124	0.000
Cu_2	Absorption	2.946	0.407	0.162	7.244	0.000
Cu_3	Epistemic curiosity	4.686	0.596	0.236	7.861	0.000
Cu_4	Perceptual curiosity	4.729	0.554	0.241	8.534	0.000
S_cB_1	Class Size	-1.441	0.470	-0.077	-3.065	0.002
S_cB_3	Number of Years Spent in Teaching	-0.223	0.111	-0.034	-1.999	0.046
S_cB_{10}	School's Support Facilities	10.707	0.483	0.509	22.189	0.000
S_cB_{11}	School's Academic Programs in Mathematics	-2.246	0.474	-0.115	-4.743	0.000

Compared to the full Model 3 in Appendix J, it is shown in Table 13a that the values of the multiple correlation coefficient R, the coefficient of determination R^2, and the Adjusted R^2

all have been reduced. The parsimonious regression Model 3 with nine predictors namely Access to Educational Technology, Exploration, Absorption, Epistemic Curiosity, Perceptual Curiosity, Class Size, Number of Years Spent in Teaching, School's Support Facilities, and School's Academic Programs in Mathematics, explains 82.3% of the variance of the sixth grade pupils' strategic competence.

The Adjusted R Square, which takes into account the number of variables in the model and the number of participants Model 3 is based on, indicates no overfitting of the model and that the results should be 82.0% generalizable from the perspective of the ratio of observations to variables in the equation (71:1 for the parsimonious Model 3). However, the standard error of the estimate, which represents an estimate of the standard deviation of the actual strategic competence values around the regression line has slightly increased to 4.67843, thus thinly enlarged the absolute size of the prediction error when the parsimonious Model 3 is used to predict strategic competence. It also indicates that at 95% confidence level, the margin of error for any predicted value of strategic competence can be calculated at ±9.17.

Table 39b displays the analysis of variance which provides the statistical test for the overall model fit of the parsimonious Model 3 in terms of the F ratio. Notice that the total sum of squares (78354.496) is equal to the total sum of squares of the full Model 3, the same amount of error that would occur if only the mean of strategic competence is used to predict this strand of mathematical proficiency. Using only Access to Educational Technology, Exploration, Absorption, Epistemic Curiosity, Perceptual Curiosity, Class Size, Number of

Years Spent in Teaching, School’s Support Facilities, and School’s Academic Programs in Mathematics reduces this error by 82.26%. Though this reduction is smaller than the 82.55% of the full Model 3, it is still deemed statistically significant with an F ratio of 327.204 and a p – value of less than 0.01. In other words, the parsimonious Model 3 is statistically significant in predicting levels of strategic competence when the scores in the Access to Educational Technology, Exploration, Absorption, Epistemic Curiosity, Perceptual Curiosity, Class Size, Number of Years Spent in Teaching, School’s Support Facilities, and School’s Academic Programs in Mathematics are known. In other words, in the parsimonious Model 3 the coefficient of the predictor motivation is zero. **Therefore, it can be concluded, that a significant portion of the sixth grade pupils’ strategic competence was influenced by the student background, school background, and curiosity.**

This implies the level of pupils' ability to formulate mathematical problems, represent them, and solve them is influenced by access to educational technology, curiosity, class size, teacher’s number of years spent in teaching, school’s support facilities, and school’s academic programs in mathematics. According to Tarantino et.al., (2013) social media, as an educational technology, can aid in the achievement of both general and content specific student learning outcomes. Therefore, overall student learning can increase when educators incorporate social media into academic course content. In addition, Stumm, Hell, and Chamorro-Premuzic (2011) showed that curiosity is a big part of academic performance. In fact, personality traits like curiosity seem to be as important as intelligence in determining how well students do in school. Biddle and Berliner (2002) offered tentative theories to explain why small classes had impressive effects in the early grades. Since there was more one-to-one interaction in smaller classes, teachers learned more about individual students. This translates into helping students develop more useful habits and ideas about themselves. On the other hand, Waldman (2003) discovered that students visit library for different purpose and this purpose have strong influence on their performance in mathematics. Adams (2011) mentioned that the major implication for teachers of remedial math courses is to use organization, affiliation, and product-focus lessons. Implementing these strategies either singularly or in combination has the potential for strengthening math ability and increasing math scores.

Finally, Table 39c presents the regression coefficients *b* and *Beta* of the parsimonious Model 3 whose predictors are Access to Educational Technology, Exploration, Absorption, Epistemic Curiosity, Perceptual Curiosity, Class Size, Number of Years Spent in Teaching, School's Support Facilities, and School's Academic Programs in Mathematics, all of which have coefficients that are statistically significant at 95% confidence level. Thus, the regression equation of the parsimonious Model 3 is

$$SC = 2.521 - 2.679S_tB_4 + 3.747Cu_1 + 2.946Cu_2 + 4.686Cu_3 + 4.729Cu_4 - 1.441S_cB_1 - 0.223S_cB_3 + 10.707S_cB_{10} - 2.246S_cB_{11}$$

Where SC is the predicted value of Strategic Competence

S_tB_4 is the observed value of Access to educational Technology

Cu_1 is the observed value of Exploration

Cu_2 is the observed value of Absorption

Cu_3 is the observed value of Epistemic Curiosity

Cu_4 is the observed value of Perceptual Curiosity

S_cB_1 is the observed value of Class Size

S_cB_3 is the observed value of Number of Years Spent in Teaching

S_cB_{10} is the observed value of School's Support Facilities

S_cB_{11} is the observed value of School's Academic Programs in Mathematics

The regression model for Adaptive Reasoning is labeled Model 4. Although the full Model 4 (using Enter Method) is statistically significant in predicting adaptive reasoning, it has predictors that are insignificant (see Appendix K). Thus, using Backward Method, insignificant predictors were eliminated. Table 40 presents the result of regression analysis using SPSS 20.

Compared to the full Model 4 in Appendix K, it is shown in Table 40a that the values of the multiple correlation coefficient R, the coefficient of determination R^2, and the Adjusted R^2 all have been reduced. The parsimonious regression Model 4 with twelve predictors namely Access to Educational Technology, Exploration, Absorption, Epistemic Curiosity, Perceptual Curiosity, Goal Orientation, Task Value, Class Size, Educational Qualifications, Ability Grouping, School's Support Facilities, and School's Academic Programs in Mathematics, explains 84.0% of the variance of the sixth grade pupils' adaptive reasoning.

Table 40b displays the analysis of variance which provides the statistical test for the overall model fit of the parsimonious Model 4 in terms of the F ratio.

Table 40
Multiple Regression Analysis of Parsimonious Model 4
(Dependent Variable: Adaptive Reasoning)

Table 40a. Model Summary

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate
4	0.917	0.840	0.837	4.64317

Table 40b. ANOVA

Model		Sum of Squares	Df	Mean Square	F	p – value
4	Regression	71777.776	12	5981.481	277.446	0.000
	Residual	13625.324	632	21.559		
	Total	85403.101	644			

Table 40c. Coefficients

	Predictors	B	Std. Error	Beta	t	p – value
I	Intercept	1.548	1.747		0.886	0.376
S_tB_4	Access to Educational Technology	-0.879	0.398	-0.049	-2.206	0.028
Cu_1	Exploration	3.039	0.528	0.145	5.761	0.000
Cu_2	Absorption	2.854	0.405	0.151	7.040	0.000
Cu_3	Epistemic curiosity	5.116	0.607	0.247	8.428	0.000
Cu_4	Perceptual curiosity	4.394	0.575	0.215	7.639	0.000
Mo_1	Goal orientation	1.326	0.608	0.070	2.179	0.030
Mo_2	Task value	-1.521	0.605	-0.080	-2.514	0.012
S_cB_1	Class Size	-2.658	0.468	-0.135	-5.684	0.000
S_cB_4	Educational Qualifications	0.279	0.165	0.027	1.688	0.092
S_cB_9	Ability Grouping	-0.652	0.274	-0.038	-2.379	0.018
S_cB_{10}	School's Support Facilities	-1.287	0.482	-0.059	-2.672	0.008
S_cB_{11}	School's Academic Programs in Mathematics	10.555	0.471	0.516	22.418	0.000

Notice that the total sum of squares (85403.101) is equal to the total sum of squares of the full Model 4, the same amount of error that would occur if only the mean of adaptive reasoning is used to predict this strand of mathematical proficiency. Using only Access to Educational Technology, Exploration, Absorption, Epistemic Curiosity, Perceptual Curiosity, Goal Orientation, Task Value, Class Size, Educational Qualifications, Ability Grouping, School's Support Facilities, and School's Academic Programs in Mathematics reduces this error by 84.05%. Though this reduction is smaller than the 84.21% of the full Model 4, it is still deemed statistically significant with an F ratio of 277.446 and a p – value of less than 0.01. In other words, the parsimonious Model 4 is statistically significant in predicting levels of adaptive reasoning when the scores in the Access to Educational Technology, Exploration, Absorption, Epistemic Curiosity, Perceptual Curiosity, Goal Orientation, Task Value, Class Size, Educational Qualifications, Ability Grouping, School's Support Facilities, and School's Academic Programs in Mathematics are known. In other words, in the parsimonious Model 4, the coefficients of the predictors student background, school background, curiosity and motivation are not zero. **Therefore, it can be concluded, that a significant portion of the sixth grade pupils' adaptive reasoning was influenced by the student background, school background, curiosity, and motivation.**

This implies that the level of pupils' capacity to think logically about the relationships among concepts and situations is influenced by access to educational technology, curiosity, motivation, school's support facilities, and school's academic programs in mathematics. The study of Brese & Mirazchiyski (2005), as cited by Kupari (2006) focused on the TIMSS 2004 and PISA 2005 studies. Their results revealed that computer at home showed strong or moderate association with mathematics achievement. In addition, Stumm, Hell, and Chamorro-Premuzic (2011) showed that curiosity is a big part of academic performance. In fact, personality traits like curiosity seem to be as important as intelligence in determining how well students do in school. Skinner and Belmont (1991), as cited by Doronila (2012), explained that students who are motivated to engage in school select tasks at the border of their competencies, initiate action when given the opportunity, and exert intense effort and concentration in the implementation of learning tasks. Keith (2004) in his study found that the size of a library media program as indicated by the size of its staff and collection is the best school predictor of mathematics achievement of students. In addition, the instructional role of the library media specialist shapes the collection and in turn academic achievement. Adams (2011) mentioned that the major implication for teachers of remedial math courses is to use organization, affiliation, and product-focus lessons. Implementing these strategies either singularly or in combination has the potential for strengthening math ability and increasing math scores.

Finally, Table 40c presents the regression coefficients *b* and *Beta* of the parsimonious Model 4 whose predictors are Access to Educational Technology, Exploration, Absorption, Epistemic Curiosity, Perceptual Curiosity, Goal Orientation, Task Value, Class Size, Educational Qualifications, Ability Grouping, School's Support Facilities, and School's Academic Programs in Mathematics, all of which have coefficients that are statistically significant at 95% confidence level. Thus, the regression equation of the parsimonious Model 4 is

$$AR = 1.548 - 0.879S_tB_4 + 3.039Cu_1 + 2.854Cu_2 + 5.116Cu_3 + 4.394Cu_4$$

$$+ 1.326Mo_1 – 1.521Mo_2 – 2.658S_cB_1 + 0.279S_cB_4 – 0.652S_cB_9$$
$$– 1.287S_cB_{10} + 10.555S_cB_{11}$$

Where AR is the predicted value of Adaptive Reasoning

S_tB_4 is the observed value of Access to educational Technology

Cu_1 is the observed value of Exploration

Cu_2 is the observed value of Absorption

Cu_3 is the observed value of Epistemic Curiosity

Cu_4 is the observed value of Perceptual Curiosity

Mo_1 is the observed value of Goal Orientation

Mo_2 is the observed value of Task Value

S_cB_1 is the observed value of Class Size

S_cB_4 is the observed value of Educational Qualifications

S_cB_9 is the observed value of Ability Grouping

S_cB_{10} is the observed value of School's Support Facilities

S_cB_{11} is the observed value of School's Academic Programs in Mathematics

The regression model for Productive Disposition is labeled Model 5. Although the full Model 5 (using Enter Method) is statistically significant in predicting productive disposition, it has predictors that are insignificant (see Appendix L). Thus, using Backward Method, insignificant predictors were eliminated. Table 41 presents the result of regression analysis using SPSS 20.

Table 41
Multiple Regression Analysis of Parsimonious Model 5
(Dependent Variable: Productive Disposition)

Table 41a. Model Summary

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate
5	0.923	0.852	0.850	4.85884

Table 41b. ANOVA

Model		Sum of Squares	df	Mean Square	F	p – value
5	Regression	86380.327	8	10797.541	457.362	0.000
	Residual	15014.866	636	23.608		
	Total	101395.194	644			

Table 41c. Coefficients

	Predictors	b	Std. Error	Beta	T	p – value
I	Intercept	10.141	1.646		6.161	0.000
S_tB_1	Number of Household Members	-1.757	0.662	-0.062	-2.654	0.008
S_tB_4	Access to Educational Technology	13.922	0.405	0.709	34.375	0.000
Cu_1	Exploration	3.650	0.534	0.159	6.829	0.000
Cu_2	Absorption	0.935	0.407	0.045	2.296	0.022
Cu_3	Epistemic Curiosity	3.408	0.609	0.151	5.594	0.000
Cu_4	Perceptual Curiosity	3.369	0.572	0.151	5.889	0.000
S_cB_1	Class Size	-2.019	0.480	-0.094	-4.210	0.000
S_cB_{10}	School's Support Facilities	-2.214	0.500	-0.093	-4.427	0.000

Compared to the full Model 5 in Appendix L, it is shown in Table 41a that the values of the multiple correlation coefficient R, the coefficient of determination R^2, and the Adjusted R^2 all have been reduced. The parsimonious regression Model 5 with eight predictors namely Number of Household Members, Access to Educational Technology, Exploration, Absorption, Epistemic Curiosity, Perceptual Curiosity, Class Size, and School's Support Facilities, explains 85.2% of the variance of the sixth grade pupils' productive disposition.

The Adjusted R Square, which takes into account the number of variables in the model and the number of participants Model 5 is based on, indicates no overfitting of the model and that the results should be 85.0% generalizable from the perspective of the ratio of observations to variables in the equation (80:1 for the parsimonious Model 5). However, the standard error of the estimate, which represents an estimate of the standard deviation of the actual productive disposition values around the regression line has slightly increased to 4.85884, thus thinly enlarged the absolute size of the prediction error when the parsimonious Model 5 is used to predict productive disposition. It also indicates that at 95% confidence level, the margin of error for any predicted value of productive disposition can be calculated at ±9.52.

Table 41b displays the analysis of variance which provides the statistical test for the overall model fit of the parsimonious Model 5 in terms of the F ratio. Notice that the total sum of squares (101395.194) is equal to the total sum of squares of the full Model 5, the same amount of error that would occur if only the mean of productive disposition is used to predict this strand of mathematical proficiency. Using only Number of Household Members, Access to Educational Technology, Exploration, Absorption, Epistemic Curiosity, Perceptual Curiosity, Class Size, and School's Support Facilities reduces this error by

85.19%. Though this reduction is smaller than the 85.34% of the full Model 5, it is still deemed statistically significant with an F ratio of 457.362 and a p – value of less than 0.01. In other words, the parsimonious Model 5 is statistically significant in predicting levels of productive disposition when the scores in the Number of Household Members, Access to Educational Technology, Exploration, Absorption, Epistemic Curiosity, Perceptual Curiosity, Class Size, and School's Support Facilities are known.

This implies that the level of pupils' tendency to see sense in mathematics, to perceive it as both useful and worthwhile, to believe that steady effort in learning mathematics pays off, and to see oneself as an effective learner and doer of mathematics is influenced by number of household members, access to educational technology, curiosity, class size and school's support facilities. Brembah (2013) reported that parents with two or three children can afford the time to increase their children's academic potentials because their time is only shared with less number of children. According to Atanda et. al. (2011) some of the reasons attributed to the observed poor achievement in Mathematics include poor school facilities and equipment, use of traditional chalk and talk methods instead of educational technology, and large pupils to teacher ratio. Curiosity, according to Stumm et. al. (2007), is basically a hunger for exploration. When one is intellectually curious, he'll go home and read the books. If one is perceptually curious, then he might go traveling to foreign countries and try different foods. Both of these, could help one do better in school.

In other words, in the parsimonious Model 5, the coefficient of the predictor motivation is zero. **Therefore, it can be concluded, that a significant portion of the sixth**

grade pupils' productive disposition was influenced by the student background, school background, and curiosity.

Finally, Table 41c presents the regression coefficients *b* and *Beta* of the parsimonious Model 5 whose predictors are Number of Household Members, Access to Educational Technology, Exploration, Absorption, Epistemic Curiosity, Perceptual Curiosity, Class Size, and School's Support Facilities, all of which have coefficients that are statistically significant at 0.05 confidence level. Thus, the regression equation of the parsimonious Model 5 is

$$PD = 10.141 - 1.757S_tB_1 + 13.922S_tB_4 + 3.650Cu_1 + 0.935Cu_2 + 3.408Cu_3 + 3.369Cu_4 - 2.019S_cB_1 - 2.214S_cB_{10}$$

Where PD is the predicted value of Productive Disposition

S_tB_1 is the observed value of Number of Household Members

S_tB_4 is the observed value of Access to educational Technology

Cu_1 is the observed value of Exploration

Cu_2 is the observed value of Absorption

Cu_3 is the observed value of Epistemic Curiosity

Cu_4 is the observed value of Perceptual Curiosity

S_cB_1 is the observed value of Class Size

S_cB_{10} is the observed value of School's Support Facilities

The regression model for Mathematical Proficiency is labeled Model 6. Although the full Model 6 (using Enter Method) is statistically significant in predicting mathematical proficiency, it has predictors that are insignificant (see Appendix M). Thus, using Backward

Method, insignificant predictors were eliminated. Table 42 presents the result of regression analysis using SPSS 20.

Table 42
Multiple Regression Analysis of Parsimonious Model 6
(Dependent Variable: Mathematical Proficiency)

Table 42a. Model Summary

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate
6	0.955	0.912	0.911	0.415

Table 42b. ANOVA

Model		Sum of Squares	df	Mean Square	F	p – value
6	Regression	1140.291	9	126.699	734.006	0.000
	Residual	109.609	635	0.173		
	Total	1249.901	644			

Table 42c. Coefficients

	Predictors	B	Std. Error	Beta	t	p – value
I	Intercept	-7.610	0.169		-44.979	0.000
S_tB_1	Number of Household Members	0.250	0.056	0.079	4.428	0.000
S_tB_4	Access to Educational Technology	0.159	0.034	0.073	4.667	0.000
S_tB_6	Family Formation	-0.031	0.018	-0.020	-1.733	0.084
S_tB_7	Level of Parental Involvement in Child's Education	-0.082	0.028	-0.036	-2.962	0.003
Cu_1	Exploration	0.504	0.045	0.198	11.086	0.000
Cu_2	Absorption	0.447	0.034	0.195	12.979	0.000
Cu_3	Epistemic curiosity	0.762	0.050	0.304	15.272	0.000
Cu_4	Perceptual curiosity	0.722	0.048	0.291	15.085	0.000
S_cB_1	Class Size	0.096	0.041	0.041	2.358	0.019

Compared to the full Model 6 in Appendix M, it is shown in Table 42a that the values of the multiple correlation coefficient R, the coefficient of determination R^2, and the Adjusted R^2 all have been reduced. The parsimonious regression Model 6 with nine predictors namely Number of Household Members, Access to Educational Technology, Family Formation, Level of Parental Involvement in Child's Education, Exploration, Absorption, Epistemic Curiosity, Perceptual Curiosity, and Class Size, explains 91.2% of the variance of the sixth grade pupils' mathematical proficiency.

The Adjusted R Square, which takes into account the number of variables in the model and the number of participants Model 6 is based on, indicates no overfitting of the model and that the results should be 91.1% generalizable from the perspective of the ratio of observations to variables in the equation (71:1 for the parsimonious Model 6). However, the standard error of the estimate, which represents an estimate of the standard deviation of the actual mathematical proficiency values around the regression line has slightly increased to 0.415, thus thinly enlarged the absolute size of the prediction error when the parsimonious Model 6 is used to predict mathematical proficiency. It also indicates that at 95% confidence level, the margin of error for any predicted value of mathematical proficiency can be calculated at ±0.81.

Table 42b displays the analysis of variance which provides the statistical test for the overall model fit of the parsimonious Model 6 in terms of the F ratio. Notice that the total sum of squares (1249.901) is equal to the total sum of squares of the full Model 6, the same amount of error that would occur if only the mean of mathematical proficiency is used to predict mathematical proficiency. Using only Number of Household Members, Access to Educational Technology, Family Formation, Level of Parental Involvement in Child's Education, Exploration, Absorption, Epistemic Curiosity, Perceptual Curiosity, and Class Size reduces this error by 91.23%. Though this reduction is smaller than the 91.41% of the full Model 6, it is still deemed statistically significant with an F ratio of 734.006 and a p – value of less than 0.01. In other words, the parsimonious Model 6 is statistically significant in predicting levels of mathematical proficiency when the scores in the Number of Household Members, Access to Educational Technology, Family Formation, Level of Parental Involvement in Child’s Education, Exploration, Absorption, Epistemic Curiosity, Perceptual Curiosity, and Class Size are known. In other words, in the parsimonious Model 6, the coefficients of the predictor motivation is zero.

Number of household members influences mathematical proficiency. According to Brembah (2013), smaller household size has been linked with higher academic achievement of the students. Students with fewer siblings are likely to receive more parents’ attention and have more access to resources compared to those children whose families are large in size.

The result that access to educational technology influences mathematical proficiency is supported by the studies of Crosnoe and Cooper (2010), Ku, Chen, Wu, Lao, Tak, and Chan (2013), and De Castro et.al., (2014). Their studies revealed that that the virtual environment helped significantly improved the scores on the post-test of the experimental group, whereas the control group did not improve their scores. The improvement in scores for children who had computer-based reinforcement compared with children who had reinforcement using traditional teaching confirmed that learning and training can change the human brain and generate measurable benefits for the children.

Meanwhile, the result that family formation influences mathematical proficiency is parallel to the studies of The Heritage Foundation (2015) and Ushie, Emeka, Owolabi, and Ononga (2012). Their studies indicated thatchildren who do not live in intact families tend to be less proficient in math and science. Also, it was concluded that the performance of students depends on their individual build up and aspirations in life, as students from single parent families compete and even do perform better in most cases than their counterpart from two parent families. As such, the father or mother though over burden and under immense home demands, keeps to time and tries to be at home with the children mostly at their adolescents.

The research of Desforges and Abouchaar (2003) supports the result of this study that parental involvement in child’s education influences mathematical proficiency. They established that parental involvement has a significant effect on children’s achievement and adjustment even after all other factors (such as social class, maternal education and poverty) have been take out of the equation between children’s aptitudes and their achievement.

On the other hand, curiosity influences mathematical proficiency because according to Stumm, Hell, and Chamorro - Premuzic (2011) curiosity is a big part of academic performance. In fact, personality traits like curiosity seem to be as important as intelligence in determining how well students do in school. Likewise, class size is a predictor of mathematical proficiency because according to the study of Mosteller, as cited by Kornfeld

(2010), proposed factors that made it likely that younger students benefited from smaller class size. When children first came to school, they were confronted with many changes and much confusion, entering this new setting from a variety of homes and circumstances.

Therefore, it can be concluded, that a significant portion of the sixth grade pupils' mathematical proficiency was influenced by the student background, school background and curiosity.

Finally, Table 42c presents the regression coefficients *b* and *Beta* of the parsimonious Model 6 whose predictors are Number of Household Members, Access to Educational Technology, Family Formation, Level of Parents' Involvement in Education, Exploration, Absorption, Epistemic Curiosity, Perceptual Curiosity, and Class Size, all of which have coefficients that are statistically significant at 0.05 confidence level. Thus, the regression equation of the parsimonious Model 6 is

$$MP = -7.610 + 0.250S_tB_1 + 0.159S_tB_4 - 0.031S_tB_6 - 0.082S_tB_7 + 0.504Cu_1 + 0.447Cu_2 + 0.762Cu_3 + 0.722Cu_4 + 0.096S_cB_1$$

Where MP is the predicted value of Mathematical Proficiency

S_tB_1 is the observed value Number of Household Members

S_tB_4 is the observed value of Access to Educational Technology

S_tB_6 is the observed value of Family Formation

S_tB_7 is the observed value of Level of Parental Involvement in Child's Education

Cu_1 is the observed value of Exploration

Cu_2 is the observed value of Absorption

Cu_3 is the observed value of Epistemic Curiosity

Cu_4 is the observed value of Perceptual Curiosity

S_cB_1 is the observed value of Class Size

Another regression model for Mathematical Proficiency is labeled Model 7. Table 43a shows the values of the multiple correlation coefficient R, the coefficient of determination R^2, and the Adjusted R^2. The full regression Model 7 with five predictors namely Conceptual Understanding, Procedural Fluency, Strategic Competence, Adaptive Reasoning, and Productive Disposition, explains 94.2% of the variance of the sixth grade pupils' mathematical proficiency.

The Adjusted R Square, which takes into account the number of variables in the model and the number of participants Model 7 is based on, indicates no overfitting of the model and that the results should be 94.2% generalizable from the perspective of the ratio of observations to variables in the equation (129:1 for the full Model 7). The standard error of the estimate, which represents an estimate of the standard deviation of the actual mathematical proficiency values around the regression line is 0.337. It also indicates that at 95% confidence level, the margin of error for any predicted value of mathematical proficiency can be calculated at ±0.66.

Table 43b displays the analysis of variance which provides the statistical test for the overall model fit of the parsimonious Model 6 in terms of the F ratio. Notice that the total sum of squares (1249.901) is equal to the total sum of squares of the full Model 6, the same amount of error that would occur if only the mean of mathematical proficiency is used to predict mathematical proficiency. Using only Conceptual Understanding, Procedural Fluency, Strategic Competence, Adaptive Reasoning, and Productive Disposition reduces this error by 94.21%. Model 7 is statistically significant with an F ratio of2079.724 and a p – value of less than 0.01.

Table 43
Multiple Regression Analysis of Full Model 7
(Dependent Variable: Mathematical Proficiency)

Table 43a. Model Summary

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate
7	0.971	0.942	0.942	0.337

Table 43b. ANOVA

Model		Sum of Squares	Df	Mean Square	F	p – value
7	Regression	1177.540	5	235.508	2079.724	0.000
	Residual	72.360	639	0.113		
	Total	1249.901	644			

Table 43c. Coefficients

	Predictors	B	Std. Error	Beta	t	p – value
I	Intercept	-9.236	.133		-69.651	0.000
CU	Conceptual Understanding	0.027	0.002	0.179	14.613	0.000
PF	Procedural Fluency	0.033	0.002	0.288	21.588	0.000
SC	Strategic Competence	0.029	0.002	0.233	17.322	0.000
AR	Adaptive Reasoning	0.033	0.002	0.269	19.917	0.000
PD	Productive Disposition	0.031	0.001	0.281	25.009	0.000

In other words, the full Model 7 is statistically significant in predicting levels of mathematical proficiency when the scores in the Conceptual Understanding, Procedural Fluency, Strategic Competence, Adaptive Reasoning, and Productive Disposition are known. In other words, in the full Model 7, the coefficients of the predictors Conceptual Understanding, Procedural Fluency, Strategic Competence, Adaptive Reasoning, and Productive Disposition are not zero. **Therefore, it can be concluded, that a significant portion of the sixth grade pupils' mathematical proficiency was influenced by the Conceptual Understanding, Procedural Fluency, Strategic Competence, Adaptive Reasoning, and Productive Disposition.**

This implies that for a pupil to learn mathematics successfully, sixth grade pupils should be developed in terms of conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition. The five strands are interwoven and interdependent in the development of proficiency in mathematics. Mathematical proficiency is not a one – dimensional trait, and it cannot be achieved by focusing on just one or two of these strands. Some researchers argue that helping children acquire mathematical proficiency calls for instructional programs that address all its strands. As they go from pre-kindergarten to eighth grade, all students should become increasingly proficient in mathematics. That proficiency should enable them to cope with the mathematical challenges of daily life and enable them to continue their study of mathematics in high school and beyond.

Finally, Table 43c presents the regression coefficients *b* and *Beta* of the Full Model 7 whose predictors are Conceptual Understanding, Procedural Fluency, Strategic Competence, Adaptive Reasoning, and Productive Disposition, all of which have coefficients that are statistically significant at 0.05 confidence level. Thus, the regression equation of the full Model 7 is

$$MP = -9.236 + 0.027CU + 0.033PF + 0.029SC + 0.033AR + 0.031PD$$

Where *MP* is the predicted value of Mathematical Proficiency

CU is the observed value of Conceptual Understanding

PF is the observed value of Procedural Fluency

SC is the observed value of Strategic Competence

AR is the observed value of Adaptive Reasoning

PD is the observed value of Productive Disposition

Interaction among Social – Contextual and Psychological Constructs in Predicting Mathematical Proficiency

This section presents the analysis of interaction among the social - contextual and psychological constructs with specified interaction terms using analysis of covariance as the statistical technique. Included in the analysis were both main and interaction effects of the constructs to mathematical proficiency.

Problem 5. Are the interactions among the social – contextual and psychological constructs statistically significant?

As mentioned several times, this study was anchored on describing the social - contextual and psychological makeup of sixth grade pupils' mathematical proficiency. Since the constructs included in this study had already been known to have significant contribution to and thus determine the level of mathematical proficiency, the question of whether they do significantly interact together, or do they co – vary, is of great interest in this section. The full Model 6 was once again put into a statistical procedure. Setting the new design of the mode, the constructs student background (number of household members, access to educational technology, level of performance in English, and level of parental involvement in child's education), school background (class size, educational qualifications, school's support facilities, and school's academic programs in mathematics), curiosity, and motivation considered having direct influences in the mathematical proficiency of the sixth grade pupils, are classified as the main effects while the product terms are the interaction effects. With four constructs, there are a lot of product terms that can be formed, but not every interaction is deemed to theoretically provide sensible information. So purposely in this study, the interaction terms that were tested are 45 2 – way interactions, 120 3 – way interactions, and 1 9 – way interactions. The new model is labeled Model 8.

Analysis of Covariance (ANCOVA) tests the null hypothesis: **The interaction does not make a significant contribution to the model**. Conceptually, ANCOVA tests whether the addition of the product term(s) to the regression equation improves the proportion of explained variance in mathematical proficiency values in social – contextual and psychological constructs alone. In other words, this hypothesis answers the question of whether the addition of the moderating effect in the model improves the prediction of performance over and above the main effects of the four constructs.

Table 44
Covariance Tests Between – Subjects Effects of Model 8
(Dependent Variable: Mathematical Proficiency)

Source		Type III Sum of Squares	df	Mean Square	F	p – value
Corrected Model		1214.908	176	6.903	92.32	0.000
I	Intercept	0.701	1	0.701	9.375	0.002
Cu	Curiosity	0.899	1	0.899	12.019	0.001
S_cB_{11}	Academic Programs in Math	0.319	1	0.319	4.261	0.040
Cu* S_cB_{11}	Curiosity * Academic Programs in Math	1.317	1	1.317	17.609	0.000
Cu* S_tB_4	Curiosity * Access to Educational Technology	1.107	1	1.107	14.805	0.000
Cu*Mo	Curiosity * Motivation	0.314	1	0.314	4.193	0.041
S_tB_4* S_cB_4* S_cB_{11}	Access to Educational Technology * Educational Qualifications * Academic Programs in Math	0.297	1	0.297	3.975	0.047
Mo* S_tB_4* S_cB_{11}	Motivation * Access to Educational Technology * Academic Programs in Math	0.388	1	0.388	5.192	0.023
Cu* S_tB_5 S_cB_{11}	Curiosity * English Performance * Academic Programs in Math	0.311	1	0.311	4.156	0.042
Cu*Mo*S_cB_{11}	Curiosity * Motivation * Academic Programs in Math	0.356	1	0.356	4.765	0.030
S_tB_4* S_cB_1* S_cB_4	Access to Educational Technology * Class Size * Educational Qualifications	0.322	1	0.322	4.308	0.038
Cu* S_tB_4* S_cB_1	Curiosity * Access to Educational Technology * Class Size	0.350	1	0.350	4.682	0.031
S_tB_4* S_tB_5* S_tB_7	Access to Educational Technology * English Performance * Parental Involvement	0.323	1	0.323	4.321	0.038
Cu* S_tB_1* S_tB_4	Curiosity * Number of Household Members * Access to Educational Technology	0.597	1	0.597	7.978	0.005
S_tB_1* S_tB_4* S_cB_{10}	Number of Household Members * Access to Educational Technology * Support Facilities	0.579	1	0.579	7.741	0.006
Cu* S_tB_1* S_cB_{11}	Curiosity * Number of Household Members * Support Facilities	0.567	1	0.567	7.588	0.006
Cu*Mo* S_tB_7	Curiosity * Motivation * Parental Involvement	.423	1	.423	5.660	.018

R Squared = 0.972 (Adjusted R Squared = 0.961)

Table 44 presents the results of the tests of between – subject effects of Model 7. Compared to full Model 6's coefficient of determination of 0.914 (see Appendix M), Model

8 has a slight difference of prediction of performance to 0.972 with the addition of the moderating effects of the interaction terms.

As shown in Table 44, the constructs curiosity and school background (academic programs in math) are deemed to have significant direct effects to the mathematical proficiency of the sixth grade pupils at 0.05 significance level. On the other hand, the significant two – way interaction effects are: Curiosity * Academic Programs in Math, Curiosity * Access to Educational Technology, and Curiosity * Motivation. Meanwhile, the significant three – way interaction effects are the following: Access to Educational Technology * Educational Qualifications * Academic Programs in Math, Motivation * Access to Educational Technology * Academic Programs in Math, Curiosity * English Performance * Academic Programs in Math, Curiosity * Motivation * Academic Programs in Math, Access to Educational Technology * Class Size * Educational Qualifications, Curiosity * Access to Educational Technology * Class Size, Access to Educational Technology * English Performance * Parental Involvement, and Curiosity * Number of Household Members * Access to Educational Technology.

The main effects Motivation, Number of Household Members, Access to Educational Technology, English Performance, Parental Involvement, Class Size, Educational Qualifications, and Support Facilities are not shown in Table 44. This is because, for example, the proportion of the error sum of squares to the corrected total sum of squares of Motivation (0.110 ÷ 1249.901 < 1%) provide evidence why its F – ratio was declared insignificant. This is also true to the other main effects and interaction effects which were declared as not significant (see Appendix N). The exclusion of these two terms from the model gave a negligible change in the model's overall fit.

Table 45
Parameter Estimates of Main and Interaction Effects of Model 9
(Dependent Variable: Mathematical Proficiency)

	Parameter	B	Std. Error	t	p – value
I	Intercept	94.142	30.746	3.062	0.002
Cu	Curiosity	-43.976	12.685	-3.467	0.001
S_cB_{11}	Academic Programs in Math	-13.394	6.489	-2.064	0.040
Cu* S_cB_{11}	Curiosity * Academic Programs in Math	8.604	2.050	4.196	0.000
Cu* S_tB_4	Curiosity * Access to Educational Technology	6.363	1.654	3.848	0.000
Cu*Mo	Curiosity * Motivation	3.939	1.924	2.048	0.041
S_tB_4* S_cB_4* S_cB_{11}	Access to Educational Technology * Educational Qualifications * Academic Programs in Math	-0.153	0.077	-1.994	0.047
Mo* S_tB_4* S_cB_{11}	Motivation * Access to Educational Technology * Academic Programs in Math	0.337	0.148	2.279	0.023
Cu* S_tB_5 S_cB_{11}	Curiosity * English Performance * Academic Programs in Math	-0.375	0.184	-2.039	0.042
Cu*Mo*S_cB_{11}	Curiosity * Motivation * Academic Programs in Math	-0.564	0.259	-2.183	0.030
S_tB_4* S_cB_1* S_cB_4	Access to Educational Technology * Class Size * Educational Qualifications	-0.132	0.064	-2.076	0.038
Cu* S_tB_4* S_cB_1	Curiosity * Access to Educational Technology * Class Size	-0.372	0.172	-2.164	0.031
S_tB_4* S_tB_5* S_tB_7	Access to Educational Technology * English Performance * Parental Involvement	-0.148	0.071	-2.079	0.038
Cu* S_tB_1* S_tB_4	Curiosity * Number of Household Members * Access to Educational Technology	-1.463	0.518	-2.825	0.005
S_tB_1* S_tB_4* S_cB_{10}	Number of Household Members * Access to Educational Technology * Support Facilities	0.985	0.354	2.782	0.006
Cu* S_tB_1* S_cB_{11}	Curiosity * Number of Household Members * Support Facilities	-1.563	0.567	-2.755	0.006
Cu*Mo* S_tB_7	Curiosity * Motivation * Parental Involvement	-0.591	0.248	-2.379	0.018

The model without the insignificant main and interaction effects, labeled as Model 9, was run again in SPSS, and Table 45 presents the new parameter estimates of the remaining two main effects and fourteen interaction effects. All main and interaction effects are now significant, indicating that the amount of change in the slope of the regression of each main effect on the mathematical proficiency that results from a unit – change in another main effect is greater than would be expected by chance alone.

Note that the main effects of the constructs to the mathematical proficiency are all negative; but because the interaction terms in Model 7 are all significant, it is inferred that nothing can be said about the main effects of constructs in the interaction since they lose meaning in the context of interaction.

Nonetheless, explaining 97.2% of the variances in the sixth grade pupils' mathematical proficiency when the values of the main and interaction effects are known and having all coefficients and its intercept statistically significant, Model 8 is objectively acceptable, and is now in a form of a the equation.

$$\begin{aligned} MP = {} & 94.142 - 43.976Cu - 13.394S_cB_{11} + 8.604\,Cu^* S_cB_{11} + 6.363\,Cu^* S_tB_4 \\ & + 3.939\,Cu^*Mo - 0.153\, S_tB_4^* S_cB_4^* S_cB_{11} + 0.337\,Mo^* S_tB_4^* S_cB_{11} - 0.375 \\ & Cu^* S_tB_5\, S_cB_{11} - 0.564\, Cu^*Mo^*S_cB_{11} - 0.132\, S_tB_4^* S_cB_1^* S_cB_4 - 0.372\, Cu^* \\ & S_tB_4^* S_cB_1 - 0.148\, S_tB_4^* S_tB_5^* S_tB_7 - 1.463\, Cu^* S_tB_1^* S_tB_4 + 0.985\, S_tB_1^* \\ & S_tB_4^* S_cB_{10} - 1.563\, Cu^* S_tB_1^* S_cB_{11} - 0.591\, Cu^*Mo^* S_tB_7 \end{aligned}$$

where *MP* is the predicted value of Mathematical Proficiency;

Cu	is the observed value of Curiosity
S_cB_{11}	is the observed value of Academic Programs in Math
Cu* S_cB_{11}	is the product of observed values of Curiosity and Academic Programs in Math

$Cu* S_tB_4$	is the product of observed values of Curiosity and Access to Educational Technology
$Cu*Mo$	is the product of observed values of Curiosity and Motivation
$S_tB_4* S_cB_4* S_cB_{11}$	is the product of observed values of Access to Educational Technology, Educational Qualifications, and Academic Programs in Math
$Mo* S_tB_4* S_cB_{11}$	is the product of observed values of Motivation, Access to Educational Technology, and Academic Programs in Math
$Cu* S_tB_5$ S_cB_{11}	is the product of observed values of Curiosity, English Performance, and Academic Programs in Math
$Cu*Mo*S_cB_{11}$	is the product of observed values of Curiosity, Motivation, and Academic Programs in Math
$S_tB_4* S_cB_1* S_cB_4$	is the product of observed values of Access to Educational Technology, Class Size, and Educational Qualifications
$Cu* S_tB_4* S_cB_1$	is the product of observed values of Curiosity, Access to Educational Technology, and Class Size
$S_tB_4* S_tB_5* S_tB_7$	is the product of observed values of Access to Educational Technology, English Performance, and Parental Involvement

Cu* S_tB_1* S_tB_4	is the product of observed values of Curiosity, Number of Household Members, and Access to Educational Technology
S_tB_1* S_tB_4* S_cB_{10}	is the product of observed values of Number of Household Members, Access to Educational Technology, and Support Facilities
Cu* S_tB_1* S_cB_{11}	is the product of observed values of Curiosity, Number of Household Members, and Support Facilities
Cu*Mo* S_tB_7	is the product of observed values of Curiosity, Motivation, and Parental Involvement

It can be concluded that the interactions between social – contextual and psychological constructs are not statistically significant. Only those which interact with curiosity and academic programs in math are statistically significant, defining the paths of association they have in shaping the level of mathematical proficiency as seen from the perspective specified in this study. In other words, the behavior of interactions between the constructs may differ once the interactions are specified over and above the way they are viewed in this study as theoretically important.

The CPMP Model

Problem 6. What model(s) can be proposed to describe the social – contextual and psychological composition of sixth grade pupils' mathematical proficiency?

This study is primarily anchored on the objective to describe and offer a clear picture of how social – contextual and psychological makeup of the sixth grade pupils combine and associate together to find out whether it affects their mathematical proficiency.

Putting together all the previously analyzed models (Model 1 – 7), they formed a 'family of statistically – fit multi – level models' trying to explain the postulate that: ***The person's level of proficiency in mathematics is influenced by curiosity and student background.***

The seven 'full' models (Model 1 to Model 7), plus some counterparts called 'parsimonious' models, and the two models with interaction effects (Model 8 and Model 9) offered seven perspectives of analyses based on the format specified in Table 3. The results, however, were 'bits' of pieces that explain single relationship (one at a time) of social - contextual and psychological constructs. Although Model 6 seemingly gave the parsimonious picture of the entire set of constructs related to mathematical proficiency, it still had a lot of loopholes that cannot be fixed by putting other models together due to overlapping issues that regression analysis is incapable of fixing.

As mentioned in Chapter III, this study adopted a more comprehensive technique called structural equation modeling (SEM) in which the previous models were combined together to form an overall single model, where adjustments could be made for it to work better. Hair (2010) supported that apart from SEM, no multivariate technique enables any researcher to test his entire theory that considers all possible information in one comprehensive analysis. So this technique was adopted because, theoretically, the sociological and psychological constructs influence mathematical proficiency, but confirmatory analysis such as SEM improves the acceptability of the model or theory.

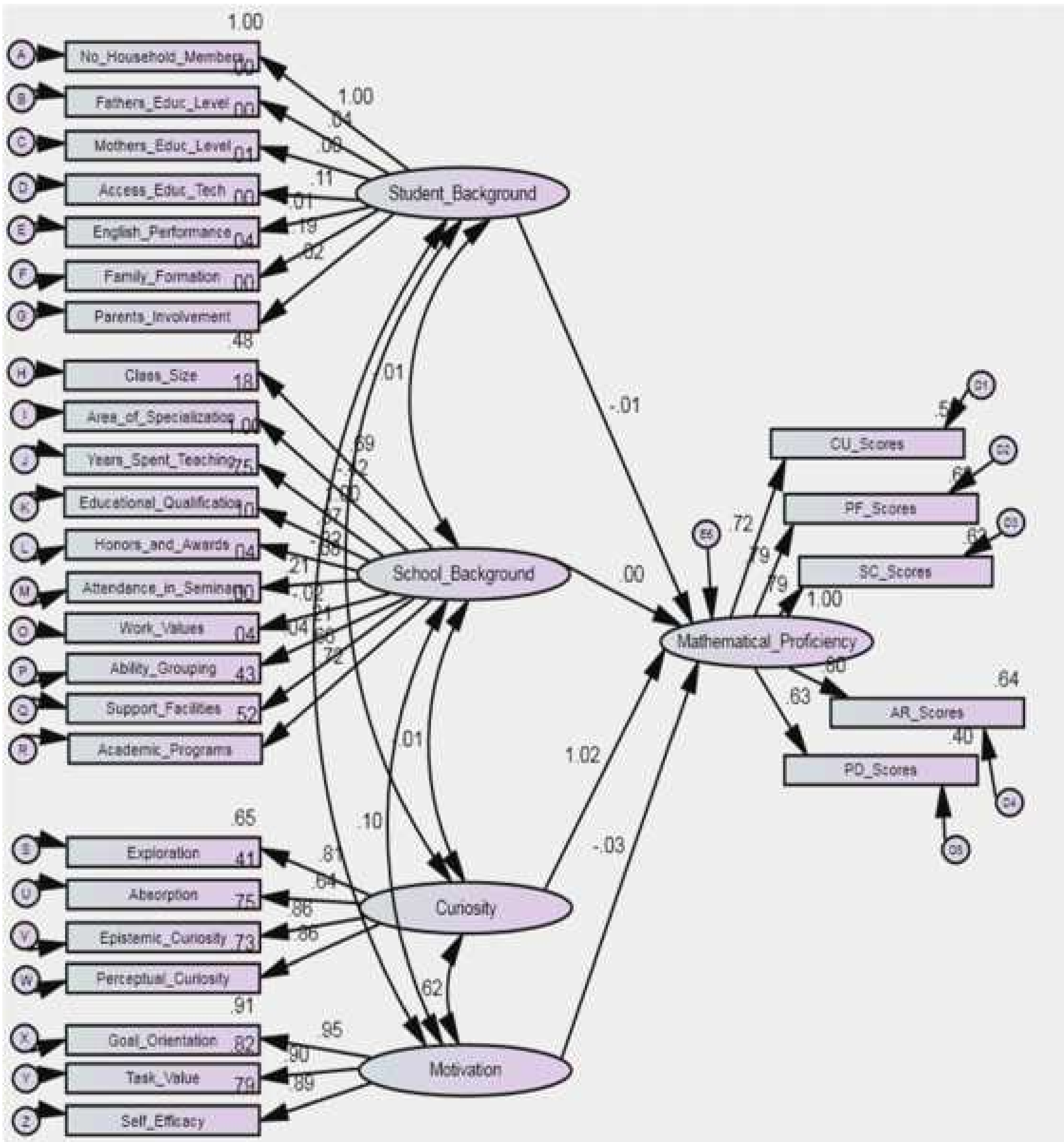


Figure 6. The Structural Equation Model

With Analysis of Moment Structures (AMOS), an add – on module in SPSS to perform SEM, the theoretical model was formulated and designed. This model, presented in Figure 6, is called the structural equation model.

The Structural Equation Model in Figure 6 has several variables – 29 observed and 35 unobserved variables; 34 exogenous (independent) and 30 endogenous (dependent) variables; and a total of 64 variables. This study used maximum likelihood estimation (MLE), an alternative to ordinary least squares (OLS) in the multiple regression models already presented. MLE, being superior than OLS, has iteratively improved parameter estimates to minimize the specified fit functions, which were pre – set on AMOS before the estimation analysis was run. AMOS has counted 435 distinct sample moments, and with 65 distinct parameters estimated, the degree of freedom was 370.

With eleven (11) iterations, the minimum estimates were reached and the results showed that the Chi – square (x^2) value, using goodness – of – fit (GOF) test which gave the overall fit of the Structural Equation Model, is equal to 5769.374 with the probability equivalent to 0.000. This p – value is the approximate probability of getting a x^2statistic as large as the x^2statistic obtained from the current set of data. In other words, the departure of the data from the model is not significant at 0.05 level. Thus, if the Structural Equation Model is used to estimate parameters of another set of data it will be 0% likely to produce the observed covariance matrix. Muller (2003) pointed out that in structural equation modeling, a model is said to fit the observed data to the extent that the model – implied covariance matrix is equivalent to the empirical covariance matrix. In short, the bigger the probability the better fit. That is why AMOS also provides modification indices such that when the model is modified based on it, the probability value increases. However, it is not a purpose of this study to chase for the empirically best – fitting model that doesn't conform the theory being postulated.

Table 46
Measures of Fit Summary of Structural Equation Model

Measures of Fit	Criteria	Values	p
Global Fit			
Chi – square (x^2) GOF	p>0.05	5769.374	0.000
Absolute Fit Indices			
Goodness – of – Fit Index (GFI)	≥0.90	0.712	
Root Mean Square Error of Approximation (RMSEA)	<0.05	0.151	0.000
Root Mean Square Residual (RMR)	<0.10	1.569	
Incremental Fit Indices			
Normed Fit Index (NFI)	≥0.90	0.586	
Tucker – Lewis Index (TLI)	Close to 1	0.562	
Comparative Fit Index (CFI)	>0.90	0.601	
Parsimony Fit Indices			
Adjusted Goodness – of – Fit Index (AGFI)	Close to 1	0.662	
Parsimony Normed Fit Index (PNFI)	Close to 1	0.534	
'Critical N'			
Hoelter at 0.05	Maximum	47	
Hoelter at 0.01	Maximum	49	

Although the x^2 test provides a test for statistical significance, in some ways its mathematical properties present trade – offs whenever the model is tested at larger samples (Hair, 2010). So, this study included also alternative measures of fit to correct the bias against large samples and increased model complexity. Included in AMOS output are several fit indices presented in Table 46. These tests gave measure of the absolute fit indices, incremental fit indices, parsimony fit indices, and the sample size indices of the model.

The goodness – of – fit index (GFI) was an early attempt to produce a fit statistic that was less sensitive to sample size. Although the sample size of 645 was not included in the GFI formula, Hair (2010) suggests that it is still sensitive to sample size due to its effect in sampling distributions.

The root mean square error of approximation (RMSEA), being the most widely used measure, attempted to correct for the tendency of the x^2GOF test statistic to reject Structural Equation Model when used with a large sample or a large number of observed variables. Thus it tells how well the Structural Equation Model fits a population, not just a sample used for estimation. It explicitly tried to correct for both Structural Equation Model's complexity and sample size by including each in its computation. The RMSEA value, sometimes called 'badness – of – fit" test, of 0.151 indicates that SEM is 15.1% 'incorrect', or 84.9% 'correct'. Under the hypothesis of 'close fit', (i.e., that RMSEA is no greater than 0.05 in the population), the probability of getting a sample RMSEA as large as 0.151 is 0.000. Similarly, the root mean square residual (RMR), which gives the square root of the average squared amount by which the sample variances and covariances differ from their estimates obtained under the assumption that Structural Equation Model is correct, tells also the 'badness – of – fit'. With RMR of 1.569, it tells that full Structural Equation Model is 156.9% 'incorrect'.

On the other hand, the normed fit index (NFI) tells the ratio of the difference in the x^2value for the fitted model and a null model divided by the x^2 value for the null model. The rule of thumb is that a model whose NFI is 0.90 or greater is of good fit. The Tucker – Lewis index (TLI), though conceptually similar to NFI, is not normed and thus its values can fall below 0 or above 1. Typically though, models with good fit have values that approach 1. Thus Structural Equation Model is of not of ‘good fit’. The comparative fit index (CFI), and improved version of NFI and is one of the most widely used indices, tells that values greater than 0.90 indicate good fit.

Moreover, the adjusted goodness of fit index (AGFI) adjusts GFI by a ratio of the degrees of freedom used in SEM to the total degrees of freedom available, taking into account differing degrees of model complexity. The parsimony normed fir index (PNFI), just like AGFI, is used to compare models with differing complexity. Relatively high values represent relatively better fit. The values of these fit indices were compared to the parsimonious Structural Equation Model, CPSP Model, which is discussed at the later part of this section.

Lastly, Hoelter’s ‘Critical N’ is the largest sample size for which one would accept the hypothesis that a model is correct. With a sample size of over 47 at 0.05 significance level and over 49 at 0.01 significance level, Structural Equation Model would have been rejected. Thus, tested at 0.05 significance level and with a sample of 645 sixth grade pupils, Structural Equation Model is not accepted and would not be empirically true when used to a sample size not greater than 47.

Considering the results of the fit measures, it can therefore be concluded that the proposed Structural Equation Model is not empirically valid and not generally acceptable. From validity and acceptability, this study proceeded to the analysis of the regression weights and covariances to test whether each is statistically significant at 0.05 level. Table

47 presents the regression weights while Table 48 presents the covariances specified in Structural Equation Model.

Table 47
Regression Weights of the Structural Equation Model

Paths			Std.	Unstd.	S.E.	C.R.	P
Mathematical Proficiency	←	Curiosity	1.021	18.403	1.120	16.425	***
Mathematical Proficiency	←	Student Background	-0.007	-0.077	0.235	-0.328	0.743
Mathematical Proficiency	←	SchoolBackground	-0.003	-0.027	0.195	-0.139	0.889
Mathematical Proficiency	←	Motivation	-0.034	-0.462	0.388	-1.191	0.234
Fathers EducLevel	←	StudentBackground	0.041	0.036	0.035	1.051	0.293
Mothers EducLevel	←	StudentBackground	0.003	0.003	0.035	0.086	0.931
Access to EducTech	←	StudentBackground	0.110	0.160	0.057	2.810	0.005
EnglishPerformance	←	StudentBackground	-0.006	-0.007	0.046	-0.147	0.883
Family Formation	←	StudentBackground	0.190	0.254	0.052	4.921	***
ParentsInvolvement	←	StudentBackground	0.018	0.015	0.034	0.448	0.654
Honors and Awards	←	School Background	-0.324	-0.410	0.050	-8.182	***
AttendanceinSeminars	←	SchoolBackground	0.209	0.218	0.041	5.296	***
Area ofSpecialization	←	SchoolBackground	-0.419	-0.197	0.019	-10.569	***
Years Spent in Teaching	←	SchoolBackground	1.000	1.957	0.080	24.528	***
EducationalQualifications	←	SchoolBackground	0.866	1.150	0.054	21.413	***
Work Values	←	SchoolBackground	-0.022	-0.009	0.017	-0.557	0.578
Ability Grouping	←	SchoolBackground	0.207	0.166	0.032	5.238	***
Support Facilities	←	SchoolBackground	0.658	0.790	0.048	16.449	***
AcademicPrograms	←	SchoolBackground	0.722	0.772	0.043	18.004	***
PerceptualCuriosity	←	Curiosity	0.856	1.089	0.043	25.622	***
Epistemic Curiosity	←	Curiosity	0.863	1.087	0.042	25.943	***
Absorption	←	Curiosity	0.643	0.885	0.050	17.524	***
TaskValue	←	Motivation	0.904	0.944	0.023	40.398	***
Self – Efficacy	←	Motivation	0.889	0.986	0.026	38.594	***
CU Scores	←	MathematicalProficiency	0.724	0.845	0.053	15.848	***
PF Scores	←	Mathematical Proficiency	0.788	1.208	0.071	16.910	***
SCScores	←	Mathematical Proficiency	0.791	1.095	0.065	16.961	***
ARScores	←	Mathematical Proficiency	0.802	1.160	0.068	17.145	***

***<0.01

As shown in Table 47, majority of the paths gave significant regression weights. Among the four constructs, three non – significant regression weights at 0.05 level indicate that the constructs at the right of the paths do not significantly contribute to the prediction of mathematical proficiency. For instance, in Structural Equation Model, motivation does not predict mathematical proficiency well. In other words, sixth grade pupils' motivation insignificantly determines their mathematical proficiency.

On the other hand, the significant regression weights at 0.05 level indicate that the constructs at the right significantly contribute to the prediction of the constructs at the left. For instance, in Structural Equation Model, curiosity does predict mathematical proficiency well. In other words, the curiosity of the sixth grade pupils significantly determines their mathematical proficiency. Going back to the raw scores, those who performed well in the Mathematical Proficiency Test had rated their curiosity high.

In the structural part of the Structural Equation Model, there are six 2 – way paths, and in AMOS estimation, they are called covariances, the unstandardized form of correlation coefficients. In Table 48, two out of six covariances among student background, school background, curiosity and motivation; that is, both school background and motivation significantly co – vary, as well as curiosity and motivation. In other words, curiosity is not significantly correlated to student background, curiosity is not significantly correlated to school background, school background is not significantly correlated to student background, and motivation is not significantly correlated to student background.

Table 48
Covariances for Structural Equation Model

Paths			Std.	Unstd.	S.E.	C.R.	P
Student Background	↔	Curiosity	0.075	0.023	0.013	1.791	0.073
School Background	↔	Curiosity	-0.007	-0.003	0.016	-0.169	0.866
Curiosity	↔	Motivation	0.624	0.160	0.013	11.901	***
StudentBackground	↔	School Background	-0.014	-0.008	0.023	-0.353	0.724
StudentBackground	↔	Motivation	0.042	0.017	0.016	1.045	0.296
School Background	↔	Motivation	0.098	0.048	0.020	2.400	0.016

***<0.01

This study has identified insignificant paths as shown in Table 47 and Table 48 where they become candidates for exclusion from the Structural Equation Model. In addition, the Structural Equation Model is not statistically significant at 0.05 level. With careful statistical analysis and review of the theoretical bases of the structure of Structural Equation Model, this study presents the parsimonious form of it presented in Figure 5. Parsimony procedure in SEM is done by removing paths from the overall structure that do not give significant estimates.

In the regression analyses, since the coefficients of the construct social – contextual has insignificant contributions mathematical proficiency, the principle of parsimony was employed. Berenson, et. al. (2006) suggests that this principle guides the selection of the regression model with the fewest independent variables that can predict the dependent variable adequately. In other words, it guides the selection of the least complex regression model.

Among the methods that can be used to apply the parsimony principle, Backward (elimination) Method was chosen for this study. This method was deemed to be more conservative stepping method in selecting statistically significant predictors and is also available in SPSS 20. It is largely a trial – and – error process for finding the best regression estimates and is similar to the Stepwise Method; in that it starts with a regression equation including all the independent variables and then deletes, one at a time, those that do not contribute significantly. Most researchers rather preferred Stepwise Method because of its ability to add or delete variables at each stage; whereas in Backward Method, once a variable is deleted, the action cannot be reversed at a later stage. However, Backward Method is preferred over Stepwise Method because according to Hair (2010) in stepwise procedure a regression model is developed with the fewest number of statistically significant independent variables and maximum predictive accuracy and in so doing, the regression model can be markedly affected by issues of multicollinearity, and the researcher relinquishes control over the formation of the model and runs a higher risk of decreased generalizability. Thus when backward procedure was applied, the constructs of student background, which are contextual, and the construct curiosity, which is psychological, significantly influence mathematical proficiency.

The model presented in Figure 7 is called the "parsimonious" structural equation model of **C**ontextual and **P**sychological Constructs of **M**athematical **P**roficiency, or CPMP - SEM, and is called **CPMP Model** for suitability purposes. the number of variables in CPMP Model is equal to that of the Structural Equation Model. AMOS has counted 153 distinct sample moments, the number of distinct parameters reduced from 65 to 35, and the degrees of freedom decreased from 370 to 118. With minimum estimation achieved, and with the reduced number of distinct parameters and degrees of freedom, the Chi – square value has decreased to 5220.392, and consequently, the probability has increased to 0.065, which is above 0.05. These results indicate that the CPMP Model is of good fit at 0.05 level of significance. Since the p – value of x^2 gives the overall fit of the model, it can be concluded that the CPMP Model is empirically valid and generally acceptable.

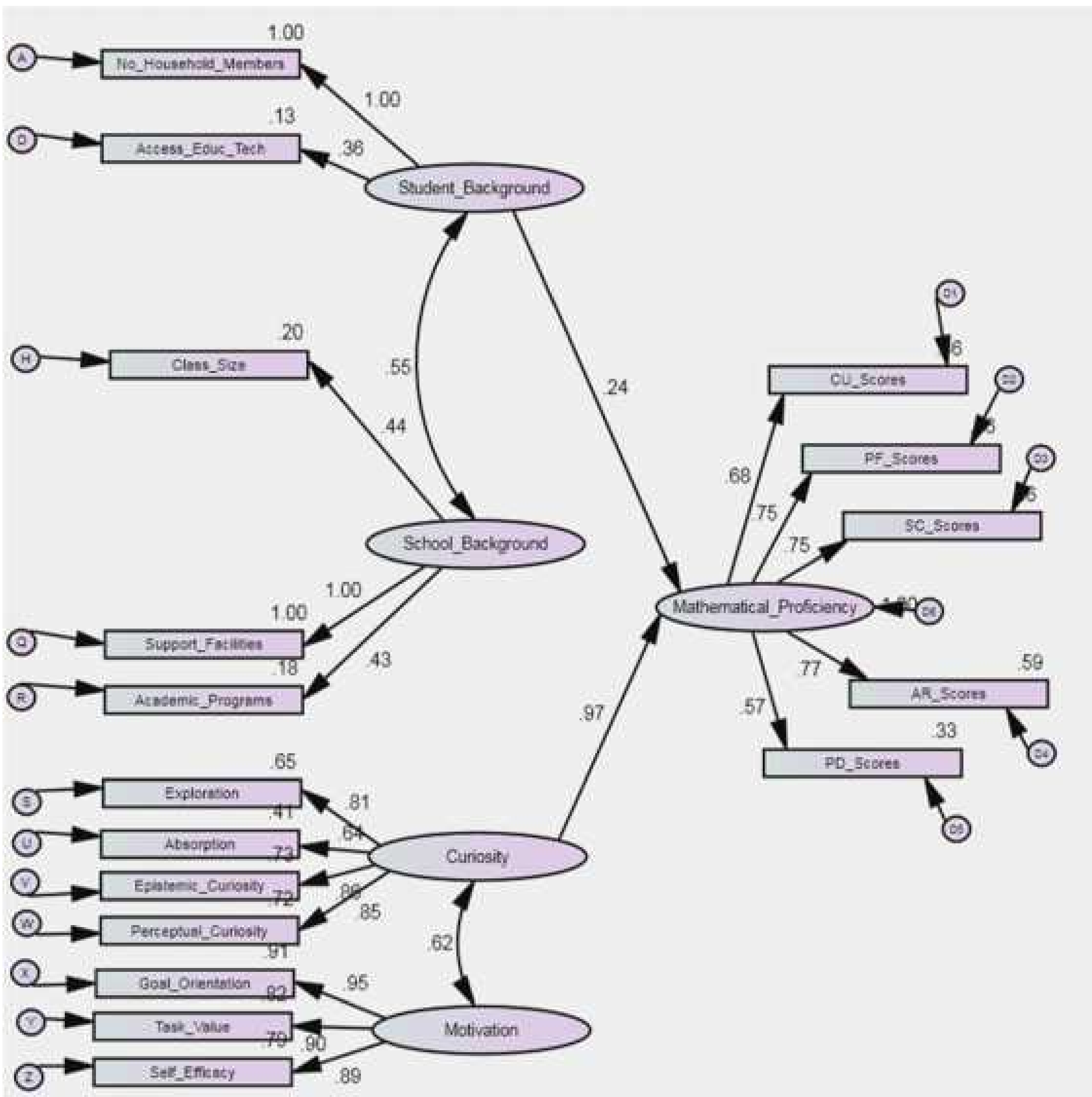


Figure 7. The CPMP Structural Equation Model

Table 49 presents the results of other measures of fit on the CPMP Model. As shown in the table, all measures of fit except GFI and NFI indicate that the CPMP Model is of good fit and statistically valid.

Table 49
Measures of Fit Summary of CPMP Model

Measures of Fit	Criteria	Values	p
Global Fit			
Chi – square (x^2) GOF	p>0.05	5220.392	0.065
Absolute Fit Indices			
Goodness – of – Fit Index (GFI)	≥0.90	0.889	
Root Mean Square Error of Approximation (RMSEA)	<0.05	0.029	0.876
Root Mean Square Residual (RMR)	<0.10	0.049	
Incremental Fit Indices			
Normed Fit Index (NFI)	≥0.90	0.889	
Tucker – Lewis Index (TLI)	Close to 1	0.986	
Comparative Fit Index (CFI)	>0.90	0.979	
Parsimony Fit Indices			
Adjusted Goodness – of – Fit Index (AGFI)	Close to 1	0.872	
Parsimony Normed Fit Index (PNFI)	Close to 1	0.776	
‘Critical N’			
Hoelter at 0.05	Maximum	180	
Hoelter at 0.01	Maximum	200	

Hair (2010) stressed that one common disadvantage of GFI and NFI in estimation is that more complex models necessarily have higher index values and artificially inflate the estimate of model fit. In short, both GFI and NFI do not support the principle of parsimony. The PNFI value (0.776) indicates that the CPMP Model is fit compared to the Structural Equation Model (0.534); while the AGFI value (0.872) indicates that it is fit compared to the Structural Equation Model (0.662).

Table 50 presents the new regression weights, standardized and unstandardized alike, and their corresponding standard errors, critical ratios and probability values. The backward elimination technique was used to achieve fourteen (14) statistically significant regression weights.

In Table 50, it is shown that the regression weights of all constructs, for the endogenous variable called mathematical proficiency, the larger regression weight is given by the exogenous variable called curiosity. This observation indicates that the respondents' complete aspects of expertise, competence, knowledge, and facility necessary for anyone to learn mathematics successfully mainly depend on their desire for acquiring new knowledge and new sensory experience that motivates exploratory behavior. This result could be explained by the Curiosity – drive theory. According to Litman (2005), equates curiosity to relatively unpleasant experiences of 'uncertainty', the reduction of which is rewarding. In essence, curiosity – drive theorists assume that coherence which is preferred in our cognitions and percepts, is disrupted by stimuli that are novel, complex, or ambiguous. By gathering new information about the relevant stimulus, cognitive and perceptual coherence is restored. Meanwhile, this could also be attributed to the belief of Tripathi (2009) that learning mathematics has been motivated by the belief that a study of mathematics helps students to learn to reason and apply such reasoning to everyday problems. It is believed that learning mathematics leads to learners' cognitive development. In addition to this, Schoenfeld (1989) found that the strongest correlation was between mathematical performance and perceived mathematical ability. Thus, curiosity is viewed as a very important part of the learning process, it implies that it is also one key element in understanding, computing, applying, reasoning and engaging.

Table 50
Regression Weights of the CPMP Model

Paths			Std.	Unstd.	S.E.	C.R.	P
Mathematical Proficiency	←	Curiosity	0.972	15.032	0.993	15.137	***
Mathematical Proficiency	←	Student Background	0.236	3.668	0.387	9.490	***
Class Size	←	School Background	0.445	0.498	0.039	12.603	***
AcademicPrograms	←	School Background	0.428	0.459	0.038	12.019	***
Support Facilities	←	School Background	1.00	1.00			
Perceptual Curiosity	←	Curiosity	0.850	1.081	0.043	25.115	***
Epistemic Curiosity	←	Curiosity	0.856	1.077	0.042	25.366	***
Absorption	←	Curiosity	0.637	0.877	0.051	17.218	***
TaskValue	←	Motivation	0.904	0.945	0.023	40.391	***
Self – Efficacy	←	Motivation	0.889	0.986	0.026	38.545	***
CU Scores	←	Mathematical Proficiency	0.681	0.865	0.063	13.657	***
PF Scores	←	Mathematical Proficiency	0.746	1.230	0.085	14.486	***
SCScores	←	Mathematical Proficiency	0.751	1.116	0.077	14.537	***
AR Scores	←	Mathematical Proficiency	0.767	1.187	0.081	14.730	***
Access to EducTech	←	Student Background	0.356	0.516	0.053	9.657	***
No. of Household Members	←	Student Background	1.00	1.00			

***<0.01

The CPMP Model also reveals that mathematical proficiency is influenced by the student background, particularly the respondents' access to educational technology and number of household members. This result could be supported by the Social Context Theory in its dimension of social environment. The Societal structures (Shapers) are macro social forces that shape the ways in which people approach their daily living activities and relationships either directly or indirectly. They are external to individuals, and include factors such as technology, social class, demography, urbanization, mass media, and the various social institutions that serve to influence the patterning of social behavior between and among individuals in society, such as family, education, religion, leisure, health, economy/work and government.

Furthermore, Activity Theory claims that activity and learning cannot be separated (Jonassen, 2006). Learners produce cognitive tools through social interactions resulting from the cultural environment produced by an activity system. The purpose of an activity system is to process an object which produces an outcome and that outcome is the production of knowledge. With the advent of technology in the form of the virtual classroom, the rules and tools affecting an activity system differ dramatically from the environment of the physical classroom. According to Murphy and Manzanares (2008) instead of the tools being tangible, such as chalk and a blackboard, they take the shape of email, software and texting. In a virtual classroom homework must be downloaded, reviewed, marked appropriately and then sent back to the student. Technology is assumed to automatically increase production by completing tasks more efficiently and effectively, thus automatically increases academic performance such as proficiency in mathematics. This impacts the object of Activity Theory by shifting it from teaching students to helping them learn (Murphy & Manzanares, 2008).

Another important theory related to this is the Social interaction. It is a key component in the Social Constructivist pedagogy and is dramatically altered by the impact of technology. “In a nutshell, each major transition in communication media from speech to print to video to electronic form has resulted in changes in our means to create, record, store, distribute, access and retrieve information” (Desai et al., 2008). As a result of these changes, the social interactions between students and students, and teachers and students have changed. Students are no longer dependent on the teacher as the main source of information. Web-based environments are important forums for joint problem solving, knowledge building and the sharing of ideas.

In the structural part of the CPMP Model, there are six 2 – way paths, and in AMOS estimation, they are called covariances, the unstandardized form of correlation coefficients.

Table 51
Covariances for CPMP Model

Paths			Std.	Ustd.	S.E.	C.R.	P
Curiosity	↔	Motivation	0.619	0.159	0.013	11.924	***
Student Background	↔	School Background	0.547	0.126	0.010	12.185	***

***<0.01

Table 51 shows that curiosity and motivation significantly co – vary, as well as student background and school background. In other words, curiosity is significantly correlated to motivation. According to Unal (2005) curiosity is thought to be a strong motivator for learning. While for Berlyne (1960) curiosity is a motivational prerequisite for exploratory behavior.

Student background is significantly correlated to school background. Parents' involvement at school, regardless of their racial/ethnic group, is associated with children's academic development (e.g., Galindo & Sheldon, 2011; Lee & Bowen, 2006). Galindo and Sheldon (2011**)** found that parents' involvement at school positively predicted growth in children's math scores in kindergarten. Lee and Bowen (2006) found that involvement at school significantly predicted Black, Latino, and White third through fifth graders' academic competencies. Also, a number of studies indicated that student achievement is correlated highly with the educational attainment of parents (Saritas and Akdemir, 2009). For instance, according to Campbell, Hombo, & Mazzeo(2000) as mentioned by Saritas and Akdemir

(2009), students whose parents had less than high school education obtained lower grades in mathematics than those whose parents had higher levels of education.

The complete tables of the estimated scalars (regression weights, covariances, variances, and shared multiple correlations) and matrices (factor score weights, total effects, direct effects, and indirect effects) are in Appendix P. One feature of SEM that makes it powerful is its ability to do several multivariate data analyses, one is regression analysis. Interestingly, the CPMP Model gave relatively high squared multiple correlations, or the R^2. In AMOS estimation, the direct, indirect, and total effects of one construct on another were also determined. The path analysis summary is presented in Table 52.

Table 52
Path Analysis of the CPMP Model
(Total)

		Standardized Effects of …				
		Motivation	Curiosity	School Background	Student Background	Mathematical Proficiency
On…	Total					
Mathematical Proficiency		0.000	0.972	0.000	0.236	0.000
On…	Direct					
Mathematical Proficiency		0.000	0.972	0.000	0.236	0.000
On…	Indirect					
Procedural Fluency		0.000	0.725	0.000	0.176	0.000
Strategic Competence		0.000	0.729	0.000	0.177	0.000
Productive Disposition		0.000	0.556	0.000	0.135	0.000
Conceptual Understanding		0.000	0.662	0.000	0.161	0.000
Adaptive Reasoning		0.000	0.745	0.000	0.181	0.000

As shown on the table, the standardized total (direct and indirect) effect of curiosity on mathematical proficiency is 0.972. That is due to both direct (unmediated) and indirect (mediated) effects of curiosity on mathematical proficiency, when curiosity goes up by 1 standard deviation, mathematical proficiency goes up by 0.972 standard deviation. While curiosity has no indirect effect on mathematical proficiency, it has indirect effects on its strands: conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition.

The standardized total (direct and indirect) effect of student background on mathematical proficiency is 0.236. That is due to both direct (unmediated) and indirect (mediated) effects of curiosity on mathematical proficiency, when curiosity goes up by 1 standard deviation, mathematical proficiency goes up by 0.236 standard deviation. While student background has no indirect effect on mathematical proficiency, it has indirect effects on its strands: conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition.

Theoretical Implications of the CPMP Model

Considering the results found through SEM, it is concluded that the postulated theory, to quote again: '***The person's level of proficiency in mathematics is psychologically channelized by the influence of the contextual constructs student and school backgrounds'***, sketched as **CPMP Model**, is empirically valid and generally acceptable.

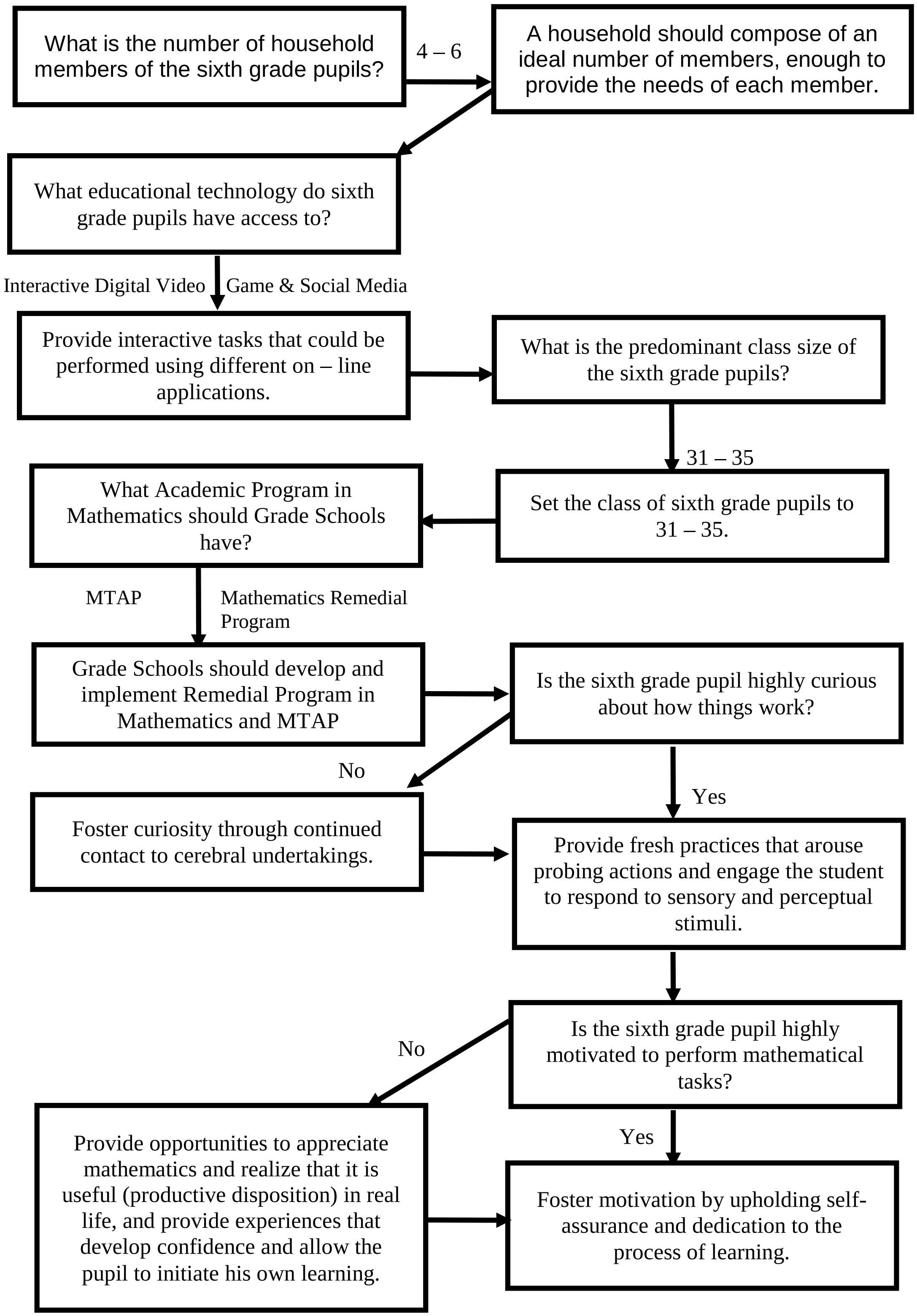


Figure 8. Diagram of Theoretical Implications of the CPMP Model

As a consequence of the theory, the diagram of theoretical implications in Figure 8 is thus designed and recommended for use of Grade School Departments for sixth grade pupils. Figure 8 shows the conceptual diagram which represents the theoretical implications of the CPMP Model. It is argued that in order to help improve the level of mathematical proficiency, this chart may be used by the Grade School Departments for the sixth grade pupils.

Chapter V

SUMMARY, FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

This chapter presents the summary, findings, conclusion, and recommendations of this study.

Summary

This study is primarily anchored on the objective to describe and offer a clear picture of how social – contextual and psychological make – up of the sixth grade pupils combine and associate together to find out whether it influences their mathematical proficiency.

The main variables of this study were student background, school background, curiosity, motivation, and the mathematical proficiency. Student background is a social – contextual construct that describes the respondents' profile in terms of number of household members, father's level of education, mother's level of education, access to educational technology, level of performance in English, family formation, and level of parental involvement in child's education. School background is a social – contextual construct that describes the respondents' profile in terms of class size, background attributes of math teacher (area of specialization, number of years spent in teaching, educational qualifications, honors and awards received, level of seminars/workshops attended, nature of participation in seminars/workshops, and work values), ability grouping, school's support facilities, and school's academic programs in mathematics.

Curiosity is a psychological construct that describes desire for acquiring new knowledge and new experience that motivates exploratory behavior and absorption of knowledge, and captures the level of individual's epistemic curiosity and perceptual curiosity. Motivation is a psychological construct that describes what drives to learn, whether a person initiates his own learning activities and on whether he maintains a commitment to the process of learning, with emphasis on his goal orientation, task value, and self – efficacy for learning mathematics. Mathematical Proficiency is the term that capture what mathematics educationists believe is necessary for anyone to learn mathematics successfully. Mathematical proficiency has five components, or strands:(1) conceptual understanding, (2) procedural fluency, (3) strategic competence, (4) adaptive reasoning, and (5) productive disposition. These strands are not independent; they represent different aspects of a complex whole.Theoretically, mathematical proficiency is dependent on family background, school background, curiosity, and motivation.

With a population of 645 sixth grade pupils in the Unified Schools of the Archdiocese of Lipa, Batangas Province, Region IV – A, this study went through two stages of data collection: (1) gathering of participants' sociological profile and psychological background through a validated self – report survey instrument (SSB) and two adopted self – report survey instruments (CI and MLI); and (2) profiling participants' mathematical proficiency through the constructed and validated 50 – item Mathematical Proficiency Test (MPT). The SSB and MPT instruments used in the two stages were validated by one sociologist, one psychologist, and three mathematics educators.

The profile of the participants in the SSB survey instrument was determined using frequency and percentage distributions. On the other hand, the profile of the respondents in the CI and MLI self – survey instruments were determined through the scoring guidelines adopted from the authors of the original instruments. Profiling and describing the participants' sociological and psychological constructs were performed in a manner that which descriptive statistics such as mean, standard deviation, skewness, and kurtosis were used. In addition, the scores of the participants in the MPT were transmuted using the formula$50\ x\ \frac{S}{T} + 50$. The use of this formula is premised on the idea that a student has to answer correctly 50% of the total number of test items. Moreover, the highest possible rating that a student can obtain here is 100%.

Multivariate data analysis techniques called regression analysis and covariance analysis in SPSS 20 were used to treat the data in the micro level. To answer the problems of this study regarding influences of the constructs on each other, six regression models were designed and analyzed. Analyses were based on six perspectives of viewing associations and influences that exist between and among the main variables (constructs) of this study plus their respective subscales called dimensions to mathematical proficiency. In each perspective, regression analysis was performed on both the overall scale and the specific subscales of each construct employing stepping method called backward elimination when necessary. Analyses on six perspectives produced twelve regression analyses, six full regression models their parsimonious counterparts. With covariance analysis, the 12th model (Model 6) was used to test the presence of statistically significant interaction effects between and among the four constructs in relation to their influence to mathematical proficiency.

In the macro level, another multivariate data analysis technique called structural equation modeling (SEM) was used to combine all regression models into one model that represents the overall picture of the social – contextual and psychological constructs as related to mathematical proficiency. A model named SPMP Model describing the postulate '***The person's level of proficiency in mathematics is influenced by curiosity and student background***' was theoretically sketched and empirically tested through SEM. Overall relative model fit tests were conducted to propose general acceptability of the CPMP Model. Path analysis was also performed.

Findings

Based on the result of the study, the following findings were drawn:

1. In the construct **student background**, majority of the sixth grade pupils have 4 – 6 household members, parents who are college graduates, access to social media, average level of performance in English, both parents at home, and high level of parental involvement in their education.
2. In the construct **school background**, majority of the sixth grade pupils have mathematics teachers who; specialized in Mathematics, spent 20 – 29 years in teaching, with MA units, attended seminars and workshops as participants, have very satisfactory work values. Also, most of them have class size of 31 –35, ability grouping based on

academic performance, library and laboratories for computer, EPP, and science, and MTAP as an academic program in Mathematics.

3. In the construct **curiosity**, results showed that majority of the respondents have high level of curiosity, and that in the overall results of Curiosity Inventory (CI), most of them have high level of curiosity and none fell on the low level. Among those who have high level of curiosity, it is in Exploration that most respondents exhibit high level of curiosity and it is in Epistemic Curiosity that most of them have average level of curiosity.
4. In the construct **motivation**, majority of the respondents have high level of motivation, and that in the overall results of MLI, most of them have high level of motivation and less than one percent have low level. It must be noted also that among those who have high level of motivation, it is in Task Value that most of them exhibit such level, and among those who have average level of motivation, it is in Self – Efficacy that most of them converge.
5. In the level of **Mathematical Proficiency**, most of the respondents have very high level of conceptual understanding, high level of procedural fluency, very high level of strategic competence, low and average levels of adaptive reasoning, and high level of productive disposition and most of them have average level of mathematical proficiency.
6. The seven regression models, one for each perspective of analysis, were found significant. However, all these models except Model 7 has predictors that were not

significant at 0.05 level, so by the principle of parsimony these models were improved and have been found also significant.

7. In parsimonious Model 6, it was found out that number of household members, access to educational technology, family formation, level of parental involvement in child's education, exploration, absorption, epistemic curiosity, perceptual curiosity, and class size are the most significant predictors of mathematical proficiency.

8. When full Model 6 was put into interaction analysis using ANCOVA, and was renamed model 8, results showed that there are fourteen interaction effects. There are variables in a form of two – way and three – way interaction effects that interact with the main effects, curiosity and academic programs in mathematics, that were found significant predictors of mathematical proficiency. Using backward elimination method, Model 8 was found statistically fit and significant.

9. Using AMOS estimation, results showed that there are two 2 – way paths. These 2 – way paths are also called covariances or unstandardized form of correlation. There are interaction effects between student background and school background, and curiosity and motivation.

10. A total of 15 analyzed regression models were put in a single analysis technique called structural equation modeling. This technique enabled to test the postulate of this study and to name its corresponding structural form as Structural Equation Model. This model was not found statistically significant because some regression weights were insignificant to the prediction of the ultimate dependent variable called mathematical proficiency. Applying principle of parsimony, some paths were removed from the

Structural Equation Model, and the resulting parsimonious model, CPMP Model, was found fit.

Conclusions

Based on the findings mentioned above, the following conclusions were drawn:

1. The sixth grade pupils have favorable student background and school background and are highly mathematically curious and motivated.
2. The sixth grade pupils have average level of mathematical proficiency.
3. Student background and school background significantly influence mathematical proficiency. Sixth grade pupils exposed to a constructive environment could effectively form their learning experiences in mathematics. This environment could also determine the quantity and quality of learning children could get over their lifetime.
4. Curiosity significantly influences mathematical proficiency. Sixth grade pupils' inclination to understanding, solving, applying, reasoning and engaging in mathematics could be intensified by their high desire for new information and knowledge.
5. There is no interaction between contextual (student background) and psychological (curiosity) constructs that could significantly contribute to the prediction of success in mathematical proficiency. Student background and curiosity work independently in the development of proficiency in mathematics of sixth grade pupils.
6. The postulated theory, quoted: '*The person's level of proficiency in mathematics is influenced by curiosity and student background*', sketched as **CPMP Model**, is empirically valid and generally acceptable.

Recommendations

Based on the findings and conclusions of this study, the researcher recommends the following:

1. Sixth grade pupils should be exposed to a variety of educational technology, with the support and supervision of the household members.
2. Teachers should extensively teach sixth grade pupils with classroom activities that boost curiosity. The classroom activities may emphasize questioning techniques that would make pupils more interested in learning mathematics.
3. The mathematical proficiency of sixth grade pupils could be developed using the CPMP Model.
4. Retest and revalidate the CPMP Model with larger samples of participants who are not only sixth grade pupils from the province of Batangas but those who randomly represent the entire population of the archipelago. On the other hand, retesting and revalidating the CPMP Model using structural equation modeling could be done but with equal number of observed variables per construct, including those found significant in the parsimonious Model 6.
5. Formulate formal and ample exposition of theory describing the CPMP Model by following a more comprehensive theory – building process and less statistical analysis.
6. Conduct a qualitative study to describe the patterns of sociological and psychological constructs of mathematical proficiency.
7. Perform an extensive quantitative study to explain the phenomenon existing among mathematical proficiency, motivation, and school background.

Bibliography

Abubakar H. L. (2010). The Impact of sound corporate governance on organizational performance.*Journal of Finance and Accounting Research*, September 2010, Pg. 76-83, Vol. 2, No. 3.

Abubakar, R., Wokoma, S. A., & Afebuame A. (2012). Mathematics: A pivotal rebranding tool for national development. *Academic Research International*, Vol. 2, No. 3. ISSN: 2223 – 9944

Adams, Chastity L. (2011). *The Effects of a Remedial Math Intervention on Standardized Test Scores in Georgia Middle Schools.* Liberty University. Retrieved from http://digitalcommons.liberty.edu/cgi/viewcontent.cgi?article=1472&context=doctoral

Adelman, H. S. & Taylor, L.(2010).*Creating successful school systems requires addressing barriers to learning and teaching.* The F. M. Duffy Reports, July 2010, 15(3).

Akdemir, Omur and SaritasTuncay (2009). *Identifying Factors Affecting the Mathematics Achievement of Students for Better Instructional Design.* Turkey. Retrieved from http://www.itdl.org/Journal/Dec_09/article03.htm

Alokan, Funmilola B., Osakinle, Eunice O., & Onijingin, Emmanuel O. (2013). The influence of parents' educational background and study facilities on academic performance among secondary school students. *Ozean Journal of Social Sciences* 6(2), 2013.ISSN 1943-2577

Ames, Carole (1992). Classrooms: Goals, Structures, and Student Motivation. *Journal of Educational Psychology*, Vol. 84, No. 3, 261 – 271.

Atanda, Ademola I. & Jaiyeoba, Adebola O. (2011).*School quality factors and secondary school students' achievement in mathematics in South-Western and North-Central Nigeria.*The African SymposiumVolume 11, No. 1.ISSN# TX 6-342-323

Bandura, A. (1977). *A Social Learning Theory.* Englewood Cliffs, NJ: Prentice Hall.

Berenson, M. L., Levine, D. & Krehbiel, T. C. (2006).*Basic Business Statistics: Concepts and Applications*. Pearson Education, Inc. Singapore

Berlyne, D. E. (1950). *Novelty and curiosity as determinants of exploratory behavior.* British Journal of Psychology, 41: 68 – 80.

Berlyne, D. E. (1954). *A theory of human curiosity.* British Journal of Psychology, 45: 180 – 191.

Berlyne, D. E. (1960). *Conflict, Arousal, and Curiosity.* New York: McGraw Hill.

Berlyne, D. E. (1967). *Arousal and reinforcement.* In D. Levine (Ed.), Nebraska symposium on motivation (pp. 1 – 110). Lincoln: University of Nebraska Press.

Biddle, B. J., & Berliner, D. C. (2002).*What research says about small classes and thepursuit of better schools.* Education Policy Reports, Arizona State University, Tempe.

Bomia, L., Beluzo, L., Demeester, D., Elander, K., Johnson, M., & Sheldon, B. (1997). *The Impact of Teaching Strategies on Intrinsic Motivation.* Champaign, IL: ERIC Clearinghouse on Elementary and Early Childhood Education. (ERIC Document Reproduction Service Nuo. ED 418925)

Bowen, Natasha K. & Lee, Jung-Sook (2006).*Children parent involvement, cultural capital, and the achievement gap among elementary schools.*American Educational Research Journal. DOI: 10.3102/00028312043002193

Brembah, Marian (2013). Household *structure and academic performance of junior high school students in Manhyia Sub – Metro of Kumasi*(Master's Thesis). Nkrumah University of Science and Technology.

Carlile, P. R. & Christensen, C. M. (2004). *The Cycles of Theory Building in Management Research*. Retrieved March 31, 2012, from http://www.hbs.edu/research/pdf/05-057.pdf.

Carlson, M. P. (1999). *The mathematical behavior of six successful mathematics graduate students: influences leading to mathematical success*. Educational Studies in Mathematics, 40, 237-258.

Chang, C. Y. (2003*).*Teaching earth sciences: Should we implement teacher-directed or student-controlled CAI in the secondary classroom?*International Journal of Science Education*, 25(4), 427-438.

Chapman, O. (2005). *Constructing pedagogical knowledge of problem solving: pre-service mathematics teachers.*In Chick, H. L. & Vincent, J. L. (Eds.). Proceedings of the 29th Conference of the International Group for the Psychology of Mathematics Education. Vol. 2, pp. 225 – 232. Melbourne: PME.

Cobb, P., Yackel, E., & Wood, T. (1991). *The teaching experiment classroom.* In P. Cobb & H. Bauersfeld (Eds.), The emergence of mathematical meaning: Interaction in classroom cultures (pp. 17–24). Hillsdale, NJ: Erlbaum.

Cohen, J. &Geier, V. K. (2010). *School Climate Research Summary.* School Climate Brief, 1(1), New York: Center for Social and Emotional Education. Retrieved from http:/www.schoolclimate.org/climate/documents/SCBrief v1n1Jan2010.pdf

Collins, R. P., Litman, J. A., & Spielberg, C. D. (2004). *The measurement of perceptual curiosity.* Personality and Individual Differences, 36, 1127-1141.

Conger, R. D., Conger, K. J., & Martin, M. J. (2010). Socioeconomic status, family processes, and individual development.*Journal of Marriage and Family*, 72, 685-704. DOI: 10.1111/j.1741-3737.2010.00725

Davis – Kean (2005). The influence of parent education and family income on child achievement: The indirect role of parental expectations and the home environment. *Journal of Family Psychology*. 2005; 19:294–304.

De Castro, Marcus Vasconcelos, Bissaco, MárciaAparecida Silva, Panccioni, Bruno Marques, Rodrigues, Silvia Cristina Martini, and Domingues, Andreia Miranda (2014). *Effect of a Virtual Environment on the Development of Mathematical Skills in Children with Dyscalculia.*Brazil. Retrieved from http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0103354

De Corte, et.al. (2008). *Unraveling the relationship between students' Mathematics - related beliefs and the classroom culture.* European Psychologist. Vol 13(1), 2008, 24-36. Retrieved March 28, 2010 from http.//psycnet.apa.org/journals/epp/13/1/24/

De Serf, Megan(2002). *The Effects of Family, Social and Background Factors on Children's Educational Attainment.* Illinois Wesleyan University Digital Commons @ IWU Honors Projects Economics Department.

Desai, M., Hart, J., & Richards, T. (2008). E-learning: paradigm shift in education. *Education*, *129* (2), 327-334. Retrieved March 10, 2009, from Ebscohost database.

Desforges, Charles and Alberto Abouchaar (2003).*The impact of parental involvement, parental support and family education on pupil achievement and adjustment: a literature review.* Queen’s Printer.

Dewey, J. (1938). *Experience and Education.* Toronto: Collier – MacMillan Canada Ltd.

Dewey, J. (1993).*How We Think: Revised and Expanded Edition with Foreword by Maxine Greene.* Boston, Massachusetts: Houghton Mifflin.

Doronila, R. A. (2012). *3P model of problem–solving among preservice mathematics teachers* (Doctoral Dissertation). Philippine Normal University – Manila, Philippines.

Duncan, T. G., & McKeachie, W. J. (2005). The making of the motivated strategies for learning questionnaire.*Educational Psychologist*, 40, 117-128.

Earle, Leon & Earle, Tony (2011). Social context theory.*South Pacific Journal of Psychology*, Vol. 11, No.2, pp. 1 – 12.

Eccles, J. S., & Wigfield, A. (2002).*Motivational beliefs, values, and goals.*Annual Review of Psychology, 53, 109 – 132.

Edelman, Susan (1997). *Curiosity and Exploration*. California State University, Northridge. Retrieved from www.csun.edu/~vcpsy00h/students/explore.htm

Feldmann, G. M. (2012). *Early numeracy: technical adequacy of select kindergarten and first grade screening measures.* University of Iowa. Retrieved from http://ir.uiowa.edu/etd/2869.

Ferguson, C. (2008). *The school-family connection: looking at the larger picture.* A Review of Current Literature. National Center for Family and Community Connections with Schools.

Fitzgerald, **M. & James, I. (2007).***The Mind of the Mathematician.*Maryland: The Johns Hopkins University Press.

Fonteboa, Melinda Bailey (2012).*The effects of the family on student achievement: a comparative study of traditional and nontraditional families*(Doctoral Dissertation).Liberty University, Lynchburg, VA.

Fuchs, K. C., Hiebert, J., Carpenter, T. P., Fennema, E., Wearne, D., Murray, H., Olivier, A., & Human, P. (2010). *Making sense: Teaching and learning mathematics with understanding.* Portsmouth, NH: Heinemann.

Galindo, Claudia& Sheldon, Steven (2012). *School and home connections and children's kindergarten achievement gains: the mediating role of family involvement.*University of Maryland, Baltimore County, Early Childhood Research Quarterly 27 (2012) 90–103.

Garnier H, Reese L., Lopez EM, & Gallimore R. (2007). Preschool antecedents of mathematics achievement of Latinos: the influence of family resources, early literacy experiences, and preschool attendance. *Hispanic Journal of Behavioral Sciences*. 2007; 29:456–471.

Ginsburg, H. & Allardice, B. (1984). *Children difficulties with school mathematics.* In B. Rogoff & J. Lave (Ed.), Everyday Cognition: Its development in social contexts (pp. 194 – 219). Cambridge, MA: Harvard University Press.

Ginsburg, H.P., Lee, J.S., & Boyd, J.S. (2008).*Mathematics education for young children: what it is and how to promote it.* Social Policy Report, 22, 3-22.

Groves, Susie (2012). *Developing mathematical proficiency.* Journal of Science and Mathematics Education in Southeast Asia, Vol. 35, No. 2, pp. 119 – 145.

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010).*Multivariate Data Analysis. 7TH ed.* Upper Saddle River: Prentice Hall.

Hakuta, K., Antonio, A., Chang, M., Kenny, D., Levin, S. & Milem, J. (2004). Effects of racial diversity on complex thinking in college students. *Journal of Psychological Science*, 15 (8), 507-510.

Hanushek, Eric A., Markman, Jacob M., Kain, John F. & Rivkin, Steven G. (2003). Does peer ability affect student achievement? *Journal of Applied Econometrics*, John Wiley & Sons, Ltd., vol. 18(5), pages 527-544.

Herrmann, Zachary (2013).*Why Mathematically Proficient Students will Rule the World.* Retrieved April 21, 2013, from https://sites.google.com/site/zacharyherrmann/blog/why-mathematically-proficient-students-will-rule-the-world

Hoffman, Lauren & Brahier, Daniel (2008).*Improving the Planning and Teaching of Mathematics by Reflecting on Research.*Mathematics Teaching in the Middle School Vol.13 No.7.

Hoxby, Caroline M. (2000). The effects of class size on student achievement: new evidence from population variation. Harvard university and national bureau of economic research. *Oxford Journals of Social Sciences&Quarterly Journal of Economics*, Volume 115, Issue 4, pp. 1239-1285.

Hunt, C. L., et.al. (2006). *Sociology in the Philippine Setting: A Modular Approach.*Phoenix Publishing House, Inc., Philippines.

James, Ajogbeje Oke & Folorunso, Alonge Micheal (2012).*Effect of Feedback and Remediation on Students' Achievement in Junior Secondary School Mathematics.*Ekiti State University, Ado Ekiti, Nigeria.

Jeynes, W. H. (2005).*A meta-analysis of the relation of parental involvement to urban elementary school student academic achievement.* Urban Education, 40, 237–269. DOI:10.1177/0042085905274540

Jonassen, D.H. (2006). Revisiting activity theory as a framework for designing student-centered learning environments. In Jonassen, D.H. & Land, S.M. (Eds.), *Theoretical foundations of learning environments* (pp. 89-121). Mahwah, New Jersey: Lawrence Erlbaum Associates.

Judd, B. (2014). *Contributing Factors to Eighth Grade Math Proficiency*. A Literature Review Conducted for Anchorage United for Youth.

Kashdan, T. B., et.al (2009). Curiosity and exploration: facilitating positive subjective experiences and personal growth opportunities.*Journal of Personality Assessment*, 82(3), pp. 291 – 305. Lawrence Erlbaum Associates, Inc.

Kashdan, T. B., et.al (2009). *The curiosity and exploration inventory-ii: development, factor structure, and psychometrics.* Journal of Research in Personality, 43(2009) 987-998.

Kashdan, T. B., and Yuen, Mantak (2007). *Whether highly curious students thrive academically dependson perceptions about the school learning environment: A studyof Hong Kong adolescents.* Springer Science+Business Media, LLC 2007

Keller, J. M. (1979). Motivation and instructional design: a theoretical perspective. *Journal of Instructional Development*, 2(4), 26-34.

Keller, J. M. (1983a). *Motivational design of instruction*. In C. M. Reigeluth (Ed.), Instructional design theories and models. (pp. 383 – 433). New York: Lawrence Erlbaum Associates.

Keller, J. M. (1983b). *Development and use of the ARCS model of motivational design*. Enschede, The Netherlands: Toegepaste Onderwijskunde, Technische Hogeschool Twente.

Keller, J. M. (1984). *The use of the ARCS model of motivation in teacher training.* In Shaw, K., & Trott, A. J. (Eds.). Aspects of Educational Technology, Volume XVII. London: Kogan Page, pp. 140 – 145.

Keller, J. M. (1987). Development and use of the ARCS model of instructional design. *Journal of Instructional Development*, 10(30, 2 – 10.

Keller, J. A. (1999). *Motivational Aspects of Exploratory Behavior. Curiosity, Imagination and Play.* London, Lawrence Erlbaum Associates.

Kilpatrick, J. (1970). *Cognitive Theory and the SMSG Program. In K. Kramer (Ed.). Problems in Teaching of Elementary School Mathematics (pp. 124-130).*Boston, MA: Allyn and Bacon, Inc.

Kilpatrick, J., Swafford, J., & Findell, B. (Eds.) (2001).*Adding It Up: Helping Children Learn Mathematics.*Washington, DC: National Academy Press.

Kornfeld, Michael (2010). *The effects of class size on student academic Achievementin a rural state.* University of Vermont. Retrieved from https://library.uvm.edu/jspui/bitstream/123456789/254/1/Kornfeld%20dissertation%2012-15-09-1.pdf

Ku, Oskar, Chen, Sherry Y., Wu, Denise H., Lao, Andrew C., and Chan, Tak– Wai (2013).*The Effects of Game – Based Learning on Mathematical Confidence and Performance: High Ability vs. Low Ability.* Taiwan.

Kupari, P. (2006).*Student and school factors affecting Finnish mathematics achievement: Results from TIMSS 1999 data.* In Howie, S. J. &Plomp, T. (Eds.) Contexts of learning mathematics and science. Lessons learned from TIMSS.London: Routledge, 127-140.

Lachance, J. A. & Mazzocco, M. M. (2006).*A longitudinal analysis of sexdifferences in math and spatial skills in primary school age children.* Learn Individ. Differ. 2006 Jan 1; 16(3): 195–216.DOI: 10.1016/j.lindif.2005.12.001

Lawanson, Olukemi & Anike Gede, Ngozi Tari (2011). Provision and management of school facilities for the implementation of ube programme. Department of educational management, University of Port Harcourt, Port Harcourt, Nigeria. *Journal of Educational and Social Research* Vol. 1 (4).

Lazaro, Helena (2014).*What is EdTech and why should it matter to you?* GA Blog. Retrieved from http://blog.generalassemb.ly/edtech-matter/

Lee, Jihyun & Shute, Valerie J. (2010).*Personal and social-contextual factors inK–12 academic performance: an integrative perspective on student learning.* Educational Psychologist, *45*(3), 185–202, 2010.ISSN: 0046-1520 print / 1532-6985 online. DOI: 10.1080/00461520.2010.493471

Lepper, M. R., Corpus, J. H., & Iyengar, S. S.(2005). Intrinsicand extrinsic motivational orientations in the classroom: age differences and academic correlates.*Journal of Educational Psychology* 2005, Vol. 97, No. 2, 184 –196.

Litman, J. A. (1998). *Theory and assessment of epistemic curiosity: the development of an experimental epistemic curiosity scale* (Master's Thesis). University of South Florida, Tampa.

Litman, J. A. (2000). *Construct and predictive validity of measures of epistemic and perceptual curiosity* (Doctoral Dissertation). University of South Florida, Tampa.

Litman, J. A. (2005). *Curiosity and the Pleasures of Learning: Wanting and Liking New Information.* University of South Florida, Tampa, FL, USA, Psychology Press.

Litman, J. A. & Spielberger, C. D. (2003). *Measuring epistemic curiosity and its diversive and specific components*(Doctoral Dissertation). University of South Florida, Tampa.

Loewenstein, G. (1994). The psychology of curiosity: A review and reinterpretation. *Psychological Bulletin*, 116, 75 – 98.

McLeod, J. K., et. al., (2013). Digital play: mathematical simulations transforming curiosity into play. *International Journal of Gaming and Computer-Mediated Simulations*, 5(2), 34-59.

Meisenberg, G. & Lynn, R. (2010). National IQs calculated and validated for 108 nations. *Intelligence* 38: 353 – 360.

Middleton, J. A. & Spanias, P. A. (1999). Motivation for Achievement in Mathematics. Findings, Generalization and Criticism of the Research. *Journal for Research in Mathematics Education*, 30(1), 65-88.

Murphy, E. & Manzanares, M. (2008). Contradictions between the virtual and physical high school classrooms: A third-generation activity theory perspective. *British Journal of Educational Technology, 39* (6), 1061-1072.

National Council of Teachers of Mathematics (2000).*Principles and Standards for School Mathematics.* Reston, VA: Author.

National Research Council (2001). *Adding It Up: Helping Children Learn Mathematics.* Washington DC: National Academy Press.

Olaniyan, D. A. & Okemakinde, T. (2008). Human capital theory: Implications for educational development. *Pakistan Journal of Social Sciences*, 5(5): 479 – 483. ISSN: 1683 – 8831

Ozturk, ElcinOlmezer (2012). *Contemporary motivation theories in educational psychology and language learning: an overview*. The International Journal of Social Sciences, Vol. 3.

Padron, Y. N., Waxman, H. C. & Lee, Y-H. (2014).*Classroom learning environment differences between resilient, average, and non-resilient middle school students' in reading.* Education and Urban Society, 46(2), 264-283.

Panopio, I. S., et.al. (2004). *Sociology, Focus on the Philippines.*Ken Incorporated, Philippines.

Parke, C. S. & Kanyongo, G. (2012). Student attendance, mobility, and mathematics achievement in an urban school district.*Journal of Educational Research*, 105(3), 161-175.

Peterson, C. & Seligman, M. E. P. (2001). Retrieved February 10, 2003 from the preliminary VIA Inventory of Strengths (VIA – VIS): http://www.positivepsychology.org

Pezdek, K., Berry, T. & Renno, P. A. (2002). Children's mathematics achievement: the role of parents' perceptions and their involvement in homework.*Journal of Educational Psychology*, Vol. 94, No. 4, 771–777.

Piccone, J. (1999). *Curiosity and Exploration. California State University, Northridge.* Retrieved April 12, 2010, from http://www.csun.edu/~vcspy00h/students/curious.htm

Pintrich, P. R., et.al. (1991). *A Manual for the Use of the Motivated Strategies for Learning Questionnaire (MSLQ).* Ann Arbor: University of Michigan, National Center for Research to Improve Postsecondary Teaching and Learning.

Pritchard, I. (2013).*Reducing class size, what do we know?* Washington, DC: Office of Educational Research and Improvement, U.S. Department of Education.
Retrieved from http://www.ed.gov/ pubs/ReducingClass/Class_size.html

Polya, G. (1945). *How to Solve it: A new aspect of mathematical method.* Princeton, USA: Princeton University Press.

Ramani, Geetha B. & Siegler, Robert S. (2014).*How Informal Learning Activities Can Promote Children's Numerical Knowledge.*Psychology, Cognitive Psychology, Educational Psychology, Developmental Psychology Online Publication. DOI: 10.1093/oxfordhb/9780199642342.013.012

Ready, Douglas D., & Silander, M.R. (2011).*School racial composition and young children's cognitive development: Isolating family, neighborhood, and school influences.* In E. Frankenberg & E. DeBray (Eds.), Integrating schools in a changing society: New policies and legal options for a multiracial generation (91-113). Chapel Hill, NC: University of North Carolina Press.

Reigeluth, C.M. & Joseph, R. (2005). Formative research on an early stage of the systemic change process in a small school district. *British Journal of Educational Technology,* 36 *(6), 937-956.*

Renner, B. (2006). Curiosity about people: the development of a social curiosity measure in adults. *Journal of Personality Assessment*, 83(3), pp.305-316.

Rivera-Batiz, Francisco L., and Lillian Marti (2005). *A School System at Risk: A Study of the Consequences of Overcrowding in New York City Public Schools*. New York: Institute for Urban and Minority Education, Teachers College, Columbia University.

Rosetti, Stefania & Tanda, Paola (2000).*Human Capital, Wages and Family Interactions.*Labour. 14 (2000): 5-34.

Russell, S. J. (2010).*Learning whole-number operations in elementary school classrooms.* In D. V. Lambdin & F. K. Lester Jr. (Eds.), Teaching and learning mathematics: Translating research for elementary school teachers (pp. 1-8). Reston, VA: NCTM.

Ryan, Richard M. & Deci, Edward L. (2005). Intrinsic and extrinsic motivations: classic definitions and new directions.*Contemporary Educational Psychology* 25, 54–67. doi:10.1006/ceps.1999.1020.

Schoenfeld, A. H. (1989). Explorations of Students' Mathematical Beliefs and Behavior. *Journal of Research in Mathematics Education*, 20(4), 338-355.

Skinner, E. & Belmont, M. (1991).*A Longitudinal Study of Motivation in School: Reciprocal Effects of Teacher Behavior and Student Engagement (*Unpublished Manuscript). University of Rochester, Rochester, NY.

Sonnenschein, Susan & Galindo, Claudia (2013). Race/Ethnicity and Early Math Skills: Relations between Home, Classroom, and Math Achievement. *Journal of Research in Education, (in press),* University of Maryland, Baltimore County.

Sonnenschein, S., Galindo, C., Thompson, J., Metzger, S.R., & Huang. H.C. (2013).*Chinese and White parents' beliefs about their children's math* *development.* Poster presented at the Society for Research in Child Development, Seattle, Washington.

Stevenson, H. W. & Stigler, J. W. (1992). *The Learning Gap.* New York: Simon & Schuster.

Stumm, S. von, Hell, B., and Chamorro-Premuzic, T. (2011). The hungry mind: intellectual curiosity is the third pillar of academic performance. *Perspectives on Psychological Science*; 6 (6): 574 DOI: 10.1177/1745691611421204

Suizzo, M., & Stapleton, L. M. (2007). *Home based parental involvement in young children's education: Examining the effects of maternal education across U.S. ethnic groups.* Educational Psychology, 27(4), 533–556.

Tarantino, Kristen, McDonough, Jessica, and Hua, Ma (2013). Effects of Student Engagement with Social Media on Student Learning: A Review of Literature. *The Journal of Technology in Student Affairs.*

Tella, Adedeji (2007). *The impact of motivation on student’s academic achievement and learning outcomes in mathematics among secondary school students in Nigeria* (Master’s Thesis). Osun State College of Education, Osun State, Nigeria.

The Heritage Foundation (2015).*Family Structure and Children Education.* Retrieved from http://www.familyfacts.org/briefs/35/family-structure-and- childrens-education

The National Academies (2015). *Adding It Up: Helping Children to Learn Mathematics.* Washington, DC: National Academy of Sciences.

Tripathi, P. N. (2009). *Problem Solving In Mathematics: A Tool for Cognitive Development.* State University of New York, Oswego, USA. Retrieved from http://cvs.gnowledge.org/episteme3/pro_pdfs/27-tripathi.pdf

Unal, H. (2005). *The influence of curiosity and spatial ability on pre-service middle and secondary mathematics teachers' understanding of geometry* (Doctoral Dissertation). The Florida State University College of Education.

Ushie, M. A., Emeka, J. O., Ononga, G. I., and Owolabi, E. O. (2012). Influence of family structure on students’ academic performance in Agege Local Government Area, Lagos state, Nigeria. *European Journal of Educational Studies* 4(2).

Vogt, W. P. (2007). *Quantitative Research Methods for Professionals.*Boston, Pearson Education, Inc.

Vygotsky, L. S. (1981). *The Genesis of Higher Mental Functions. In J. V. Wertsch (Ed.). The Concept of Activity in Soviet Psychology (pp. 144-188).* Armonk NY: M. E. Sharpe.

Walker, E. L. (1980). Berlyne's Theoretical Contributions to Psychology.*Motivation and Emotion, Vol. 4, No. 2*, 1980, Pebble Beach, California.

Wavo, E. Y. T. (2004). Honesty, cooperation and curiosity achievement of some schools on Nanjing (China). *IFE Psychologia: An International Journal*, 12, 178–188.

Weber, Max & Swedberg, Richard (2011). *Essays in economic sociology*. Princeton University Press. p. 22.ISBN 978-0-691-00906-3.

Wertsch, J. V. (1985). *Vygotsky and the Social Formation of the Mind.*Cambridge, MA: Harvard University Press.

Wu, Zhonghe (2008). Using the MSA Model to assess Chinese sixth graders' mathematical proficiency. *Journal of Mathematics Education*, Vol. 1, No. 1, pp. 74 – 95.

Williamson, P., McLeskey, J., Hoppey, D., & Rentz, T. (2004).*Is inclusion an illusion? An examination of national and state trends toward the education of students with learning disabilities in general education classrooms.* Learning Disabilities Research and Practice, 19(2), 109-115.

Woolfolk, A. (2008). Motivation in Learning and Teaching. *Psychology in Education,* 437-479.

Yamamoto, Yoko & Holloway, Susan (2010). *Parental Expectations and Children's Academic Performance in Sociocultural Context.* EducPsychol Rev (2010) 22:189–214 DOI 10.1007/s10648-010-9121-z

Yunus, A. S. & Ali, W. Z. (2009). Motivation in the learning of Mathematics. *European Journal of Social Sciences - Volume 7, Number 4*, pp. 93-101.

Appendices

Appendix A
Letters for Validation of the Student – School Profile (SSP) and
Mathematical Proficiency Test

November 11, 2014

Dr. ELISA S. BACCAY
Philippine Normal University
Taft Ave., Manila

Dear Madam:

Greetings of peace!

I am currently pursuing a degree in Doctor of Philosophy at Philippine Normal University – Manila, and is planning to conduct a research study entitled ***"Sociological and Psychological Constructs of Sixth Grade Pupils' Mathematical Proficiency"*** as a final requirement of the course.

In this regard, may I submit to your good office the attached instruments, i.e. the researcher's self – made questionnaires for your comments and suggestions?

I am hoping for your consideration and support in accomplishing this research. Thank you very much in anticipation of your favorable response.

Respectfully yours,

Mr. FEEJAY A. DIMACULANGAN
Researcher

Noted:

Dr. RENE R. BELECINA
Research Adviser

Dr. ERMINDA C. FORTES
Research Adviser

November 11, 2014

Dr. ROBERT DIAZ
Philippine Normal University
Taft Ave., Manila

Dear Sir:

Greetings of peace!

I am currently pursuing a degree in Doctor of Philosophy at Philippine Normal University – Manila, and is planning to conduct a research study entitled ***"Sociological and Psychological Constructs of Sixth Grade Pupils' Mathematical Proficiency"*** as a final requirement of the course.

In this regard, may I submit to your good office the attached instrument, i.e. the researcher's self – made questionnaire for your comments and suggestions?

I am hoping for your consideration and support in accomplishing this research. Thank you very much in anticipation of your favorable response.

Respectfully yours,

Mr. FEEJAY A. DIMACULANGAN
Researcher

Noted:

Dr. RENE R. BELECINA
Research Adviser

Dr. ERMINDA C. FORTES
Research Adviser

November 11, 2014

Dr. DANILO K. VILLENA
Philippine Normal University
Taft Ave., Manila

Dear Sir:

Greetings of peace!

I am currently pursuing a degree in Doctor of Philosophy at Philippine Normal University – Manila, and is planning to conduct a research study entitled ***"Sociological and Psychological Constructs of Sixth Grade Pupils' Mathematical Proficiency"*** as a final requirement of the course.

In this regard, may I submit to your good office the attached instrument, i.e. the researcher's self – made questionnaire for your comments and suggestions?

I am hoping for your consideration and support in accomplishing this research. Thank you very much in anticipation of your favorable response.

Respectfully yours,

Mr. FEEJAY A. DIMACULANGAN
Researcher

Noted:

Dr. RENE R. BELECINA
Research Adviser

Dr. ERMINDA C. FORTES
Research Adviser

November 11, 2014

Dr. FORTUNATO G. VENDIVEL
Philippine Normal University
Taft Ave., Manila

Dear Sir:

Greetings of peace!

I am currently pursuing a degree in Doctor of Philosophy at Philippine Normal University – Manila, and is planning to conduct a research study entitled ***"Sociological and Psychological Constructs of Sixth Grade Pupils' Mathematical Proficiency"*** as a final requirement of the course.

In this regard, may I submit to your good office the attached instrument, i.e. the researcher's self – made questionnaire for your comments and suggestions?

I am hoping for your consideration and support in accomplishing this research. Thank you very much in anticipation of your favorable response.

Respectfully yours,

Mr. FEEJAY A. DIMACULANGAN
Researcher

Noted:

Dr. RENE R. BELECINA
Research Adviser

Dr. ERMINDA C. FORTES
Research Adviser

November 11, 2014

Dr. ROGEN A. DORONILA
Notre Dame of Dadiangas University
General Santos City

Dear Sir:

Greetings of peace!

I am currently pursuing a degree in Doctor of Philosophy at Philippine Normal University – Manila, and is planning to conduct a research study entitled ***"Sociological and Psychological Constructs of Sixth Grade Pupils' Mathematical Proficiency"*** as a final requirement of the course.

In this regard, may I submit to your good office the attached instrument, i.e. the researcher's self – made questionnaire for your comments and suggestions?

I am hoping for your consideration and support in accomplishing this research. Thank you very much in anticipation of your favorable response.

Respectfully yours,

Mr. FEEJAY A. DIMACULANGAN
Researcher

Noted:

Dr. RENE R. BELECINA
Research Adviser

Dr. ERMINDA C. FORTES
Research Adviser

PHILIPPINE NORMAL UNIVERSITY
Taft Avenue, Manila
Graduate Studies and Teacher Education Research

November 26, 2014

Ms. Iza C. Elises
School Head
Josemaria Montessori School
Bauan, Batangas

Dear Ms. Elises:

Greetings of peace!

My name is **Feejay A. Dimaculangan**, a Ph.D. Mathematics Education student at Philippine Normal University in Manila. As one of the requirements in Ph.D Mathematics Education, I am currently conducting a study entitled "Sociological and Psychological Constructs of Sixth Grade Pupils' Mathematical Proficiency".

This study aims to help increase the school administrators' awareness of the factors that influence mathematical proficiency. The information will aid them in enhancing the instructional program of the school. It is assumed that by gathering information by observation and interpreting what is found, patterns and generalizations will emerge.

In view of this, I am humbly asking assistance from your good office to allow the researcher **validate** his self – made test that could determine the level of Mathematical Proficiency of the research participants in terms of conceptual understanding, procedural fluency, strategic competence, adaptive reasoning and productive disposition.

Your cooperation and support in accomplishing this research will be highly appreciated. Thank you very and I look forward to merit your gracious approval.

Respectfully yours,

FEEJAY A. DIMACULANGAN
Researcher

Approved:

Ms. IZA C. ELISES
School Head – Josemaria Montessori School

PHILIPPINE NORMAL UNIVERSITY
Taft Avenue, Manila
Graduate Studies and Teacher Education Research

November 26, 2014

Engr. Vicente P. Cordero
School Head
Bauan Colleges Inc.
Bauan, Batangas

Dear Engr. Cordero:

Greetings of peace!

My name is **Feejay A. Dimaculangan**, a Ph.D. Mathematics Education student at Philippine Normal University in Manila and an alumnus of Bauan Colleges Inc. (formerly Bauan High School). As one of the requirements in Ph.D Mathematics Education, I am currently conducting a study entitled ***"Sociological and Psychological Constructs of Sixth Grade Pupils' Mathematical Proficiency"***.

This study aims to help increase the school administrators' awareness of the factors that influence mathematical proficiency. The information will aid them in enhancing the instructional program of the school. It is assumed that by gathering information by observation and interpreting what is found, patterns and generalizations will emerge.

In view of this, I am humbly asking assistance from your good office to allow the researcher **validate** his self – made test that could determine the level of Mathematical Proficiency of the research participants in terms of conceptual understanding, procedural fluency, strategic competence, adaptive reasoning and productive disposition.

Your cooperation and support in accomplishing this research will be highly appreciated. Thank you very much and I look forward to merit your gracious approval.

Respectfully yours,

FEEJAY A. DIMACULANGAN
Researcher

Approved:

Engr. VICENTE P. CORDERO 11/26/2014
BCI School Head

PHILIPPINE NORMAL UNIVERSITY
Taft Avenue, Manila
Graduate Studies and Teacher Education Research

November 26, 2014

Mrs. Florencia C. Pesigan
School Head
St. Jude Elementary School of Learning Inc.
San Pascual, Batangas

Dear Mrs. Pesigan:

Greetings of peace!

My name is **Feejay A. Dimaculangan**, a Ph.D. Mathematics Education student at Philippine Normal University in Manila. As one of the requirements in Ph.D Mathematics Education, I am currently conducting a study entitled ***"Sociological and Psychological Constructs of Sixth Grade Pupils' Mathematical Proficiency"***.

This study aims to help increase the school administrators' awareness of the factors that influence mathematical proficiency. The information will aid them in enhancing the instructional program of the school. It is assumed that by gathering information by observation and interpreting what is found, patterns and generalizations will emerge.

In view of this, I am humbly asking assistance from your good office to allow the researcher **validate** his self – made test that could determine the level of Mathematical Proficiency of the research participants in terms of conceptual understanding, procedural fluency, strategic competence, adaptive reasoning and productive disposition.

Your cooperation and support in accomplishing this research will be highly appreciated. Thank you very much and I look forward to merit your gracious approval.

Respectfully yours,

FEEJAY A. DIMACULANGAN
Researcher

Approved:

Mrs. FLORENCIA C. PESIGAN
School Head – St. Jude Elementary School of Learning Inc.

Appendix B

Letter Asking Permission to Conduct Research in Schools

PHILIPPINE NORMAL UNIVERSITY
113 Years of Service and Leadership in Teacher Education

December 3, 2014

Rev. Fr. Carlo Magno C. Ilagan
President
Unified Schools of the Archdiocese of Lipa

REQUEST FOR PERMISSION TO CONDUCT RESEARCH IN SCHOOLS

Dear Fr. Carlo:

Greetings of peace!

The undersigned is a Ph.D. Mathematics Education student at Philippine Normal University, Manila who is currently conducting a study entitled "Sociological and Psychological Constructs of Sixth Grade Pupils' Mathematical Proficiency".

This study aims to help increase the school stakeholders' awareness of the factors that influence mathematical proficiency. The information will aid them in enhancing the instructional program of the school. It is assumed that by gathering information by observation and interpreting what is found, patterns and generalizations will emerge.

In view of this, he is humbly seeking consent from your good office to allow him to conduct a study in the member schools of the Unified Schools of the Archdiocese of Lipa (USAL), Grade School Department. The following are the research instruments that the Grade 6 Pupils and Mathematics 6 Teachers will answer.

1. Respondent's Profile
2. Curiosity Inventory
3. Motivation for Learning Inventory
4. Mathematical Proficiency Test (50 – item test)

Thank you very much in anticipation of your favorable response.

Respectfully yours,

FEEJAY A. DIMACULANGAN
Researcher

Approved:

Rev. Fr. CARLO MAGNO C. ILAGAN
USAL President

PHILIPPINE NORMAL UNIVERSITY
113 Years of Service and Leadership in Teacher Education

December 11, 2014

Sr. Hayde Marie L. Coronel, CSFN
Principal
Academia de San Francisco Javier
Nasugbu, Batangas

Dear Sr. Hayde Marie:

Greetings of peace!

The undersigned is a Ph.D. Mathematics Education student at Philippine Normal University, Manila and the Grade School Assistant Principal of Sta. Teresa College, Bauan, Batangas who is currently conducting a study entitled ***"Sociological and Psychological Constructs of Sixth Grade Pupils' Mathematical Proficiency"***.

This study aims to help increase school stakeholders' awareness of the factors that influence mathematical proficiency. The information will aid them in enhancing the instructional program of the school. It is assumed that by gathering information by observation and interpreting what is found, patterns and generalizations will emerge.

In view of this, he is humbly asking assistance from your good office to allow him to conduct a study in Academia de San Francisco Javier. The following are the research instruments that the Grade 6 Pupils and Mathematics 6 Teachers will answer.

1. Respondent's Profile
2. Curiosity Inventory
3. Motivation for Learning Inventory
4. Mathematical Proficiency Test (50 – item test)

Your cooperation and support in accomplishing this research will be highly appreciated. Thank you very much in anticipation of your favorable response.

Respectfully yours,

FEEJAY A. DIMACULANGAN
Researcher

Approved:

12/11/14

Sr. HAYDE MARIE L. CORONEL, CSFN
Principal

PHILIPPINE NORMAL UNIVERSITY
113 Years of Service and Leadership in Teacher Education

December 11, 2014

Mrs. Jessielaine C. Acorda
Principal
Academia De San Isidro Labrador
San Luis, Batangas

Dear Mrs. Acorda:

Greetings of peace!

The undersigned is a Ph.D. Mathematics Education student at Philippine Normal University, Manila and the Grade School Assistant Principal of Sta. Teresa College, Bauan, Batangas who is currently conducting a study entitled ***"Sociological and Psychological Constructs of Sixth Grade Pupils' Mathematical Proficiency"***.

This study aims to help increase school stakeholders' awareness of the factors that influence mathematical proficiency. The information will aid them in enhancing the instructional program of the school. It is assumed that by gathering information by observation and interpreting what is found, patterns and generalizations will emerge.

In view of this, he is humbly asking assistance from your good office to allow him to conduct a study in Academia De San Isidro Labrador. The following are the research instruments that the Grade 6 Pupils and Mathematics 6 Teachers will answer.

1. Respondent's Profile
2. Curiosity Inventory
3. Motivation for Learning Inventory
4. Mathematical Proficiency Test (50 – item test)

Your cooperation and support in accomplishing this research will be highly appreciated. Thank you very much in anticipation of your favorable response.

Respectfully yours,

FEEJAY A. DIMACULANGAN
Researcher

Approved:

JCAcorda
Mrs. JESSIELAINE C. ACORDA
Principal

PHILIPPINE NORMAL UNIVERSITY
113 Years of Service and Leadership in Teacher Education

December 11, 2014

Rev. Fr. Noel B. Salanguit
Principal
Escuela Sagrada Familia
Luyos, Tanauan City

Dear Fr. Salanguit:

Greetings of peace!

The undersigned is a Ph.D. Mathematics Education student at Philippine Normal University, Manila and the Grade School Assistant Principal of Sta. Teresa College, Bauan, Batangas who is currently conducting a study entitled ***"Sociological and Psychological Constructs of Sixth Grade Pupils' Mathematical Proficiency"***.

This study aims to help increase school stakeholders' awareness of the factors that influence mathematical proficiency. The information will aid them in enhancing the instructional program of the school. It is assumed that by gathering information by observation and interpreting what is found, patterns and generalizations will emerge.

In view of this, he is humbly asking assistance from your good office to allow him to conduct a study in Escuela Sagrada Familia. The following are the research instruments that the Grade 6 Pupils and Mathematics 6 Teachers will answer.

1. Respondent's Profile
2. Curiosity Inventory
3. Motivation for Learning Inventory
4. Mathematical Proficiency Test (50 – item test)

Your cooperation and support in accomplishing this research will be highly appreciated. Thank you very much in anticipation of your favorable response.

Respectfully yours,

FEEJAY A. DIMACULANGAN
Researcher

Approved:

Rev. Fr. NOEL B. SALANGUIT
Principal

PHILIPPINE NORMAL UNIVERSITY
113 Years of Service and Leadership in Teacher Education

December 11, 2014

Mrs. Virginia I. Estacio
Principal
Our Lady of Caysasay Academy
Taal, Batangas

Dear Mrs. Estacio:

Greetings of peace!

The undersigned is a Ph.D. Mathematics Education student at Philippine Normal University, Manila and the Grade School Assistant Principal of Sta. Teresa College, Bauan, Batangas who is currently conducting a study entitled ***"Sociological and Psychological Constructs of Sixth Grade Pupils' Mathematical Proficiency"***.

This study aims to help increase school stakeholders' awareness of the factors that influence mathematical proficiency. The information will aid them in enhancing the instructional program of the school. It is assumed that by gathering information by observation and interpreting what is found, patterns and generalizations will emerge.

In view of this, he is humbly asking assistance from your good office to allow him to conduct a study in Our Lady of Caysasay Academy. The following are the research instruments that the Grade 6 Pupils and Mathematics 6 Teachers will answer.

1. Respondent's Profile
2. Curiosity Inventory
3. Motivation for Learning Inventory
4. Mathematical Proficiency Test (50 – item test)

Your cooperation and support in accomplishing this research will be highly appreciated. Thank you very much in anticipation of your favorable response.

Respectfully yours,

FEEJAY A. DIMACULANGAN
Researcher

Approved:

Mrs. VIRGINIA I. ESTACIO
Principal

PHILIPPINE NORMAL UNIVERSITY
113 Years of Service and Leadership in Teacher Education

December 11, 2014

Mrs. Eusebia P. Dimayuga
Principal
Our Lady of Peace Academy
Tuy, Batangas

Dear Mrs. Dimayuga:

Greetings of peace!

The undersigned is a Ph.D. Mathematics Education student at Philippine Normal University, Manila and the Grade School Assistant Principal of Sta. Teresa College, Bauan, Batangas who is currently conducting a study entitled ***"Sociological and Psychological Constructs of Sixth Grade Pupils' Mathematical Proficiency"***.

This study aims to help increase school stakeholders' awareness of the factors that influence mathematical proficiency. The information will aid them in enhancing the instructional program of the school. It is assumed that by gathering information by observation and interpreting what is found, patterns and generalizations will emerge.

In view of this, he is humbly asking assistance from your good office to allow him to conduct a study in Our Lady of Peace Academy. The following are the research instruments that the Grade 6 Pupils and Mathematics 6 Teachers will answer.

1. Respondent's Profile
2. Curiosity Inventory
3. Motivation for Learning Inventory
4. Mathematical Proficiency Test (50 – item test)

Your cooperation and support in accomplishing this research will be highly appreciated. Thank you very much in anticipation of your favorable response.

Respectfully yours,

FEEJAY A. DIMACULANGAN
Researcher

Approved:

epdimayuga
Mrs. EUSEBIA P. DIMAYUGA
Principal

PHILIPPINE NORMAL UNIVERSITY
113 Years of Service and Leadership in Teacher Education

December 11, 2014

Sr. Ma. Josefina J. Valencia, MCSH
Principal
San Guillermo Academy
Talisay, Batangas

Dear Sr. Ma. Josefina:

Greetings of peace!

The undersigned is a Ph.D. Mathematics Education student at Philippine Normal University, Manila and the Grade School Assistant Principal of Sta. Teresa College, Bauan, Batangas who is currently conducting a study entitled ***"Sociological and Psychological Constructs of Sixth Grade Pupils' Mathematical Proficiency"***.

This study aims to help increase school stakeholders' awareness of the factors that influence mathematical proficiency. The information will aid them in enhancing the instructional program of the school. It is assumed that by gathering information by observation and interpreting what is found, patterns and generalizations will emerge.

In view of this, he is humbly asking assistance from your good office to allow him to conduct a study in San Guillermo Academy. The following are the research instruments that the Grade 6 Pupils and Mathematics 6 Teachers will answer.

1. Respondent's Profile
2. Curiosity Inventory
3. Motivation for Learning Inventory
4. Mathematical Proficiency Test (50 – item test)

Your cooperation and support in accomplishing this research will be highly appreciated. Thank you very much in anticipation of your favorable response.

Respectfully yours,

FEEJAY A. DIMACULANGAN
Researcher

Approved:

Sr. MA. JOSEFINA J. VALENCIA, MCSH
Principal

PHILIPPINE NORMAL UNIVERSITY
113 Years of Service and Leadership in Teacher Education

December 11, 2014

Rev. Fr. Jaime V. Cunanan
Principal
St. Isidore Catholic School
Cuenca, Batangas

Dear Fr. Jaime:

Greetings of peace!

The undersigned is a Ph.D. Mathematics Education student at Philippine Normal University, Manila and the Grade School Assistant Principal of Sta. Teresa College, Bauan, Batangas who is currently conducting a study entitled ***"Sociological and Psychological Constructs of Sixth Grade Pupils' Mathematical Proficiency"***.

This study aims to help increase school stakeholders' awareness of the factors that influence mathematical proficiency. The information will aid them in enhancing the instructional program of the school. It is assumed that by gathering information by observation and interpreting what is found, patterns and generalizations will emerge.

In view of this, he is humbly asking assistance from your good office to allow him to conduct a study in St. Isidore Catholic School. The following are the research instruments that the Grade 6 Pupils and Mathematics 6 Teachers will answer.

1. Respondent's Profile
2. Curiosity Inventory
3. Motivation for Learning Inventory
4. Mathematical Proficiency Test (50 – item test)

Your cooperation and support in accomplishing this research will be highly appreciated. Thank you very much in anticipation of your favorable response.

Respectfully yours,

FEEJAY A. DIMACULANGAN
Researcher

Approved:

by: [signature]

Rev. Fr. JAIME V. CUNANAN
Principal

PHILIPPINE NORMAL UNIVERSITY
113 Years of Service and Leadership in Teacher Education

December 4, 2014

Randy M. Baja, Ph.D.
Principal
St. Mary's Educational Institute
Lemery, Batangas

Dear Dr. Baja:

Greetings of peace!

The undersigned is a Ph.D. Mathematics Education student at Philippine Normal University, Manila and the Grade School Assistant Principal of Sta. Teresa College, Bauan, Batangas who is currently conducting a study entitled ***"Sociological and Psychological Constructs of Sixth Grade Pupils' Mathematical Proficiency"***.

This study aims to help increase school stakeholders' awareness of the factors that influence mathematical proficiency. The information will aid them in enhancing the instructional program of the school. It is assumed that by gathering information by observation and interpreting what is found, patterns and generalizations will emerge.

In view of this, he is humbly asking assistance from your good office to allow him to conduct a study in St. Mary's Educational Institute. The following are the research instruments that the Grade 6 Pupils and Mathematics 6 Teachers will answer.

1. Respondent's Profile
2. Curiosity Inventory
3. Motivation for Learning Inventory
4. Mathematical Proficiency Test (50 – item test)

Your cooperation and support in accomplishing this research will be highly appreciated. Thank you very much in anticipation of your favorable response.

Respectfully yours,

FEEJAY A. DIMACULANGAN
Researcher

Approved:

RANDY M. BAJA, Ph.D.
Principal

PHILIPPINE NORMAL UNIVERSITY
113 Years of Service and Leadership in Teacher Education

December 11, 2014

Mr. Joseph T. Ascan
Principal
St. Michael Archangel Parochial School
Lobo, Batangas

Dear Mr. Ascan:

Greetings of peace!

The undersigned is a Ph.D. Mathematics Education student at Philippine Normal University, Manila and the Grade School Assistant Principal of Sta. Teresa College, Bauan, Batangas who is currently conducting a study entitled ***"Sociological and Psychological Constructs of Sixth Grade Pupils' Mathematical Proficiency"***.

This study aims to help increase school stakeholders' awareness of the factors that influence mathematical proficiency. The information will aid them in enhancing the instructional program of the school. It is assumed that by gathering information by observation and interpreting what is found, patterns and generalizations will emerge.

In view of this, he is humbly asking assistance from your good office to allow him to conduct a study in St. Michael Archangel Parochial School. The following are the research instruments that the Grade 6 Pupils and Mathematics 6 Teachers will answer.

1. Respondent's Profile
2. Curiosity Inventory
3. Motivation for Learning Inventory
4. Mathematical Proficiency Test (50 – item test)

Your cooperation and support in accomplishing this research will be highly appreciated. Thank you very much in anticipation of your favorable response.

Respectfully yours,

FEEJAY A. DIMACULANGAN
Researcher

Approved:

Joseph T. Ascan
Mr. JOSEPH T. ASCAN
Principal

PHILIPPINE NORMAL UNIVERSITY
113 Years of Service and Leadership in Teacher Education

December 11, 2014

Sr. Ma. Viviana C. Zamudio, POIC
Principal
St. Raphael Archangel Parochial School
Calaca, Batangas

Dear Sr. Ma. Viviana:

Greetings of peace!

The undersigned is a Ph.D. Mathematics Education student at Philippine Normal University, Manila and the Grade School Assistant Principal of Sta. Teresa College, Bauan, Batangas who is currently conducting a study entitled ***"Sociological and Psychological Constructs of Sixth Grade Pupils' Mathematical Proficiency"***.

This study aims to help increase school stakeholders' awareness of the factors that influence mathematical proficiency. The information will aid them in enhancing the instructional program of the school. It is assumed that by gathering information by observation and interpreting what is found, patterns and generalizations will emerge.

In view of this, he is humbly asking assistance from your good office to allow him to conduct a study in St. Raphael Archangel Parochial School. The following are the research instruments that the Grade 6 Pupils and Mathematics 6 Teachers will answer.

1. Respondent's Profile
2. Curiosity Inventory
3. Motivation for Learning Inventory
4. Mathematical Proficiency Test (50 – item test)

Your cooperation and support in accomplishing this research will be highly appreciated. Thank you very much in anticipation of your favorable response.

Respectfully yours,

FEEJAY A. DIMACULANGAN
Researcher

Approved:

Sr. MA. VIVIANA C. ZAMUDIO, POIC
Principal

PHILIPPINE NORMAL UNIVERSITY
113 Years of Service and Leadership in Teacher Education

December 11, 2014

Mrs. Lilian B. Holgado
Principal
St. Therese Catholic School
Sta. Teresita, Batangas

Dear Mrs. Holgado:

Greetings of peace!

The undersigned is a Ph.D. Mathematics Education student at Philippine Normal University, Manila and the Grade School Assistant Principal of Sta. Teresa College, Bauan, Batangas who is currently conducting a study entitled ***"Sociological and Psychological Constructs of Sixth Grade Pupils' Mathematical Proficiency"***.

This study aims to help increase school stakeholders' awareness of the factors that influence mathematical proficiency. The information will aid them in enhancing the instructional program of the school. It is assumed that by gathering information by observation and interpreting what is found, patterns and generalizations will emerge.

In view of this, he is humbly asking assistance from your good office to allow him to conduct a study in St. Therese Catholic School. The following are the research instruments that the Grade 6 Pupils and Mathematics 6 Teachers will answer.

1. Respondent's Profile
2. Curiosity Inventory
3. Motivation for Learning Inventory
4. Mathematical Proficiency Test (50 – item test)

Your cooperation and support in accomplishing this research will be highly appreciated. Thank you very much in anticipation of your favorable response.

Respectfully yours,

FEEJAY A. DIMACULANGAN
Researcher

Approved:

BHolgado
Mrs. LILIAN B. HOLGADO
Principal

PHILIPPINE NORMAL UNIVERSITY
113 Years of Service and Leadership in Teacher Education

December 11, 2014

Mrs. Amelia L. Mendoza
Principal
St. Thomas Academy
Sto. Tomas, Batangas

Dear Mrs. Mendoza:

Greetings of peace!

The undersigned is a Ph.D. Mathematics Education student at Philippine Normal University, Manila and the Grade School Assistant Principal of Sta. Teresa College, Bauan, Batangas who is currently conducting a study entitled ***"Sociological and Psychological Constructs of Sixth Grade Pupils' Mathematical Proficiency"***.

This study aims to help increase school stakeholders' awareness of the factors that influence mathematical proficiency. The information will aid them in enhancing the instructional program of the school. It is assumed that by gathering information by observation and interpreting what is found, patterns and generalizations will emerge.

In view of this, he is humbly asking assistance from your good office to allow him to conduct a study in St. Thomas Academy. The following are the research instruments that the Grade 6 Pupils and Mathematics 6 Teachers will answer.

1. Respondent's Profile
2. Curiosity Inventory
3. Motivation for Learning Inventory
4. Mathematical Proficiency Test (50 – item test)

Your cooperation and support in accomplishing this research will be highly appreciated. Thank you very much in anticipation of your favorable response.

Respectfully yours,

FEEJAY A. DIMACULANGAN
Researcher

Approved:

Mrs. AMELIA L. MENDOZA
Principal

PHILIPPINE NORMAL UNIVERSITY
113 Years of Service and Leadership in Teacher Education

December 4, 2014

Randy M. Baja, Ph.D.
Principal
Sta.Teresa College
Bauan, Batangas

Dear Dr. Baja:

Greetings of peace!

The undersigned is a Ph.D. Mathematics Education student at Philippine Normal University, Manila and the Grade School Assistant Principal of Sta. Teresa College, Bauan, Batangas who is currently conducting a study entitled ***"Sociological and Psychological Constructs of Sixth Grade Pupils' Mathematical Proficiency"***.

This study aims to help increase school stakeholders' awareness of the factors that influence mathematical proficiency. The information will aid them in enhancing the instructional program of the school. It is assumed that by gathering information by observation and interpreting what is found, patterns and generalizations will emerge.

In view of this, he is humbly asking assistance from your good office to allow him to conduct a study in Sta. Teresa College. The following are the research instruments that the Grade 6 Pupils and Mathematics 6 Teachers will answer.

1. Respondent's Profile
2. Curiosity Inventory
3. Motivation for Learning Inventory
4. Mathematical Proficiency Test (50 – item test)

Your cooperation and support in accomplishing this research will be highly appreciated. Thank you very much in anticipation of your favorable response.

Respectfully yours,

FEEJAY A. DIMACULANGAN
Researcher

Approved:

RANDY M. BAJA, Ph.D.
Principal

Appendix C. Guidelines in the Administration of the Instruments

GUIDELINES IN THE ADMINISTRATION OF THE TEST AND OTHER INSTRUMENTS

For the Teacher who will administer the test and other instruments:

1. Parts IA, IIA, IIB and Mathematical Proficiency Test will be answered by the Sixth Grade Pupils. Kindly follow the schedule given below.

   Day 1:

IA Respondent's Profile	5 minutes
IIA Curiosity Inventory	10 minutes
IIB Motivation for Learning Inventory	10 minutes

   Day 2 :

Mathematical Proficiency Test	45 minutes
TOTAL	70 minutes

2. Kindly remind the pupils to take the Mathematical Proficiency Test seriously. With the permission of the school principal, the results of the mathematical proficiency test will be recorded and graded as a summative test.

3. Part IB will be answered by all Mathematics 6 Teachers.
4. All the accomplished instruments will be collected by the researcher before the start of the Christmas vacation.

Your cooperation and support in accomplishing this research will be highly appreciated. Thank you very much.

Mr. Feejay A. Dimaculangan
Researcher

Appendix D. Student – School Profile (SSP)

QUESTIONNAIRE FOR SIXTH GRADE PUPILS

Part IA – RESPONDENT'S PROFILE

Please answer all the items in this questionnaire as honestly and accurately as you can to enable the researcher to come up with a profile of his respondents. Kindly return the accomplished questionnaire to the researcher. **Rest assured that your responses will be kept in confidence and that will be used for research purposes only.** Thank you very much.

FEEJAY A. DIMACULANGAN
Researcher

Directions: Please put a check mark on the appropriate space for items 1 – 6 and encircle the number corresponding to your answer for item number 7.

Name in Print: (Optional)______________________________________
School:____

1. Number of Household Members
   ____ 1 – 3
   ____ 4 – 6
   ____ 7 – 9
   ____ 10 – 12
   ____ 13 and Above

2. Father's Level of Education
   ____ Grade School (Not Completed)
   ____ Grade School (Completed)
   ____ High School (Not Completed)
   ____ High School (Completed)
   ____ College (Not Completed)
   ____ College (Completed)
   ____ Master's Degree (Not Completed)
   ____ Master's Degree (Completed)
   ____ Doctorate Degree (Not Completed)
   ____ Doctorate Degree (Completed)

3. Mother's Level of Education
   ____ Grade School (Not Completed)
   ____ Grade School (Completed)
   ____ High School (Not Completed)
   ____ High School (Completed)
   ____ College (Not Completed)
   ____ College (Completed)
   ____ Master's Degree (Not Completed)
   ____ Master's Degree (Completed)
   ____ Doctorate Degree (Not Completed)
   ____ Doctorate Degree (Completed)

4. Access to Educational Technology (possible to have more than one answer)
   ____ Ebook
   ____ LCD Projector
   ____ Laptop
   ____ Tablet PC
   ____ Personal Computer
   ____ Smartphone
   ____ Podcasting
   ____ Smartboard
   ____ Interactive Digital Video Game
   ____ Social Media (Facebook, Twitter, Blogs, etc.)
   ____ Video Technology (e.g. YouTube, Skype, etc.)

5. Level of Performance in English (Grade in English during Second Quarter)
   ____ 90 and Above		Very High

____ 85 – 89 High
____ 80 – 84 Average
____ 75 – 79 Low
____ Below 75 Very Low

6. Family Formation
____ Living with Father only
____ Living with Mother only
____ Living with Both Parents
____ Living with Guardian(s)
____ Living with Sibling(s)
____ Living with Other Relatives

7. Level of Parental Involvement in Child's Education

Parental Involvement in Child's Education	Very High	High	Average	Low	Very Low
a. My parent talks to me about school	5	4	3	2	1
b. My parent helps me in doing my homework	5	4	3	2	1
c. My parent expects me to do well in school	5	4	3	2	1
d. My parent monitors my whereabouts during school days	5	4	3	2	1
e. My parent makes sure that my out – of – school activities are useful	5	4	3	2	1
f. My parent helps me plan for high school	5	4	3	2	1
g. My parent attends Parent – Teacher Association meetings	5	4	3	2	1
h. My parent checks/monitors my assignments and other school tasks	5	4	3	2	1

QUESTIONNAIRE FOR MATHEMATICS 6 TEACHERS

Part IB – RESPONDENT'S PROFILE

Your answers to all items below will help the researcher establish a profile of his respondents in the study. Please answer all the items in the questionnaire as honestly and accurately as you can. Kindly return the accomplished questionnaire to the researcher. **Rest assured that your responses will be kept in confidence and will be used for research purposes only**. Thank you very much.

FEEJAY A. DIMACULANGAN
Researcher

Directions: Please print or write legibly. Supply or check the information required in each item. Use additional sheets if necessary.

Name in Print: (Optional)_______________________________________
School:____

1. Class Size (Number of Pupils in the Classroom)
   ____ 51 and Above
   ____ 46 – 50
   ____ 41 – 45
   ____ 36 – 40
   ____ 31 – 35
   ____ 26 – 30
   ____ Below 26

2. Area of Specialization
   ____ Mathematics
   ____ Others (Please specify) ___________________________

3. Number of Years Spent in Teaching
   ____ 30 and Above
   ____ 20 – 29
   ____ 15 – 19
   ____ 10 – 14
   ____ 5 – 9
   ____ 0 – 4

4. Educational Qualifications
   ____ BEED Graduate
   ____ BSED Graduate
   ____ 4 – Year Course with Education Units
   ____ With MA Units
   ____ Completed Academic Requirements in MA
   ____ MA Graduate
   ____ With Ph.D./Ed.D. units
   ____ Completed Academic Requirements in Ph.D./Ed.D.
   ____ Ph.D./Ed.D. Graduate
   ____ Others (Please specify) __________________________________

5. Honors and Awards Received (Please specify)
____
____
____

6. Level of Seminars/Workshops Attended
_____ Local
_____ Regional
_____ National
_____ International
_____ Others (Please specify) ____

7. Nature of Participation in Seminars/Workshops

_____ Speaker
_____ Participant
_____ Secretariat
_____ Panel Reactor
_____ Commentator
_____ Others (Please specify) ________________________

8. Work Values (Please rate yourself honestly in each of the following values using the scale.)

Work Values	Excellent	Very Satisfactory	Satisfactory	Fair	Poor
a. Resourcefulness	5	4	3	2	1
b. Sense of responsibility	5	4	3	2	1
c. Creativity	5	4	3	2	1
d. Initiative	5	4	3	2	1
e. Punctuality	5	4	3	2	1
f. Orderliness	5	4	3	2	1
g. Commitment	5	4	3	2	1
h. Loyalty	5	4	3	2	1
i. Determination	5	4	3	2	1
j. Cooperativeness	5	4	3	2	1
k. Industry	5	4	3	2	1
l. Cheerfulness	5	4	3	2	1
m. Achievement – Oriented	5	4	3	2	1
n. Compassion	5	4	3	2	1
o. Sincerity	5	4	3	2	1
p. Foresight	5	4	3	2	1
q. Composure	5	4	3	2	1

r. Sense of Humor	5	4	3	2	1

9. Ability Grouping (Basis for Selection/Placement of Pupils)
   ____ Academic Performance
   ____ Academic Achievement
   ____ Subject Proficiency
   ____ Character/Conduct

10. School's Support Facilities
    ____ Library
    ____ Computer Laboratory
    ____ Science Laboratory
    ____ Electronic & Media Center
    ____ Reading Center
    ____ Speech Laboratory
    ____ Math Laboratory
    ____ Others (Please specify) ____________________

11. School's Academic Programs in Mathematics
    ______ Mathematics Remedial Program
    ______ Mathematics Enrichment Program
    ______ Mathematics Summer Program
    ______ MTAP
    ______ Others (Please specify) ______________________________

Appendix E. Curiosity Inventory (CI)

QUESTIONNAIRE FOR SIXTH GRADE PUPILS

Part IIA – CURIOSITY INVENTORY (CI)

Your answers to all items in the inventory will help the researcher achieve his purposes in his study. Please answer all items as honestly and accurately as you can and return the accomplished form to the researcher. **Rest assured that your responses will be kept in confidence and will be used for research purposes only.** Thank you very much.

FEEJAY A. DIMACULANGAN
Researcher

Directions: Rate the statements below for how accurately they reflect the way YOU GENERALLY FEEL AND BEHAVE NOW by encircling the numbers. Items are anchored on the following scale:

5	–	Always	2	–	Rarely
4	–	Often	1	–	Never
3	–	Sometimes			

1.	I would describe myself as someone who actively seeks as much information as I can in a new situation.	5 4 3 2 1
2.	I find myself looking for new opportunities to grow as a person (e.g., information, people, and resources).	5 4 3 2 1
3.	I actively seek as much information as I can in new situations.	5 4 3 2 1
4.	I am at my best when doing something that is challenging.	5 4 3 2 1
5.	I am always looking for experiences that challenge how I think about myself and the world.	5 4 3 2 1
6.	I frequently seek out opportunities to challenge myself and grow as a person.	5 4 3 2 1
7.	When I am actively interested in something, it takes a great deal to disturb me.	5 4 3 2 1
8.	Everywhere I go, I am out looking for new things or experiences.	5 4 3 2 1
9.	I like to do things that are little scary.	5 4 3 2 1
10.	I prefer activities that are excitingly unpredictable.	5 4 3 2 1
11.	I am the kind of person who accepts unfamiliar people, events, and places.	5 4 3 2 1
12.	Difficult conceptual problems can keep me awake all night thinking about solutions.	5 4 3 2 1
13.	I enjoy learning about subjects that are familiar to me.	5 4 3 2 1
14.	I can spend hours on a single problem because I just can’t rest without knowing the answer.	5 4 3 2 1
15.	If I read something that puzzles me at first, I keep reading until I understand it.	5 4 3 2 1

16.	It bothers me if I come across a word that I don't know, so I will look up its meaning in a dictionary.	5	4	3	2	1
17.	I feel frustrated if I can't figure out the solution to a problem, so I work even harder to solve it.	5	4	3	2	1
18.	I ponder for a long time in an attempt to solve some fundamental problems.	5	4	3	2	1
19.	I am critical of current ideas and theories.	5	4	3	2	1
20.	I enjoy discussing abstract concepts.	5	4	3	2	1
21.	If I am given an incomplete puzzle, I like to try to find the final solution.	5	4	3	2	1
22.	When someone asks me a riddle, I am interested in trying to solve it.	5	4	3	2	1
23.	When I am given a new kind of arithmetic problem, I enjoy imagining the solutions.	5	4	3	2	1
24.	When I see a complicated piece of machinery, I like to ask someone how it works.	5	4	3	2	1
25.	I enjoy exploring new ideas.	5	4	3	2	1
26.	I find it fascinating to learn new information.	5	4	3	2	1
27.	If I am given an unfamiliar task, I like trying how it gets done.	5	4	3	2	1
28.	When I learn something new, I would like to find out more about it.	5	4	3	2	1
29.	When I see an incomplete puzzle, I like imagining how to solve it.	5	4	3	2	1
30.	I am interested in discovering how things work.	5	4	3	2	1

Scoring Key:

Exploration	1 – 6
Absorption	7 – 11
Epistemic Curiosity	12 – 21
Perceptual Curiosity	22 – 30

Appendix F. Motivation for Learning Inventory (MLI)

Part IIB – MOTIVATION FOR LEARNING INVENTORY (MLI)

Directions: Rate the statements below for how accurately they **truly applies to you** by encirclingthe numbers. Items are anchored on the following scale:

5	–	Always	2	–	Rarely
4	–	Often	1	–	Never
3	–	Sometimes			

1.	I like math because it really challenges me to learn new things	5	4	3	2	1
2.	I believe I will receive an excellent grade in a math class.	5	4	3	2	1
3.	I'm certain I can understand the most difficult lesson presented in a math class.	5	4	3	2	1
4.	It is important for me to learn the lessons in a math class.	5	4	3	2	1
5.	I'm confident I can learn the basic concepts taught in a math class.	5	4	3	2	1
6.	I'm confident I can understand the most difficult lesson presented by the teacher in a math class.	5	4	3	2	1
7.	I like math lessons because it arouses my curiosity, even if it is difficult to learn.	5	4	3	2	1
8.	I am very interested in the lessons of a math subject.	5	4	3	2	1
9.	I'm confident I can do an excellent job on the assignments and tests in mathematics.	5	4	3	2	1

10. I expect to do well in a math class.	5 4 3 2 1
11. The most satisfying thing for me in a math class is trying to understand the lessons as thoroughly as possible.	5 4 3 2 1
12. I think the lessons in a math class are useful for me to learn.	5 4 3 2 1
13. When I have the opportunity in a math class, I choose activities that I can learn from, even if they don't guarantee a good grade.	5 4 3 2 1
14. I like mathematics as a subject.	5 4 3 2 1
15. Understanding the subject matter of mathematics is very important to me.	5 4 3 2 1
16. I'm sure I can master the skills being taught in a math class.	5 4 3 2 1
17. I want to do my best in a math class because it is important to show my mathematical ability to my family and friends.	5 4 3 2 1
18. Considering the difficulty of a math course, the teacher, and my skills, I think I will do well in a math class.	5 4 3 2 1
19. The things I am learning in math will be useful to me.	5 4 3 2 1
20. I feel confident that I will do well in a math class.	5 4 3 2 1
21. The math teacher makes the lesson seem important.	5 4 3 2 1
22. I feel that math gives me a lot of satisfaction.	5 4 3 2 1
23. In a math class, I try to set and achieve high standard of excellence.	5 4 3 2 1
24. I feel satisfied with what I am getting from a math class.	5 4 3 2 1
25. The content of a math subject relates to my expectations and goals.	5 4 3 2 1
26. To accomplish my goals, it is important that I do well in math.	5 4 3 2 1
27. As I am taking a math class, I believe that I can succeed if I try hard enough.	5 4 3 2 1
28. The personal uses of math subject are clear to me.	5 4 3 2 1
29. I find the challenge level in math to be about right: neither too easy, nor too hard.	5 4 3 2 1
30. The amount of work I have to do is appropriate for this type of subject.	5 4 3 2 1

Scoring Key:

Goal Orientation	1, 7, 11, 13, 17, 20, 23, 25, 28, 30
Task Value	4, 8, 12, 14, 15, 19, 21, 22, 24, 29
Self – Efficacy	2, 3, 5, 6, 9, 10, 16, 18, 26, 27

Appendix G. Mathematical Proficiency Test

MATHEMATICAL PROFICIENCY TEST FOR SIXTH GRADE PUPILS

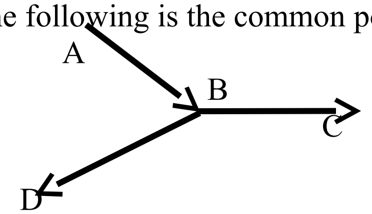
Your answers to all items in the test will help the researcher achieve his purposes in his study. Please answer all items and return the accomplished test paper to the researcher. **Rest assured that your responses will be kept in confidence and will be used for research purposes only.** Thank you very much.

FEEJAY A. DIMACULANGAN
Researcher

Name ______________________________
School____________________

Directions: Read each item carefully. Encircle the letter of the correct answer.

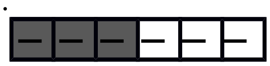
1. Which is divisible by 4?
   A. 448 C. 1 514
   B. 518 D. 2302
2. Which of the following is the common point in the given angles?



   A. A C. C
   B. B D. D

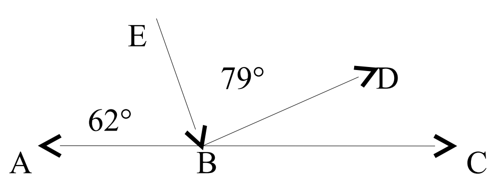
3. Which illustrates $\frac{1}{3} \div 2$?

   A.

   B.

   C.

   D.

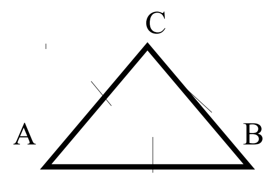
4. What is “6 lemons to 12 pears” in symbols?
   A. 1 $\leftrightarrow$ 2
   C. 1 : 2
   B. 2 > 1
   D. 2 / 1
5. What is the approximate mass of a sando bag of rice?
   A. 32 kg
   C. 0.32 kg
   B. 3.2 kg
   D. 0.032 kg
6. Which is equivalent to 25% of 88?
   A. $\frac{1}{4}$ of 88
   C. $\frac{3}{4}$ of 88
   B. $\frac{1}{2}$ of 88
   D. $\frac{3}{2}$ of 88
7. What number will divide the sum of 1 200, 1 000, 900, 1 600 and 1 400 to get an average of 1 220?
   A. 4
   C. 6
   B. 5
   D. 7
8. Which object occupies more space than the others?
   A. cell phone
   C. netbook
   B. laptop
   D. tablet PC
9. What is the measure of each angle in any acute triangle?
   A. acute
   C. scalene
   B. obtuse
   D. straight
10. How many sides does a pentagon have?
    A. 5
    C. 7
    B. 6
    D. 8
11. Which expresses 252 as a product of prime factors using the index notation?
    A. $2^2 \times 3 \times 5$
    C. $2^2 \times 3 \times 7$
    B. $2^2 \times 3^2 \times 5$
    D. $2^2 \times 3^2 \times 7$
12. If a straight line measures 180°, then what is the measure of ∠DBC in the given figure?



    A. 39°
    C. 62°
    B. 42°
    D. 69°
13. What is the difference of $3\frac{4}{6} - 1\frac{1}{6}$?
    A. $\frac{2}{3}$
    C. $2\frac{1}{2}$

B. $\frac{4}{3}$ D. $2\frac{4}{3}$

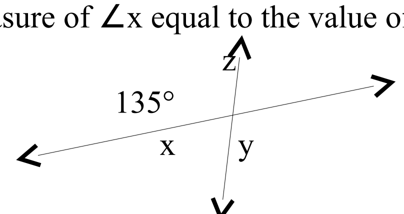
14. What is the simplest form of 44 : 40?
 A. 1 : 4 C. 10 : 11
 B. 4 : 1 D. 11 : 10
15. What number will be multiplied to 5.907 to get 59.07?
 A. 10 C. 1 000
 B. 100 D. 10 000
16. What is 3 : 100 in percent?
 A. 3% C. 6%
 B. 30% D. 60%
17. What is the average of 10, 15 and 20?
 A. 15 C. 37
 B. 28 D. 43
18. Which is the value of *w* if $V = l\ x\ w\ x\ h$?
 A. V x l x h C. $\frac{V}{l\,x\,h}$
 B. V x h x l D. $\frac{l\,x\,h}{V}$
19. In the marked triangle, what is the measure of ∠A?



 A. 30° C. 60°
 B. 45° D. 90°
20. The angles of a quadrilateral measure 110°, 80° and 60°. What is the measure of its fourth angle?
 A. 100° C. 220°
 B. 110° D. 400°
21. Rizza made 10 postcards to sell. She wants to pack the postcards into envelopes with the same number of postcards in each envelope with no remaining postcards. How many postcards can she put into each envelope, 4, 5, 6 or 9?
 A. 4 C. 6
 B. 5 D. 9
22. Three angles are on a straight line. If ∠1 = 75°and ∠2 = 85°, then what is the measure of ∠3?
 A. 20° C. 40°
 B. 30° D. 50°
23. There are 15 girls in a class, $\frac{2}{3}$ of them have long hair. How many girls do not have long hair?

A. 3
B. 5
C. 7
D. 10

24. There are 4 lions in a zoo. They are fed 12 kg of meat a day, 2 more lions are added to the zoo. How much meat would have to be prepared now to feed all the lions for a day?
    A. 12 kg
    B. 14 kg
    C. 16 kg
    D. 18 kg
25. A bread costs ₱ 9.50. Michael bought a dozen of this bread. How much did he pay for them?
    A. ₱ 114
    B. ₱ 114.75
    C. ₱ 115.25
    D. ₱ 115.50
26. A school has 1 500 pupils. On a certain day, 30 of the pupils were absent. What is the percentage of the pupil who were present on that day?
    A. 96%
    B. 97%
    C. 98%
    D. 99%
27. Miggy bought a dozen of pencils at ₱ 19.50 each. He bought another half a dozen at ₱ 24.00 each. How much did he pay for each dozen on the average?
    A. ₱ 21.00
    B. ₱ 22.00
    C. ₱ 23.00
    D. ₱ 24.00
28. Daniel wants to cut a block of cheese into smaller cubes that measure $8cm^3$ each. How many such cubes of cheese can he cut from the large blockwith volume equal to 192 cm^3?
    A. 20
    B. 22
    C. 24
    D. 26
29. A signage that reads "Give Way" has a shape of an equilateral triangle. If two of its angles has a sum of 120°, then what is the measure of the other angle?
    A. 30°
    B. 45°
    C. 60°
    D. 90°
30. Enrique would like to use triangular tiles in covering a table with ten sides starting from a vertex. How many tiles could easily cover the entire table?
    A. 6
    B. 8
    C. 10
    D. 12
31. When is a number divisible by 10?
    A. it ends in zero
    B. it is divisible by 2
    C. it is divisible by 5
    D. it is an even number
32. Why is the measure of ∠x equal to the value of ∠z?



    A. angles about a straight line
    B. angles about one point
    C. opposite angles
    D. vertical angles

33. Why is the estimated quotient of $7\frac{6}{7} \div 4$ equal to 2?

   A. the divisor is 4
   B. the whole number is 7
   C. $7\frac{6}{7}$ is approximately equal to 8
   D. the fraction is almost equal to 1

34. How can you simplify 35 : 450?
   A. Divide 35 by 450.
   B. Divide 450 by 35.
   C. Divide 35 and 450 by a greatest common factor.
   D. Determine the common multiples of 35 and 450.

35. Which will make 5.907 equal to 59.07?
   A. When it is multiplied by 1.
   B. When it is multiplied by 0.01.
   C. When it is multiplied by 10.
   D. When it is multiplied by 100.

36. Why is 25% the same as 1 : 4?
   A. Because 2 is $\frac{1}{2}$ of 4.
   B. Because $\frac{25}{100}$ is equal to 4.
   C. Because 25 : 100 = 1 : 4
   D. Because 25 : 100 = 1 : 2

37. Why is ₱ 44.58 the average of ₱ 49.50, ₱ 45.00, ₱ 39.75, ₱ 40.65 and ₱ 48.00?
   A. ₱222.9 ÷ 5 = ₱ 44.58
   B. ₱222.9 x 5 = ₱ 44.58
   C. ₱222.9 – 5 = ₱ 44.58
   D. ₱222.9 + 5 = ₱ 44.58

38. A solid has dimensions of 3 cm x 3 cm x 1 cm. Why is the volume of the solid equal to 9 cm^3?
   A. a layer has 3 unit cubes and there are 3 layers
   B. a layer has 4 unit cubes and there are 4 layers
   C. a layer has 5 unit cubes and there are 5 layers
   D. a layer has 6 unit cubes and there are 6 layers

39. Given that ∠A of a right triangle is 45°, why is the measure of ∠C equal to 45°?
   A. 95° – 50° = 45°
   B. 105° – 60° = 45°
   C. 180° – 90° – 45° = 45°
   D. 360° – 180° – 45° = 45°

40. Why is square a regular polygon?
   A. it has four sides
   B. the sides are not of equal length
   C. two of its sides and angles are equal
   D. all its sides and all its angles are equal

41. The mass of the Sun is 1 989 000 000 000 000 000 000 000 000 000 kg. Using scientific notation it becomes 1.989×10^{30} kg. Why should you choose to writethe mass of the Sun using scientific notation?

A. It will make me look more intelligent.
B. When I use it others will adore me.
C. It is more convenient to use especially if it will be written.
D. It might be one of the items in the National Achievement Test.

42. Richard prefers a tripod than a monopod in taking pictures because ________.
    A. it is more expensive
    B. he can take good pictures
    C. it is given as a gift to him
    D. it has three legs that make it more stable
43. Liza is preparing for her Third Quarterly Test. How should she manage her time in studying her lessons if she has only 12 hours to study Filipino, Mathematics, MSEP and English?
    A. She should divide 12 hours giving each subject $\frac{1}{4}$ of her available time.
    B. Study first her favorite subject then the remaining time will be used in studying other subjects.
    C. Give more time in studying MSEP because it is an easy subject.
    D. She will visit first her Facebook account so that she will be relaxed before studying her lessons.
44. The Castro family has Chicken curry for dinner. It is also Charmaine's favorite. She knows that it is just enough for the 8 members of her family. What must she do if she is done eating her part and still she would like to eat some more?
    A Get some more even if she knows that his eldest brother is not yet eating.
    B Ask her mother to cook some more so that she can have more to eat.
    C She will take her part and enjoy eating it so that all of the members could eat chicken curry.
    D Ask her father if instead of eating chicken curry he will eat fried chicken just to give in to her craving of the viand.
45. Jerome and his brother Jerry went on shopping. He noticed that the change they got from Department Store are 5, 10 and 25 centavos. What should they do with the coins?
    A Tell the sales lady to keep the change.
    B Keep them because 10 pieces of ₱ 0.10 is ₱ 1.00.
    C Throw them away because they have no more value.
    D Place them in a jar and display it in the receiving room.

46. Roland scored 37 out of 60 in a quarterly test in Mathematics. Why does the teacher compute the percentage of his score?
    A To give him extra homework and test.
    B To determine if he passed or not the quarterly test.
    C To record his score in the record book of the teacher.

D To compare his score from the score of his classmates.

47. The average size of white T – shirt of Grade VI pupils in an elementary school is 10. If the Municipal Councilor will donate white T – shirts in the school, how will the average size of T – shirt help him?
    A The T – shirts that he will buy are size 10.
    B The T – shirts that he will buy are below size 10.
    C The T – shirts that he will buy are above size 10.
    D The T – shirts that he will buy are combinations of sizes 6 – 14.
48. Romeo bought a new pair of shoes. The box of the shoes has dimensions of 11 in x 6 in x 5 in. Which is true about the shoes of Romeo?
    A Romeo has a black leather shoes.
    B Romeo's feet is 10 – 11 inches long.
    C Romeo has doesn't like his running shoes.
    D Romeo will return the shoes to the store because it doesn't fit him.
49. A carpenter is using an instrument called triangle in order to make sure that corners form 90° angles. This means that ___________________.
    A houses can be triangular in shape
    B pupils should become carpenters
    C triangles are useful tools to carpenters
    D carpenters studied triangle in Grade VI
50. Ayala Triangle in Makati was formed due to the intersections of three roads namely Makati Avenue, Ayala Avenue and Paseo De Roxas. What can you say about the structures in Ayala Triangle?
    A It causes heavy traffic.
    B The triangle was formed accidentally.
    C It is a mark that Makati is a progressive city.
    D It is easily accessible from three intersecting roads.

Key to Correction

1	A	40.	D
2	B	41.	C
3	A	42.	D
4	C	43.	A
5	A	44.	C
6	A	45.	B
7	B	46.	B

8 B
9 A
10 A
11 D
12 A
13 C
14 D
15 A
16 A
17 A
18 C
19 C
20 B
21 B
22 A
23 D
24 D
25 A
26 C
27 A
28 C
29 C
30 B
31 A
32 D
33 C
34 C
35 C
36 C
37 A
38 A
39 C

47. D
48. B
49. C
50. D

Appendix H. Multiple Regression Analyses of Full Model 1 (Enter Method)

Model Summary

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate
1	.819[a]	.671	.658	5.43548

ANOVA

Model		Sum of Squares	Df	Mean Square	F	p – value
1	Regression	37296.965	24	1554.040	52.600	.000

Residual	18317.531	620	29.544
Total	55614.496	644	

Coefficients

Predictors	B	Std. Error	Beta	t	p – value
Intercept	30.135	4.913		6.133	.000
Number of Household Members	2.322	.762	.110	3.048	.002
Father's Level of Education	-.330	.385	-.022	-.858	.391
Mother's Level of Education	.074	.378	.005	.195	.845
Access to Educational Technology	-5.411	.471	-.372	-11.497	.000
Level of Performance in English	.222	.274	.019	.812	.417
Family Formation	-.028	.236	-.003	-.121	.904
Level of Parents' Involvement in Education	.459	.368	.030	1.247	.213
Exploration	4.086	.632	.241	6.468	.000
Absorption	4.301	.484	.281	8.889	.000
Epistemic curiosity	10.240	.734	.613	13.952	.000
Perceptual curiosity	8.635	.696	.522	12.403	.000
Goal orientation	.685	.840	.045	.816	.415
Task value	.067	.755	.004	.089	.929
Self – efficacy	-.694	.677	-.048	-1.026	.305
Class Size	-3.683	.555	-.233	-6.635	.000
Area of Specialization	-.306	.922	-.013	-.332	.740
Number of Years Spent in Teaching	.303	.419	.054	.723	.470
Educational Qualifications	-.615	.657	-.075	-.936	.350
Honors and Awards	.206	.353	.024	.582	.561
Attendance in Seminars/Workshops	.033	.307	.003	.108	.914
Work Values	.072	.769	.003	.094	.925
Ability Grouping	.048	.363	.004	.133	.894
School's Support Facilities	-4.424	.573	-.250	-7.728	.000
School's Academic Programs in	-4.751	.567	-.288	-8.383	.000

Mathematics

Appendix I. Multiple Regression Analyses of Full Model 2 (Enter Method)

Model Summary

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate
1	.929	.863	.858	4.60777

ANOVA

Model		Sum of Squares	Df	Mean Square	F	p – value
1	Regression	82843.950	24	3451.831	162.580	.000

Residual	13163.569	620	21.232		
Total	96007.519	644			

Coefficients

Predictors	B	Std. Error	Beta	t	p – value
Intercept	4.121	4.165		.989	.323
Number of Household Members	-.090	.646	-.003	-.139	.890
Father's Level of Education	.339	.326	.017	1.041	.298
Mother's Level of Education	.236	.321	.012	.736	.462
Access to Educational Technology	-2.997	.399	-.157	-7.511	.000
Level of Performance in English	-.113	.232	-.007	-.485	.628
Family Formation	-.062	.200	-.005	-.310	.757
Level of Parents' Involvement in Education	-.410	.312	-.020	-1.314	.189
Exploration	2.859	.535	.128	5.340	.000
Absorption	3.288	.410	.164	8.017	.000
Epistemic curiosity	5.017	.622	.229	8.064	.000
Perceptual curiosity	4.655	.590	.214	7.888	.000
Goal orientation	-.149	.712	-.007	-.209	.834
Task value	.039	.640	.002	.061	.951
Self – efficacy	.036	.574	.002	.063	.950
Class Size	11.786	.471	.566	25.048	.000
Area of Specialization	-.137	.782	-.004	-.175	.861
Number of Years Spent in Teaching	-.168	.355	-.023	-.471	.637
Educational Qualifications	.190	.557	.018	.341	.733
Honors and Awards	.107	.300	.009	.356	.722
Attendance in Seminars/Workshops	.269	.261	.019	1.034	.302
Work Values	-.630	.652	-.019	-.967	.334
Ability Grouping	.620	.307	.035	2.019	.044
School's Support Facilities	-1.453	.485	-.062	-2.994	.003
School's Academic Programs in	-1.985	.480	-.091	-4.131	.000

Mathematics

Appendix J. Multiple Regression Analyses of Full Model 3 (Enter Method)

Model Summary

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate
1	.909	.825	.819	4.69630

ANOVA

Model		Sum of Squares	Df	Mean Square	F	p – value

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	64680.238	24	2695.010	122.194	.000
	Residual	13674.258	620	22.055		
	Total	78354.496	644			

Coefficients

Predictors	B	Std. Error	Beta	t	p – value
Intercept	2.719	4.245		.640	.522
Number of Household Members	.906	.658	.036	1.377	.169
Father's Level of Education	-.184	.332	-.010	-.553	.581
Mother's Level of Education	.443	.327	.025	1.357	.175
Access to Educational Technology	-2.602	.407	-.151	-6.398	.000
Level of Performance in English	.356	.237	.026	1.504	.133
Family Formation	-.238	.203	-.020	-1.172	.242
Level of Parents' Involvement in Education	-.242	.318	-.013	-.760	.447
Exploration	3.706	.546	.184	6.791	.000
Absorption	2.886	.418	.159	6.904	.000
Epistemic curiosity	4.447	.634	.224	7.012	.000
Perceptual curiosity	4.562	.602	.233	7.585	.000
Goal orientation	-.128	.726	-.007	-.176	.860
Task value	.502	.653	.028	.769	.442
Self – efficacy	-.355	.585	-.021	-.608	.544
Class Size	-1.506	.480	-.080	-3.141	.002
Area of Specialization	-.391	.797	-.014	-.491	.624
Number of Years Spent in Teaching	-.288	.362	-.043	-.794	.427
Educational Qualifications	.023	.568	.002	.041	.968
Honors and Awards	.143	.305	.014	.468	.640
Attendance in Seminars/Workshops	.286	.266	.023	1.078	.281
Work Values	-.372	.664	-.012	-.560	.576
Ability Grouping	.081	.313	.005	.259	.796
School's Support Facilities	10.568	.495	.502	21.363	.000

School's Academic Programs in Mathematics	-2.306	.490	-.118	-4.710	.000

Appendix K. Multiple Regression Analyses of Full Model 4 (Enter Method)

Model Summary

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate
1	.918	.842	.836	4.66347

ANOVA

Model		Sum of Squares	Df	Mean Square	F	p – value
1	Regression	71919.369	24	2996.640	137.790	.000

Residual	13483.732	620	21.748
Total	85403.101	644	

Coefficients

Predictors	B	Std. Error	Beta	t	p – value
Intercept	2.292	4.216		.544	.587
Number of Household Members	-.055	.654	-.002	-.084	.933
Father's Level of Education	-.280	.330	-.015	-.847	.397
Mother's Level of Education	-.032	.324	-.002	-.098	.922
Access to Educational Technology	-.887	.404	-.049	-2.197	.028
Level of Performance in English	-.096	.235	-.007	-.409	.683
Family Formation	.039	.202	.003	.193	.847
Level of Parents' Involvement in Education	-.230	.316	-.012	-.728	.467
Exploration	3.173	.542	.151	5.856	.000
Absorption	2.897	.415	.153	6.980	.000
Epistemic curiosity	5.141	.630	.248	8.165	.000
Perceptual curiosity	4.326	.597	.211	7.243	.000
Goal orientation	.844	.721	.045	1.171	.242
Task value	-1.567	.648	-.083	-2.418	.016
Self – efficacy	.568	.581	.032	.979	.328
Class Size	-2.730	.476	-.139	-5.732	.000
Area of Specialization	.887	.791	.031	1.121	.263
Number of Years Spent in Teaching	.102	.360	.015	.283	.777
Educational Qualifications	.289	.564	.028	.513	.608
Honors and Awards	-.352	.303	-.033	-1.162	.246
Attendance in Seminars/Workshops	-.075	.264	-.006	-.286	.775
Work Values	.168	.660	.005	.254	.799
Ability Grouping	-.855	.311	-.050	-2.748	.006
School's Support Facilities	-1.249	.491	-.057	-2.543	.011
School's Academic Programs in	10.541	.486	.515	21.680	.000

Mathematics

Appendix L. Multiple Regression Analyses of Full Model 5 (Enter Method)

Model Summary				
Model	**R**	**R Square**	**Adjusted R Square**	**Standard Error of the Estimate**
1	.924	.853	.848	4.89673

ANOVA					
Model	**Sum of Squares**	**Df**	**Mean Square**	**F**	**p – value**

	Regression	86528.840	24	3605.368	150.362	.000
1	Residual	14866.354	620	23.978		
	Total	101395.194	644			

Coefficients

Predictors	B	Std. Error	Beta	t	p – value
Intercept	10.758	4.426		2.431	.015
Number of Household Members	-1.595	.686	-.056	-2.325	.020
Father's Level of Education	.314	.346	.015	.906	.366
Mother's Level of Education	-.496	.341	-.025	-1.456	.146
Access to Educational Technology	13.816	.424	.704	32.582	.000
Level of Performance in English	-.100	.247	-.006	-.403	.687
Family Formation	-.107	.212	-.008	-.502	.616
Level of Parents' Involvement in Education	-.002	.332	.000	-.005	.996
Exploration	3.832	.569	.167	6.734	.000
Absorption	1.058	.436	.051	2.426	.016
Epistemic curiosity	3.686	.661	.163	5.574	.000
Perceptual curiosity	3.615	.627	.162	5.764	.000
Goal orientation	-.236	.757	-.011	-.312	.755
Task value	.190	.680	.009	.279	.780
Self – efficacy	-.183	.610	-.009	-.301	.764
Class Size	-2.168	.500	-.101	-4.335	.000
Area of Specialization	.655	.831	.021	.788	.431
Number of Years Spent in Teaching	-.063	.378	-.008	-.166	.868
Educational Qualifications	.042	.592	.004	.072	.943
Honors and Awards	-.136	.318	-.012	-.427	.669
Attendance in Seminars/Workshops	-.225	.277	-.016	-.811	.418
Work Values	.159	.693	.005	.229	.819
Ability Grouping	-.212	.327	-.011	-.648	.517
School's Support Facilities	-2.315	.516	-.097	-4.489	.000

School's Academic Programs in Mathematics	-.497	.511	-.022	-.974	.330

Appendix M. Multiple Regression Analyses of Full Model 6 (Enter Method)

Model Summary

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate
1	.956	.914	.911	.416

ANOVA

Model		Sum of Squares	Df	Mean Square	F	p – value

	Regression	1142.575	24	47.607	275.017	.000
1	Residual	107.326	620	.173		
	Total	1249.901	644			

Coefficients

Predictors	B	Std. Error	Beta	t	p – value
Intercept	-7.478	.376		-19.884	.000
Number of Household Members	.222	.058	.070	3.815	.000
Father's Level of Education	-.032	.029	-.014	-1.076	.282
Mother's Level of Education	.035	.029	.016	1.200	.230
Access to Educational Technology	.171	.036	.079	4.752	.000
Level of Performance in English	.019	.021	.011	.895	.371
Family Formation	-.034	.018	-.023	-1.900	.058
Level of Parents' Involvement in Education	-.085	.028	-.037	-3.016	.003
Exploration	.508	.048	.200	10.513	.000
Absorption	.431	.037	.188	11.627	.000
Epistemic curiosity	.737	.056	.294	13.126	.000
Perceptual curiosity	.711	.053	.287	13.336	.000
Goal orientation	.068	.064	.030	1.054	.292
Task value	-.031	.058	-.014	-.541	.589
Self – efficacy	-.051	.052	-.024	-.984	.325
Class Size	.100	.042	.042	2.356	.019
Area of Specialization	.055	.071	.016	.775	.439
Number of Years Spent in Teaching	.018	.032	.022	.562	.574
Educational Qualifications	-.006	.050	-.005	-.116	.908
Honors and Awards	-.013	.027	-.010	-.466	.641
Attendance in Seminars/Workshops	.007	.024	.004	.286	.775
Work Values	-.054	.059	-.014	-.912	.362
Ability Grouping	-.030	.028	-.014	-1.067	.286
School's Support Facilities	.013	.044	.005	.307	.759

School's Academic Programs in Mathematics	.064	.043	.026	1.475	.141

Appendix N. Test of Between – Subjects Effects (Full)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1214.908[a]	176	6.903	92.320	.000
Intercept	.701	1	.701	9.375	.002
Overall_CI	.899	1	.899	12.019	.001
Overall_MLI	.110	1	.110	1.469	.226
No_Household_Members	.204	1	.204	2.727	.099
Access_Educ_Tech	.050	1	.050	.668	.414
English_Performance	.050	1	.050	.662	.416
Parents_Involvement	.208	1	.208	2.776	.096
Class_Size	.010	1	.010	.128	.721

Educational_Qualification	1.146E-05	1	1.146E-05	.000	.990
Support_Facilities	.004	1	.004	.050	.824
Academic_Programs	.319	1	.319	4.261	.040
Access_Educ_Tech * Academic_Programs	.112	1	.112	1.499	.222
Class_Size * Academic_Programs	.140	1	.140	1.875	.172
Educational_Qualification * Academic_Programs	.083	1	.083	1.116	.291
English_Performance * Academic_Programs	.005	1	.005	.061	.806
No_Household_Members * Academic_Programs	.000	1	.000	.006	.940
Overall_CI * Academic_Programs	1.317	1	1.317	17.609	.000
Overall_MLI * Academic_Programs	.206	1	.206	2.755	.098
Parents_Involvement * Academic_Programs	.025	1	.025	.340	.560
Support_Facilities * Academic_Programs	.054	1	.054	.717	.398
Access_Educ_Tech * Class_Size	.009	1	.009	.117	.733
Access_Educ_Tech * Educational_Qualification	.009	1	.009	.117	.732
Access_Educ_Tech * English_Performance	.039	1	.039	.517	.473
No_Household_Members * Access_Educ_Tech	.004	1	.004	.048	.827
Overall_CI * Access_Educ_Tech	1.107	1	1.107	14.805	.000
Overall_MLI * Access_Educ_Tech	.229	1	.229	3.058	.081
Access_Educ_Tech * Parents_Involvement	.111	1	.111	1.486	.223
Access_Educ_Tech * Support_Facilities	.043	1	.043	.575	.449
Class_Size * Educational_Qualification	.001	1	.001	.010	.921
English_Performance * Class_Size	.160	1	.160	2.139	.144
No_Household_Members * Class_Size	.046	1	.046	.619	.432
Overall_CI * Class_Size	.011	1	.011	.145	.703
Overall_MLI * Class_Size	.000	1	.000	.006	.937
Parents_Involvement * Class_Size	.003	1	.003	.042	.838
Class_Size * Support_Facilities	.093	1	.093	1.241	.266
English_Performance * Educational_Qualification	.005	1	.005	.071	.790
No_Household_Members * Educational_Qualification	.060	1	.060	.796	.373
Overall_CI * Educational_Qualification	.045	1	.045	.599	.439

Overall_MLI * Educational_Qualification	.048	1	.048	.636	.425
Parents_Involvement * Educational_Qualification	.107	1	.107	1.427	.233
Educational_Qualification * Support_Facilities	.001	1	.001	.011	.918
No_Household_Members * English_Performance	.016	1	.016	.219	.640
Overall_CI * English_Performance	.000	1	.000	.003	.958
Overall_MLI * English_Performance	.024	1	.024	.321	.571
English_Performance * Parents_Involvement	.017	1	.017	.228	.633
English_Performance * Support_Facilities	.056	1	.056	.744	.389
Overall_CI * No_Household_Members	.267	1	.267	3.572	.059
Overall_MLI * No_Household_Members	.184	1	.184	2.460	.117
No_Household_Members * Parents_Involvement	.247	1	.247	3.298	.070
No_Household_Members * Support_Facilities	.031	1	.031	.418	.518
Overall_CI * Overall_MLI	.314	1	.314	4.193	.041
Overall_CI * Parents_Involvement	.003	1	.003	.045	.833
Overall_CI * Support_Facilities	.157	1	.157	2.102	.148
Overall_MLI * Parents_Involvement	.137	1	.137	1.829	.177
Overall_MLI * Support_Facilities	.144	1	.144	1.924	.166
Parents_Involvement * Support_Facilities	.051	1	.051	.681	.410
Access_Educ_Tech * Class_Size * Academic_Programs	.008	1	.008	.102	.749
Access_Educ_Tech * Educational_Qualification * Academic_Programs	.297	1	.297	3.975	.047
Access_Educ_Tech * English_Performance * Academic_Programs	.127	1	.127	1.695	.194
No_Household_Members * Access_Educ_Tech * Academic_Programs	.257	1	.257	3.438	.064
Overall_CI * Access_Educ_Tech * Academic_Programs	.060	1	.060	.804	.370
Overall_MLI * Access_Educ_Tech * Academic_Programs	.388	1	.388	5.192	.023
Access_Educ_Tech * Parents_Involvement * Academic_Programs	.011	1	.011	.146	.702
Access_Educ_Tech *	.178	1	.178	2.374	.124

Support_Facilities * Academic_Programs					
Class_Size * Educational_Qualification * Academic_Programs	.000	1	.000	.005	.944
English_Performance * Class_Size * Academic_Programs	.109	1	.109	1.460	.228
No_Household_Members * Class_Size * Academic_Programs	.237	1	.237	3.168	.076
Overall_CI * Class_Size * Academic_Programs	.159	1	.159	2.124	.146
Overall_MLI * Class_Size * Academic_Programs	.070	1	.070	.939	.333
Parents_Involvement * Class_Size * Academic_Programs	.018	1	.018	.246	.620
Class_Size * Support_Facilities * Academic_Programs	.028	1	.028	.381	.537
English_Performance * Educational_Qualification * Academic_Programs	.035	1	.035	.464	.496
No_Household_Members * Educational_Qualification * Academic_Programs	.019	1	.019	.248	.619
Overall_CI * Educational_Qualification * Academic_Programs	.030	1	.030	.403	.526
Overall_MLI * Educational_Qualification * Academic_Programs	.037	1	.037	.496	.481
Parents_Involvement * Educational_Qualification * Academic_Programs	.011	1	.011	.153	.696
Educational_Qualification * Support_Facilities * Academic_Programs	.073	1	.073	.980	.323
No_Household_Members * English_Performance * Academic_Programs	.001	1	.001	.017	.896
Overall_CI * English_Performance * Academic_Programs	.311	1	.311	4.156	.042
Overall_MLI * English_Performance * Academic_Programs	.022	1	.022	.288	.592
English_Performance * Parents_Involvement * Academic_Programs	.003	1	.003	.038	.846
English_Performance * Support_Facilities * Academic_Programs	.002	1	.002	.023	.879
Overall_CI *	.238	1	.238	3.189	.075

No_Household_Members * Academic_Programs					
Overall_MLI * No_Household_Members * Academic_Programs	.247	1	.247	3.309	.070
No_Household_Members * Parents_Involvement * Academic_Programs	.008	1	.008	.114	.736
No_Household_Members * Support_Facilities * Academic_Programs	.084	1	.084	1.127	.289
Overall_CI * Overall_MLI * Academic_Programs	.356	1	.356	4.765	.030
Overall_CI * Parents_Involvement * Academic_Programs	.003	1	.003	.040	.842
Overall_CI * Support_Facilities * Academic_Programs	.001	1	.001	.017	.896
Overall_MLI * Parents_Involvement * Academic_Programs	.098	1	.098	1.308	.253
Overall_MLI * Support_Facilities * Academic_Programs	.009	1	.009	.125	.724
Parents_Involvement * Support_Facilities * Academic_Programs	.042	1	.042	.556	.456
Access_Educ_Tech * Class_Size * Educational_Qualification	.322	1	.322	4.308	.038
Access_Educ_Tech * English_Performance * Class_Size	.005	1	.005	.072	.788
No_Household_Members * Access_Educ_Tech * Class_Size	.015	1	.015	.198	.656
Overall_CI * Access_Educ_Tech * Class_Size	.350	1	.350	4.682	.031
Overall_MLI * Access_Educ_Tech * Class_Size	.139	1	.139	1.860	.173
Access_Educ_Tech * Parents_Involvement * Class_Size	.033	1	.033	.447	.504
Access_Educ_Tech * Class_Size * Support_Facilities	.104	1	.104	1.385	.240
Access_Educ_Tech * English_Performance * Educational_Qualification	.007	1	.007	.094	.760
No_Household_Members * Access_Educ_Tech * Educational_Qualification	.155	1	.155	2.077	.150
Overall_CI * Access_Educ_Tech * Educational_Qualification	.044	1	.044	.590	.443
Overall_MLI * Access_Educ_Tech * Educational_Qualification	.046	1	.046	.618	.432

Access_Educ_Tech * Parents_Involvement * Educational_Qualification	.001	1	.001	.009	.922
Access_Educ_Tech * Educational_Qualification * Support_Facilities	.100	1	.100	1.334	.249
No_Household_Members * Access_Educ_Tech * English_Performance	.027	1	.027	.356	.551
Overall_CI * Access_Educ_Tech * English_Performance	.086	1	.086	1.150	.284
Overall_MLI * Access_Educ_Tech * English_Performance	.012	1	.012	.166	.684
Access_Educ_Tech * English_Performance * Parents_Involvement	.323	1	.323	4.321	.038
Access_Educ_Tech * English_Performance * Support_Facilities	.000	1	.000	.005	.944
Overall_CI * No_Household_Members * Access_Educ_Tech	.597	1	.597	7.978	.005
Overall_MLI * No_Household_Members * Access_Educ_Tech	.037	1	.037	.501	.479
No_Household_Members * Access_Educ_Tech * Parents_Involvement	.077	1	.077	1.028	.311
No_Household_Members * Access_Educ_Tech * Support_Facilities	.579	1	.579	7.741	.006
Overall_CI * Overall_MLI * Access_Educ_Tech	.017	1	.017	.232	.630
Overall_CI * Access_Educ_Tech * Parents_Involvement	.006	1	.006	.076	.783
Overall_CI * Access_Educ_Tech * Support_Facilities	.005	1	.005	.062	.803
Overall_MLI * Access_Educ_Tech * Parents_Involvement	.036	1	.036	.480	.489
Overall_MLI * Access_Educ_Tech * Support_Facilities	.001	1	.001	.012	.914
Access_Educ_Tech * Parents_Involvement * Support_Facilities	.008	1	.008	.109	.741
English_Performance * Class_Size * Educational_Qualification	.203	1	.203	2.710	.100
No_Household_Members * Class_Size * Educational_Qualification	.066	1	.066	.877	.350
Overall_CI * Class_Size *	.131	1	.131	1.753	.186

Educational_Qualification					
Overall_MLI * Class_Size * Educational_Qualification	.061	1	.061	.814	.367
Parents_Involvement * Class_Size * Educational_Qualification	.000	1	.000	.002	.968
Class_Size * Educational_Qualification * Support_Facilities	.099	1	.099	1.324	.251
No_Household_Members * English_Performance * Class_Size	.007	1	.007	.087	.768
Overall_CI * English_Performance * Class_Size	.044	1	.044	.586	.444
Overall_MLI * English_Performance * Class_Size	.110	1	.110	1.474	.225
English_Performance * Parents_Involvement * Class_Size	.055	1	.055	.740	.390
English_Performance * Class_Size * Support_Facilities	.228	1	.228	3.051	.081
Overall_CI * No_Household_Members * Class_Size	.248	1	.248	3.319	.069
Overall_MLI * No_Household_Members * Class_Size	.284	1	.284	3.794	.052
No_Household_Members * Parents_Involvement * Class_Size	.026	1	.026	.353	.553
No_Household_Members * Class_Size * Support_Facilities	.022	1	.022	.298	.586
Overall_CI * Overall_MLI * Class_Size	.014	1	.014	.184	.668
Overall_CI * Parents_Involvement * Class_Size	.009	1	.009	.115	.735
Overall_CI * Class_Size * Support_Facilities	.003	1	.003	.042	.838
Overall_MLI * Parents_Involvement * Class_Size	.110	1	.110	1.475	.225
Overall_MLI * Class_Size * Support_Facilities	.001	1	.001	.012	.915
Parents_Involvement * Class_Size * Support_Facilities	.044	1	.044	.590	.443
No_Household_Members * English_Performance * Educational_Qualification	.010	1	.010	.127	.721
Overall_CI * English_Performance * Educational_Qualification	.001	1	.001	.009	.923

Overall_MLI * English_Performance * Educational_Qualification	.023	1	.023	.305	.581
English_Performance * Parents_Involvement * Educational_Qualification	.018	1	.018	.244	.621
English_Performance * Educational_Qualification * Support_Facilities	.042	1	.042	.562	.454
Overall_CI * No_Household_Members * Educational_Qualification	.226	1	.226	3.021	.083
Overall_MLI * No_Household_Members * Educational_Qualification	.056	1	.056	.744	.389
No_Household_Members * Parents_Involvement * Educational_Qualification	.192	1	.192	2.574	.109
No_Household_Members * Educational_Qualification * Support_Facilities	.021	1	.021	.275	.601
Overall_CI * Overall_MLI * Educational_Qualification	.066	1	.066	.888	.346
Overall_CI * Parents_Involvement * Educational_Qualification	.001	1	.001	.013	.909
Overall_CI * Educational_Qualification * Support_Facilities	.209	1	.209	2.797	.095
Overall_MLI * Parents_Involvement * Educational_Qualification	.011	1	.011	.147	.702
Overall_MLI * Educational_Qualification * Support_Facilities	.071	1	.071	.948	.331
Parents_Involvement * Educational_Qualification * Support_Facilities	.011	1	.011	.148	.700
Overall_CI * No_Household_Members * English_Performance	.021	1	.021	.285	.593
Overall_MLI * No_Household_Members * English_Performance	.054	1	.054	.720	.397
No_Household_Members * English_Performance * Parents_Involvement	.004	1	.004	.047	.828
No_Household_Members * English_Performance * Support_Facilities	.127	1	.127	1.700	.193
Overall_CI * Overall_MLI * English_Performance	.064	1	.064	.856	.355
Overall_CI * English_Performance * Parents_Involvement	.211	1	.211	2.824	.094

Overall_CI * English_Performance * Support_Facilities	.097	1	.097	1.291	.256
Overall_MLI * English_Performance * Parents_Involvement	.129	1	.129	1.723	.190
Overall_MLI * English_Performance * Support_Facilities	.020	1	.020	.271	.603
English_Performance * Parents_Involvement * Support_Facilities	.143	1	.143	1.916	.167
Overall_CI * Overall_MLI * No_Household_Members	.027	1	.027	.355	.552
Overall_CI * No_Household_Members * Parents_Involvement	.024	1	.024	.328	.567
Overall_CI * No_Household_Members * Support_Facilities	.567	1	.567	7.588	.006
Overall_MLI * No_Household_Members * Parents_Involvement	.025	1	.025	.334	.564
Overall_MLI * No_Household_Members * Support_Facilities	.041	1	.041	.542	.462
No_Household_Members * Parents_Involvement * Support_Facilities	.024	1	.024	.321	.571
Overall_CI * Overall_MLI * Parents_Involvement	.423	1	.423	5.660	.018
Overall_CI * Overall_MLI * Support_Facilities	.007	1	.007	.098	.755
Overall_CI * Parents_Involvement * Support_Facilities	4.038E-06	1	4.038E-06	.000	.994
Overall_MLI * Parents_Involvement * Support_Facilities	.165	1	.165	2.207	.138
Overall_CI * Overall_MLI * No_Household_Members * Access_Educ_Tech * English_Performance * Parents_Involvement * Class_Size * Educational_Qualification * Support_Facilities * Academic_Programs	.036	1	.036	.481	.488
Error	34.993	468	.075		
Total	7007.000	645			
Corrected Total	1249.901	644			

a. R Squared = .972 (Adjusted R Squared = .961)

Appendix O. AMOS Estimation Output of Parsimonious CPMP Model

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
Mathematical_Proficiency	<---	Curiosity	15.032	.993	15.137	***	par_12
Mathematical_Proficiency	<---	Student_Background	3.668	.387	9.490	***	par_16
No_Household_Members	<---	Student_Background	1.000				
Class_Size	<---	School_Background	.498	.039	12.603	***	par_1
Support_Facilities	<---	School_Background	1.000				
Academic_Programs	<---	School_Background	.459	.038	12.019	***	par_2
Exploration	<---	Curiosity	1.000				
Perceptual_Curiosity	<---	Curiosity	1.081	.043	25.115	***	par_3
Epistemic_Curiosity	<---	Curiosity	1.077	.042	25.366	***	par_4
Absorption	<---	Curiosity	.877	.051	17.218	***	par_5
Goal_Orientation	<---	Motivation	1.000				

			Estimate	S.E.	C.R.	P	Label
Task_Value	<---	Motivation	.945	.023	40.391	***	par_6
Self_Efficacy	<---	Motivation	.986	.026	38.545	***	par_7
CU_Scores	<---	Mathematical_Proficiency	.865	.063	13.657	***	par_8
PF_Scores	<---	Mathematical_Proficiency	1.230	.085	14.486	***	par_9
SC_Scores	<---	Mathematical_Proficiency	1.116	.077	14.537	***	par_10
AR_Scores	<---	Mathematical_Proficiency	1.187	.081	14.730	***	par_11
PD_Scores	<---	Mathematical_Proficiency	1.000				
Access_Educ_Tech	<---	Student_Background	.516	.053	9.657	***	par_15

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
Student_Background	.194	.011	17.944	***	par_17
School_Background	.275	.015	17.944	***	par_18
Curiosity	.195	.016	12.169	***	par_19
Motivation	.339	.021	16.097	***	par_20
D6	.000				
A	.000				
Q	.000				
H	.276	.015	17.944	***	par_21
R	.258	.014	17.944	***	par_22
S	.105	.007	15.439	***	par_23
U	.219	.013	17.031	***	par_24
V	.082	.006	14.242	***	par_25
W	.087	.006	14.427	***	par_26
X	.033	.004	7.461	***	par_27
Y	.068	.005	12.806	***	par_28
Z	.087	.006	13.764	***	par_29
D4	46.064	2.853	16.144	***	par_30
D1	40.344	2.393	16.856	***	par_31
D5	95.881	5.531	17.334	***	par_32
D3	45.082	2.763	16.318	***	par_33
D2	56.145	3.432	16.360	***	par_34
D	.356	.020	17.944	***	par_35

Squared Multiple Correlations: (Group number 1 - Default model)

	Estimate
Mathematical_Proficiency	1.000
Access_Educ_Tech	.126
PF_Scores	.557
SC_Scores	.563
PD_Scores	.328
CU_Scores	.464
AR_Scores	.588
Self_Efficacy	.791
Task_Value	.817
Goal_Orientation	.911

	Estimate
Absorption	.406
Epistemic_Curiosity	.733
Perceptual_Curiosity	.723
Exploration	.651
Academic_Programs	.183
Support_Facilities	1.000
Class_Size	.198
No_Household_Members	1.000

Factor Score Weights (Group number 1 - Default model)

	Access_Educ_Tech	PF_Scores	SC_Scores	PD_Scores	CU_Scores	AR_Scores	Self_Efficacy	Task_Value	Goal_Orientation	Absorption	Epistemic_Curiosity	Perceptual_Curiosity	Exploration	Academic_Programs	Support_Facilities	Class_Size	No_Household_Members
Motivation	.000	.000	.000	.000	.000	.000	.192	.237	.509	.004	.012	.011	.008	.000	.000	.000	-.006
Curiosity	.000	.004	.005	.002	.004	.005	.010	.012	.027	.054	.176	.166	.128	.000	.000	.000	-.085
School_Background	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	1.000	.000	.000
Student_Background	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	1.000

	Access_Educ_Tech	PF_Scores	SC_Scores	PD_Scores	CU_Scores	AR_Scores	Self_Efficacy	Task_Value	Goal_Orientation	Absorption	Epistemic_Curiosity	Perceptual_Curiosity	Exploration	Academic_Programs	Support_Facilities	Class_Size	No_Household_Members
Mathematical_Proficiency	.000	.067	.075	.032	.065	.078	.151	.186	.400	.810	2.642	2.500	1.931	.000	.000	.000	2.396

Total Effects (Group number 1 - Default model)

	Motivation	Curiosity	School_Background	Student_Background	Mathematical_Proficiency
Mathematical_Proficiency	.000	15.032	.000	3.668	.000
Access_Educ_Tech	.000	.000	.000	.516	.000
PF_Scores	.000	18.483	.000	4.510	1.230
SC_Scores	.000	16.779	.000	4.094	1.116
PD_Scores	.000	15.032	.000	3.668	1.000
CU_Scores	.000	13.003	.000	3.173	.865
AR_Scores	.000	17.838	.000	4.353	1.187
Self_Efficacy	.986	.000	.000	.000	.000
Task_Value	.945	.000	.000	.000	.000
Goal_Orientation	1.000	.000	.000	.000	.000
Absorption	.000	.877	.000	.000	.000
Epistemic_Curiosity	.000	1.077	.000	.000	.000
Perceptual_Curiosity	.000	1.081	.000	.000	.000
Exploration	.000	1.000	.000	.000	.000
Academic_Programs	.000	.000	.459	.000	.000
Support_Facilities	.000	.000	1.000	.000	.000
Class_Size	.000	.000	.498	.000	.000
No_Household_Members	.000	.000	.000	1.000	.000

Standardized Total Effects (Group number 1 - Default model)

	Motivation	Curiosity	School_Background	Student_Background	Mathematical_Proficiency
Mathematical_Proficiency	.000	.972	.000	.236	.000
Access_Educ_Tech	.000	.000	.000	.356	.000
PF_Scores	.000	.725	.000	.176	.746
SC_Scores	.000	.729	.000	.177	.751
PD_Scores	.000	.556	.000	.135	.572
CU_Scores	.000	.662	.000	.161	.681
AR_Scores	.000	.745	.000	.181	.767
Self_Efficacy	.889	.000	.000	.000	.000
Task_Value	.904	.000	.000	.000	.000
Goal_Orientation	.954	.000	.000	.000	.000
Absorption	.000	.637	.000	.000	.000
Epistemic_Curiosity	.000	.856	.000	.000	.000
Perceptual_Curiosity	.000	.850	.000	.000	.000
Exploration	.000	.807	.000	.000	.000
Academic_Programs	.000	.000	.428	.000	.000
Support_Facilities	.000	.000	1.000	.000	.000
Class_Size	.000	.000	.445	.000	.000
No_Household_Members	.000	.000	.000	1.000	.000

Direct Effects (Group number 1 - Default model)

	Motivation	Curiosity	School_Background	Student_Background	ProficiencyMathematical_
Mathematical_Proficiency	.000	15.032	.000	3.668	.000
Access_Educ_Tech	.000	.000	.000	.516	.000
PF_Scores	.000	.000	.000	.000	1.230
SC_Scores	.000	.000	.000	.000	1.116
PD_Scores	.000	.000	.000	.000	1.000
CU_Scores	.000	.000	.000	.000	.865
AR_Scores	.000	.000	.000	.000	1.187
Self_Efficacy	.986	.000	.000	.000	.000
Task_Value	.945	.000	.000	.000	.000
Goal_Orientation	1.000	.000	.000	.000	.000
Absorption	.000	.877	.000	.000	.000
Epistemic_Curiosity	.000	1.077	.000	.000	.000
Perceptual_Curiosity	.000	1.081	.000	.000	.000
Exploration	.000	1.000	.000	.000	.000
Academic_Programs	.000	.000	.459	.000	.000
Support_Facilities	.000	.000	1.000	.000	.000
Class_Size	.000	.000	.498	.000	.000

	Motivation	Curiosity	School_Background	Student_Background	ProficiencyMathematical_
No_Household_Members	.000	.000	.000	1.000	.000

Standardized Direct Effects (Group number 1 - Default model)

	Motivation	Curiosity	School_Background	Student_Background	roficiencyMathematical_
Mathematical_Proficiency	.000	.972	.000	.236	.000
Access_Educ_Tech	.000	.000	.000	.356	.000
PF_Scores	.000	.000	.000	.000	.746
SC_Scores	.000	.000	.000	.000	.751
PD_Scores	.000	.000	.000	.000	.572
CU_Scores	.000	.000	.000	.000	.681
AR_Scores	.000	.000	.000	.000	.767
Self_Efficacy	.889	.000	.000	.000	.000
Task_Value	.904	.000	.000	.000	.000
Goal_Orientation	.954	.000	.000	.000	.000
Absorption	.000	.637	.000	.000	.000
Epistemic_Curiosity	.000	.856	.000	.000	.000
Perceptual_Curiosity	.000	.850	.000	.000	.000
Exploration	.000	.807	.000	.000	.000
Academic_Programs	.000	.000	.428	.000	.000
Support_Facilities	.000	.000	1.000	.000	.000
Class_Size	.000	.000	.445	.000	.000
No_Household_Members	.000	.000	.000	1.000	.000

Indirect Effects (Group number 1 - Default model)

	Motivation	Curiosity	School_Background	Student_Background	roficiencyMathematical_
Mathematical_Proficiency	.000	.000	.000	.000	.000
Access_Educ_Tech	.000	.000	.000	.000	.000
PF_Scores	.000	18.483	.000	4.510	.000

	Motivation	Curiosity	School_Background	Student_Background	roficiencyMathematical_
SC_Scores	.000	16.779	.000	4.094	.000
PD_Scores	.000	15.032	.000	3.668	.000
CU_Scores	.000	13.003	.000	3.173	.000
AR_Scores	.000	17.838	.000	4.353	.000
Self_Efficacy	.000	.000	.000	.000	.000
Task_Value	.000	.000	.000	.000	.000
Goal_Orientation	.000	.000	.000	.000	.000
Absorption	.000	.000	.000	.000	.000
Epistemic_Curiosity	.000	.000	.000	.000	.000
Perceptual_Curiosity	.000	.000	.000	.000	.000
Exploration	.000	.000	.000	.000	.000
Academic_Programs	.000	.000	.000	.000	.000
Support_Facilities	.000	.000	.000	.000	.000
Class_Size	.000	.000	.000	.000	.000
No_Household_Members	.000	.000	.000	.000	.000

Standardized Indirect Effects (Group number 1 - Default model)

	Motivation	Curiosity	School_Background	Student_Background	ProficiencyMathematical_
Mathematical_Proficiency	.000	.000	.000	.000	.000
Access_Educ_Tech	.000	.000	.000	.000	.000
PF_Scores	.000	.725	.000	.176	.000
SC_Scores	.000	.729	.000	.177	.000
PD_Scores	.000	.556	.000	.135	.000
CU_Scores	.000	.662	.000	.161	.000
AR_Scores	.000	.745	.000	.181	.000
Self_Efficacy	.000	.000	.000	.000	.000
Task_Value	.000	.000	.000	.000	.000
Goal_Orientation	.000	.000	.000	.000	.000
Absorption	.000	.000	.000	.000	.000

	Motivation	Curiosity	School_Background	Student_Background	ProficiencyMathematical_
Epistemic_Curiosity	.000	.000	.000	.000	.000
Perceptual_Curiosity	.000	.000	.000	.000	.000
Exploration	.000	.000	.000	.000	.000
Academic_Programs	.000	.000	.000	.000	.000
Support_Facilities	.000	.000	.000	.000	.000
Class_Size	.000	.000	.000	.000	.000
No_Household_Members	.000	.000	.000	.000	.000

Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	35	5220.392	118	.096	44.241
Saturated model	153	.000	0		
Independence model	17	11567.400	136	.000	85.054

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	0.049	.889	.872	.756
Saturated model	.000	1.000		
Independence model	16.770	.184	.082	.164

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.889	.880	.954	.986	.979
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	.868	.776	.880
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

NCP

Model	NCP	LO 90	HI 90
Default model	5102.392	4869.225	5341.885
Saturated model	.000	.000	.000
Independence model	11431.400	11081.786	11787.315

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	1.106	0.923	0.061	0.295
Saturated model	.000	.000	.000	.000
Independence model	17.962	17.751	17.208	18.303

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.029	.003	.065	.876
Independence model	.361	.356	.367	.000

AIC

Model	AIC	BCC	BIC	CAIC
Default model	5290.392	5292.405	5446.816	5481.816

Model	AIC	BCC	BIC	CAIC
Saturated model	306.000	314.799	989.795	1142.795
Independence model	11601.400	11602.377	11677.377	11694.377

ECVI

Model	ECVI	LO 90	HI 90	MECVI
Default model	2.215	1.853	1.587	2.218
Saturated model	.475	.475	.475	.489
Independence model	18.015	17.472	18.567	18.016

HOELTER

Model	HOELTER .05	HOELTER .01
Default model	180	200
Independence model	100	100

Appendix P. Certificate of Authenticity

University Publications Office
CGSTER

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

CERTIFICATION

This is to certify that the dissertation of MR. FEEJAY A. DIMACULANGAN entitled "Contextual and Psychological Constructs of Sixth Grade Pupils' Mathematical Proficiency" **passed** the authenticity test performed by the office on March 6, 2015 using the Anti-Plagiarism software of the university.

ANTRIMAN V. ORLEANS, Ph.D.
Director

PNU OR No. 237854
UCRSS PO: 2015-0124
Student No: G2010129554

Appendix Q. Certificate of Editing

STA. TERESA COLLEGE
Bauan, Batangas

March 2, 2015

CERTIFICATION

TO WHOM IT MAY CONCERN:

This certifies that the dissertation draft entitled **"CONTEXTUAL AND PSYCHOLOGICAL CONSTRUCTS OF SIXTH GRADE PUPILS' MATHEMATICAL PROFICIENCY"** by FEEJAY A. DIMACULANGAN has been edited by the undersigned.

This certification is issued for whatever legal purpose it may serve him best.

RANDY M. BAJA, Ph. D.