Problem Solving Strategies and Metacognitive Skills for Gifted Students in Middle School

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PROBLEM SOLVING STRATEGIES AND METACOGNITIVE SKILLS FOR GIFTED STUDENTS IN MIDDLE SCHOOL

A Thesis

Submitted to the Graduate Faculty of the Louisiana State University and Agricultural and Mechanical College in partial fulfillment of the requirements for the degree of Masters of Natural Sciences

in

The Interdepartmental Program in Natural Sciences

by

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B.S.Ed. University of San Carlos, Philippines, 2002
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ABSTRACT

This study is conducted to investigate if the designed four-step method strategy (GEAR strategy adapted from Polya, 1973) in solving math problems has improved students’ performance scores and enhanced the metacognitive skills of gifted students. The respondents of this study include middle school gifted students who took math eight course in the school year 2013-2014 at Westdale Middle School in East Baton Rouge Parish School System. There are four classes of math eight gifted students who participated in the study. The classes were chosen randomly for experimental and controlled group and were equalized on the basis of the pre-test results of the Module 1 Edusoft Test and the Metacognitive Activities Inventory (MCAI) questionnaire form. During the 4-week period, the experimental group received GEAR strategy while the controlled group used any method they had learned in solving math word problems systematically or nonsystematical way. After the 4-week training period, the results of paired-sample t-test showed that the experimental group’s post-test scores on Module 2 Edusoft test have increased but not overwhelmingly, however, there is a significant difference of their MCAI post-test. The results imply that GEAR strategy does affect the metacognitive skills of middle school gifted students in problem solving and creates a marginal improvement on their classroom performance. This study provides the discussions, implications, and suggestions.
Administrators often advise teachers of gifted students to “over plan.” What it means is that the teacher of gifted students should prepare differentiated activities suited to the needs of students. A gifted teacher is under the impression that gifted students can think well, creatively, and can solve problems quickly. Teachers may believe this because of the Louisiana Administration Code which defines, “gifted children and youth” as “students who demonstrate abilities that give evidence of high performance in academic and intellectual aptitude.” (Louisiana Admin. Code title 28 § 901).

Contrary to this widely held belief, the researcher has found that Math 8 Gifted students in East Baton Rouge Parish School System (EBRPSS) often skip problems that they know they don’t know during a word problem activity. Often the researcher will see on their paper either a question mark (?), blank, the words “don’t know”, or the symbol “Idk” that literally means “I don’t know.” When asked, some students say, "When I read the problem and realized that I do not know how to answer it, then I will just let the teacher know that I do not get it." Some also said, “I have not met this kind of problem, so I will just wait for the teacher to show me the answer.” There is no sign of an attempt to solve the problem. Some students automatically shut down or withdraw the moment they see a problem that they don’t know how to solve.

The focus of this study is to enhance the metacognitive skills of gifted students. Metacognitive skill is one of the components of metacognition. Schraw and Denison (1994) define metacognition as “the knowledge and regulation of one’s cognition." It has two main components, namely; metacognitive knowledge and metacognitive skillfulness. The focus of this study is on metacognitive skillfulness, which refers to “what you do when you don’t know what to do”
Regulation of cognition includes regulatory activities that are grouped under three categories; planning, monitoring, and evaluating [Cooper, M., & Sandi-Urena, S. (2009)]. The researcher examined each student’s responses to word problems and realized that there is a need to enhance the students’ metacognitive skills in problem solving. The reason students stop or quit if they see a problem that they know they don’t know is the lack of metacognitive skills and perseverance to solve the problem.

Students should maintain a positive attitude towards working the problems out and persevere in solving them. Solving the math problem without perseverance is a mutual concern that most teachers have. The lack of perseverance is a problem that Common Core State Standards (CCSS) help resolve through the implementation of the mathematical practices. The first mathematical practice is “Make sense of problems and persevere in solving them” This mathematical practice describes the three categories of metacognitive skills. The mathematical practice states that “Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary.” ("Standards of mathematical," 2014)

Teachers often introduce problem solving strategies in order to increase student success. Providing a variety of problem solving approaches allow students to think about which strategy is more appropriate to use and more efficient. Polya stresses that an effective problem solving process
consists of four main stages: understanding the problem, devising a plan, carrying out the plan, and looking back (Polya, 1973). The researcher make used of Polya’s theory and adjusted the strategy into an acronym for student’s to apply as a learning strategy. In order to help gifted students to persevere in solving math problems and to enhance their metacognitive skills, the researcher designed a problem solving strategy using the four main stages of Polya (1973). The researcher uses the acronym of GEAR where G stands for Given, E for Expectation(s), A for the answer, and R for Review. In the G part, students are expected to read the problem carefully and take note of the provided data that are needed to solve the problem. Students may list down the data presented in a columnar form, as rows, or as an organizer. In the E part, students are to write down what the problem is, or list down the objective(s) of the problem, and goals. The A part is where students will provide the computation part of the problem or may write the solution of the problem comprehensively. Students may use facts, formula, theorems or postulates to validate their answer. The R part is where students are to go back and review their work to see if they have found a sensible answer.

1.1 Purpose of the Study

Two previous studies have been conducted to determine the effect of problem solving strategy on the metacognitive skills of regular students; both studies measured findings using the Metacognitive Activity Inventory (MCAI). One study involved sixth-grade students, and found that instruction in learning-strategies increased awareness of the strategy and were effective in using metacognitive skills, thus increasing achievement [Caliskan, M. and Sunbul, A (2011)]. The other study involved high school chemistry students, and revealed a few differences in the effect of the intervention but supported students’ abilities to solve complex chemistry problems with the use of metacognitive skills (Delvecchio, 2011).
These results led the researcher to design the problem-solving strategy (GEAR) in hopes that it would enhance the metacognitive skills and improves the classroom performance scores of Math 8 middle school gifted students. This study seeks to find answers to the following questions:

1. What is the effect of GEAR Strategy Intervention towards the metacognitive skills of gifted students?
2. What is the effect of GEAR Strategy intervention towards the classroom performance score of gifted students?
3. What are the implication(s) in using intervention towards gifted students?

1.2 Definition of Terms

Gifted Students
“Gifted children and youth are students who demonstrate abilities that give evidence of high performance in academic and intellectual aptitude.” (Louisiana Admin. Code title 28 § 901).

Metacognition
Metacognition is defined as “the knowledge and regulation of one’s cognition” Schraw and Denison (1994). Schraw, Crippen, and Hartley (2006) elaborated upon this definition: “Knowledge of cognition includes the awareness of what one knows, how one learns, what strategies one knows, and when one implements strategies. Regulation of cognition includes planning, monitoring, and evaluation. Planning involves one’s connection to previous knowledge, plan for using strategies, and use of time. Monitoring is one’s self-checking at each stage of the task. Evaluation includes the learner’s appraisal of the outcome and reflection on what new knowledge he or she gained”. [Delvecchio, F. (2011)]
**Metacognitive Skills**

Metacognitive skills are “the regulatory activities associated with solving problems” (Brown, 1978). They involve planning, monitoring, and evaluation components of metacognition. It is also called as ‘Regulation of cognition’ which refers to the activities and actions undertaken by individuals to control their own cognition [Cooper, M., & Sandi-Urena, S. (2009)].

**Problem Solving**

“Problem solving is the process by which a student arrives at a solution to a problem. Integral to this are students’ thinking, planning, reasoning, and executing of the plan as they progress from the initial problem state to the fulfillment of their goal” (Wilson, 2000), [Delvecchio, F. (2011)]

**1.3 Metacognitive Framework**

The metacognitive framework (see Figure 0) is a pedagogical device that was developed by Delvecchio (Delvecchio, 2011). The framework will serve as a guide for teachers’ instruction of problem solving and student’s approaches to problem solving. The research revised (or adjusted) Delvecchio’s work by categorizing G and E as planning, A as monitoring, and R for evaluation, specific to solving math problems and their association with regulation of cognition which includes planning, monitoring, and evaluation. As mentioned by Delvecchio, the theoretical foundation for this framework comes from the literature on models for problem solving (Polya, 1957; Resnick & Glaser, 1976) and metacognition (e.g., Schraw, Crippen, & Hartley, 2006). Figure 0 displays the metacognitive framework when a student has current knowledge before he/she is acquainted with a math problem. The framework shows that when given a problem to solve, students should create a plan by reading the problem, determining the given and its goal, separating out the given information into relevant and irrelevant, breaking the problem down into smaller tasks, finding the relations (formulae) between the quantities, and mapping out solutions. In the monitoring section,
students will try, revise, and check their solutions to see if the whole procedure does make sense. Students may have errors in their computation and will change the solution until the whole procedure does make sense. Then in the evaluation part, each student is expected to make sure that the solution answers the question. Looking back to the expectation, students should know that their answer is correct and does make sense. The researcher expects that after the entire metacognitive framework process, students will learn new knowledge which enhances metacognitive skills.

Figure 0. The Metacognitive Framework adapted from Delvecchio, F. (2011)

1.4 Overview of the Thesis

This thesis is structured into five chapters. The first chapter introduces the purpose of the study, defines terms, and explains the metacognitive framework. Chapter 2 presents the related literature surveys that guided this study. Chapter 3 identifies the methodology used for this study, the instrument, participants and other sources needed for analysis. Chapter 4 displays the results and evidence gathered for this study. Finally, chapter 5 presents an interpretation of the data, discusses implications, and offers recommendations for future research.
CHAPTER 2:  
LITERATURE REVIEW

2.1 Problem Solving Strategies

Strategies in solving math problems are essential in math education. It has always been a challenge for educators to teach students how to solve problems. As noted by Erbas, A. & Okur, S. (2012), “Problem solving is not just a method in mathematics, but a major part of learning mathematics where the students deepen their understanding of mathematical concepts by analyzing and synthesizing their knowledge” (Krulik and Rudnick 2003; NCTM 2000; OECD 2003; Polya 1973). This implies that students should learn how to regulate their own knowledge to be successful learners. However, “a substantial portion of problem solving is done by rote. Students struggle through one problem in the section, the teacher reveals a model solution and the remainder of the problems in the section are solved in the same manner” (Posamentier and Krulik 1998, p. 15). This type of method is no longer applicable today. With Common Core State Standards (CCSS), “the middle school and high school standards call on students to practice applying mathematical ways of thinking to real-world issues and challenges. They prepare students to think and reason mathematically. Mathematical understanding and procedural skill are equally important, and both are assessable using mathematical tasks of sufficient richness” [http://www.corestandards.org/about-the-standards/myths-vs-facts/]. Understanding and procedural skill are what comprises metacognition. Polya stresses that an effective problem solving process consists of four main stages: understanding the problem, devising a plan, carrying out the plan, and looking back (Polya, 1973). According to Erbas and Okur 2012, “successful students used metacognitive verification to be sure that they found what the problem has asked. Although, every problem solving framework or model emphasizes the importance of verification (e.g., Polya
1973), skipping this step seems to be a typical behavior of many students. Although students had difficulties in every episode during problem solving, they were able to use their metacognitive skills to detect the mistake or missing parts of the process and adapted themselves independently to make the required changes” (Erbas & Okur, 2012).

2.2 Metacognition

There have been many studies that define metacognition using descriptions. The following authors (as cited in Cooper and Santiago, 2009) describe metacognition as: “thinking about one’s own thinking (Rickey & Stacy, 2000)”, “knowledge and regulation of one’s own cognitive system (Brown, 1987)”, and the “capacity to reflect upon one’s actions and thoughts (Schraw, 2001)”. The simplest description is “knowing about knowing (Metcalfe & Shimamura, 1995).” Moreover according to Schraw, 2001 (as cited in Cooper and Sandi-Urena, 2009), “knowledge of cognition describes an individual’s awareness of cognition at three different levels: declarative (knowing about things), procedural (knowing about how to do things), and conditional (knowing why and when to do things). Regulation of cognition refers to the activities and actions undertaken by individuals to control their own cognition.” Regulation of cognition includes regulatory activities that were grouped under three categories; planning, monitoring, and evaluating [Cooper, M., & Sandi-Urena, S. (2009)]. “Metacognitive skills concern the procedural knowledge that is required for the actual regulation of and control over one’s learning activities” (Brown and DeLoache 1978; Veenman 2004). According to Van Der Stel and Veenman (2008) orientation, planning, monitoring, as well as reflection skills in problem-solving, are the elements of metacognitive skills. People who master problem-solving are applying the metacognitive skills during the entire process of the problem solving. These skills include: (a) identifying of the problem’s goal, (b) comprehending the problem before solving it, (c) recalling and relating to past knowledge, (d)
attaining a higher grasp of their conceptual understanding, (e) cutting down the problem into several steps, (f) exercising flexibility by modifying techniques to attain the identified goal, and (g) employing self-evaluation of the solution made (Haidar & Naqabi, 2008; Whimbey & Lochhead, 1986). Practice and implementation of the metacognitive skill are quickly learned. Moreover, the student’s achievement in doing the problem-solving can be predicted by how their metacognitive skills are being used (Haidar & Naqabi, 2008; Howard, McGee, Shia & Hong, 2001; Rickey & Stacy, 2000; Rozencwajg, 2003). Swanson (1990) in his study, concluded that metacognitive skill is a better predictor of student problem solving success than their aptitude; furthermore, it also shows that the higher levels of metacognitive skills compensated for low aptitude on problem solving activities. Kapa (2007) said the students who are utilizing the metacognitive skills can easily recall and use their past knowledge to challenging problems. It is tantamount to saying that the students’ metacognitive skills can be enhanced through explicit teaching (Hartman, 2001a; Martinez, 1998; Schraw, 2001). However, it will become more beneficial when the given instruction is integrated with the subject specific learning activities (Case & Gunstone, 2002; Gredler, 2009).

2.3 Gifted Students

Giftedness is tantamount to excellence or ingenuity. This is a label that is used to distinguish one with exceptional qualities. Until now, states could not even agree on a common definition of giftedness. According to Cramond (2004), “A single definition would defy the principles of the cultural and temporal relativity of the concept of giftedness.” Each state has its own definition of giftedness. Below are definition of giftedness from other states that surrounds Louisiana according to the National Association for Gifted Children (NAGC):

Arkansas – “Gifted and talented children and youth are those of high potential or ability whose learning characteristics and educational needs require qualitatively
differentiated educational experiences and/or services. Possession of these talents and gifts, or the potential for their development, will be evidenced through an interaction of above average intellectual ability, task commitment and/or motivation, and creative ability (Arkansas, 2009).”

Mississippi - “Gifted children shall mean children who are found to have an exceptionally high degree of intellect, and/or academic, creative or artistic ability (TIP, n.d).”

Texas - “Gifted and talented student means a child or youth who performs at or shows the potential for performing at a remarkably high level of accomplishment when compared to others of the same age, experience, or environment and who: (1) exhibits high performance capability in an intellectual, creative, or artistic area; (2) possesses an unusual capacity for leadership; or (3) excels in a specific academic field (Texas, n.d.).”

The commonalities of the states’ definitions are high performance and outstanding intellect. This could mean that a gifted student has higher intellectual ability compared with the average students. Moreover, Kanevsky (1992) found out that the high-ability children demonstrated significantly better ability to explain their own strategies, and the reason for using the strategies, compared to the low performing students. Benito (2000), concluded that a six year old gifted child already has knowledge of some mathematical basic operations, applies that knowledge automatically, and can determine what strategy to use for solving a problem. Moreover, according to Schraw and Graham (1997), metacognitive knowledge and control most likely start to develop in the early stage of the gifted students than the non-gifted students. Eventually, the gifted children demonstrate superior metacognitive knowledge over the non-gifted children. The researcher has observed that gifted students prefer to solve given word problems in math independently. Tis observation parallels that of Pajares (1996), who found that “Gifted students reported higher math self-efficacy and self-efficacy for self-regulated learning as well as lower math anxiety than did regular education students.”

Moreover, in solving the mathematical and word problems, the gifted students who have a high sense of efficacy are more likely to manifest interest in and focus on working the problems,
give more effort, show longer perseverance in spite of the adversity, and a strong positive motivation that they will be successful of the assigned tasks (Bandura, 1986). Therefore, based on some studies conducted, the gifted students are expected to have higher metacognitive skills than the nongifted students. Jausovec (1998) discovered that gifted students are more intellectually efficient compared with the nongifted students when asked to do problem-solving, especially when given more difficult problems. According to Borkowski & Peck, (1986) the gifted children who have the metacognitive skills are most likely to develop rapidly than those of the non-gifted. Moreover, Sternberg (2001) said the gifted students who acquired giftedness as developing expertise at a faster rate than the nongifted students. At any rate, the teachers of gifted students are encouraged to use differentiated instruction and any learning strategies that would address students’ individual educational needs.

To function effectively in the classroom and in their future careers, gifted students are expected to be sharp thinkers, learn how to learn, and know how to apply their knowledge in real life situations (Doyle, 2013). The researcher is fully aware that the field of metacognition can be utilized to present a useful framework to improve one's knowledge, enhancing critical thinking and helping make wise decisions in any life situations. Moreover, a study on metacognition in mathematical problem solving revealed that students required mathematical knowledge but also need to know when and how to use the strategies along with monitoring and regulating their problem-solving processes using their metacognitive skills (Erbas & Okur, 2012). Combining both knowledge and regulation could help students easily achieve higher level performance.

2.4 Perseverance

Problem solving requires knowledge and skills in order to be successful. However, there are a few gifted students who easily give up, when they see a problem they have no idea how to
solve. There is no sign of attempt on their paper, rather leaving it blank, writing “I don’t know (idk)”, and putting question mark. This avoidance is a big concern in the classroom setting especially in a gifted classroom. The first Common Core State Standards Mathematical Practice is “Make sense of problems and persevere in solving them.” This mean as further explain by Common Core, that “mathematically proficient students starts by explaining to themselves the meaning of a problem and looking for entry points to its solution”. According to Lehman 2008 (as cited by Duncker, 2013), “While there is a lack of conclusive research delineating the effects of specific emotions on problem solving outcomes, a hypothesis that a problem solving method that responds to the student’s negative emotions by directing the student with hints to diffuse the confusion and alleviate the frustration experienced would be the most effective framework for developing problem solving ability and subsequent perseverance in students (Lehman, 2008)”. 
CHAPTER 3
METHODOLOGY

The purpose of this study is to investigate the effect of an intervention to metacognitive skills of gifted students and, thus, the classroom performance of gifted students in a self-contain classroom setting. This research is designed as an experimental study and conveys a solving strategy designed by the researcher and identified as GEAR (GEAR=Given, Expectation, Answer, and Review). GEAR strategy serves as the intervention of this study. The researcher has randomly selected two middle school gifted classes, one to be a control group and the other to be the experimental group. Pre-test results using Module 1 Edusoft Test and the Metacognitive Activity Inventory (MCAI) (Cooper & Sandi-Urena, 2009) show that both groups are very similar. This section includes the respondents, composed intervention, instruments used and the method that are included in this study.

3.1 The Respondents

The respondents of this study include middle school gifted students with ages ranging from 13 to 15 years old enrolled in four Math 8 course classes. There were 17 boys and 22 girls, 24 African American students, 12 Caucasian American students, and 3 Asian American students. Twenty-three students are seventh graders who qualified for Math 8 Accelerated Math, and 16 students are eighth graders. Gifted students in East Baton Rouge Parish School System are students who are identified to have exceptional abilities (Lejeune 2011). Moreover, they were able to meet the criteria for eligibility as defined by Louisiana Administrative Code Part CI. Bulletin 1508—Pupil Appraisal Handbook. In Louisiana, “Gifted Children and Youth are students who demonstrate abilities that give evidence of high performance in academic and intellectual aptitude (Louisiana Admin. Code title 28 § 1904).”
3.2 Intervention Design

The problem solving strategy intervention is a strategy designed by the researcher. The intervention was adopted from the four main phases of problem solving method of Polya, which includes understanding the problem, devising a plan, carrying out the plan, and looking back (Polya, 1973). The researcher uses the acronym of GEAR (GEAR = Given, Expectation, Answer, Review). The students may write these acronyms in a columnar form, graphical organizer form or simply as a row (Fig. 1). In the Given (G) part, students are expected to read the problem carefully and take note of the provided data that are needed to solve the problem. In the Expectation (E) part, students are supposed to write down what the problem is or list down the objective(s) of the problem. The Answer (A) part is where students provide the computation part of the problem or maybe the solution. Students may use facts, formula, theorems or postulates to validate their answer. In the Review (R) part, students examine their work to check if the answer they have found makes sense.

<table>
<thead>
<tr>
<th>Given</th>
<th>Expectation</th>
<th>Answer</th>
<th>Review</th>
</tr>
</thead>
</table>

Figure 1a. GEAR Strategy in column

<table>
<thead>
<tr>
<th>Given</th>
<th>Expectation</th>
<th>Answer</th>
<th>Review</th>
</tr>
</thead>
</table>

Figure 1b. GEAR Strategy in rows
The acronym “GEAR” has also been chosen because of its etymological meaning. In word origins, “the etymological meaning of gear is roughly ‘that which puts one in a state of readiness’—hence ‘equipment, apparatus.’” (Gear, 2006). The acronym reflects both the process which readies students for new knowledge and the “apparatus” which will help them gain that knowledge.

Figures below show sample word problems that both students in controlled and experimental group has completed before and after GEAR intervention.

![Sample Problem](image1.png)

Figure 2a. Sample Problem before Intervention (Controlled)

![Sample Problem](image2.png)

Figure 2b. Sample Problem before Intervention (Experimental)
Figure 3a. Sample Problem after Intervention (Controlled)

Figure 3b. Sample Problem after Intervention (Controlled)

Figure 4a. Sample Problem after Intervention (Experimental)

Figure 4b. Sample Problem after Intervention (Experimental)
On the first day of the research process, both groups received the same instructional strategies. Students were taught by the same teacher, received the same activities, and participated in the same amount of instructional time. After the fourth week, students took Module 1 Edusoft test and MCAI. These two instruments serve as the pre-test data of this study. After the test, the use of GEAR strategy was introduced to the experimental group. It requires the student to write and follow the steps of GEAR strategy in solving any word problem. Students used this approach for four weeks, and after that they took Module 2 Edusoft Test. In addition, they completed the post test of MCAI.

On the other hand, the control group of students was not exposed to GEAR strategy. The teacher introduced a problem and showed how to solve it using whole , which included teacher-student interaction through question and answer before moving on to the next problem. Students in the control group mimicked the teacher’s method and display their work to indicate that their answers made sense. The control group had been using whole class discussion of solving a word problem from the beginning of the research process until the eighth week. After the eighth week, students took Module 2 Edusoft Test and MCAI. These two instruments were collected and labeled as a post test.

3.3 Data Sources

There were two data types used during this study: (3.3.1) Metacognitive Activity Inventory (MCAI) and (3.3.2) Edusoft Tests. The Module 1 and Module 2 Edusoft Tests were used as pre and post-test for this study.

3.3.1 Metacognitive Activity Inventory (MCAI)

The Metacognitive Activities Inventory (MCAI) was designed by Cooper, M., & Sandi-Urena, S (2009) to assess the metacognitive skills of students in problem solving. The MCAI (see
Appendix A) has 27 items and uses a 5-point Likert Scale ranging from 1 (Never) through 5 (Always) (Delvecchio, F. 2011; Cooper, M., and Sandi-Urena, S 2009). There are eight items (items 20-27) that were scored inversely to avoid the effects of acquiescence (the tendency of respondents to agree with most of the statements presented to them) (Cooper, M., & Sandi-Urena, 2009). The metacognitive skills were assessed using a percentage total score. The higher the rate means, the better the metacognitive skills (Cooper and Sandi-Urena, 2009). The researcher tallied the result of each Likert scale item and added it all up with 135 as the maximum points. The MCAI results were translated into percentages. According to previous findings, MCAI is a tool to measure the effect that changes in teaching practices or learning environments which may have an effect on the metacognitive skillfulness of students (Cooper, M., & Sandi-Urena, 2009). The researcher used this tool to assess if the intervention used in a gifted classroom yields a significant effect on students’ metacognitive skills. All the students took the MCAI Pre-test before Module 1 Instruction and data was collected. The results are presented in Chapter 3.

3.3.2 Edusoft Test

The Edusoft test is a test that utilizes the Edusoft Program developed by Houghton Mifflin Harcourt Company. The East Baton Rouge Parish School System (EBRPSS) acquires the Edusoft Software to be used for the entire District.

Module 1

The researcher is teaching Math 8 Gifted class in EBRPSS. Students are expected to be proficient in Module 1 Edusoft test before moving on to the next module. In order to be evaluated as “proficient,” students should score at least 55% (Basic Level) or above (Mastery or Advanced Level) on the Edusoft test. Module 1 (see appendix B) is about “The Number System and Properties of Exponents” and it includes three Common Core State Standards (CCSS), namely;
8. EE. A1 (Properties of Integer Exponents), 8.EE.A.3 (Scientific Notation), and 8.EE.A.4 (Operations in Scientific Notation). A strategy used in teaching the students in Module one is whole group instruction. Both groups received the same activities and teaching materials. The researcher used Engage New York activities as mandated by the school district.

Module 2

Implementation of Module two was done using the GEAR strategy for the experimental group while the controlled group continued with the whole group instruction. Both groups used the same activities and teaching materials in teaching Module 2 (see appendix C). Module 2 is about “Congruency” and the CCSS includes the following, namely; 8.G.A.1.(Properties of Transformation), 8.G.A.2 (Sequence of Transformation), 8.G.A.5 Angle Sum and exterior angle of triangles), 8.G.B.6 (Pythagorean Theorem), and G.B.7 (Application of Pythagorean Theorem).

In teaching Module 2, the experimental group was encouraged to use GEAR Strategy. The teacher offered incentives for implementing the GEAR Strategy by giving extra points. Gifted students are highly motivated for the given incentive and therefore, used the strategy thoroughly. After four weeks of intensive use of GEAR Strategy and upon completion of Module two instruction, both groups completed Module 2 Edusoft Test and the post test on MCAI. Collected data are analyzed in the next chapter.

3.4 Procedure

This study was conducted over an eight-week period and included instruction in two module units based on the “East Baton Rouge Parish School System Year at a Glance for Math 8.” The first module is titled “The Number System and Properties of Exponents,” and the second is titled “Congruency.” The classes were divided into two groups, experimental and control. From
four classes, two classes were chosen to be the experimental group, and the remaining two were the control group. The groups were chosen randomly.

Module 1 instruction was delivered to both groups without the use of GEAR problem solving strategy. Students solved the problem and after the four week instruction, all respondents took Module 1 Edusoft test and MCAI, which serves as the pre-test in this study. Test results are obtained from both groups and the mean score appears to be slightly the same. The MCAI pre-test results of both groups was also obtained, and the results also appear to be similar.

Since pre-tests result show that both groups are at par, therefore an experimental study can be achieved. During the four-week instruction, students in the experimental group were encouraged to use the GEAR strategy (four step methods adapted by Polya) and were required to show their work on each problem. The teacher motivated the students to use GEAR strategy by offering points incentives for those who showed their work through GEAR. The controlled group, on the other hand, received no problem solving intervention (GEAR strategy). Students were to solve a word problem however they understood as long as they yielded a correct answer.

After the next four weeks of instruction, the experimental group used GEAR Strategy while the controlled group used the whole group instruction. Both groups took Module 2 Edusoft Test and MCAI. These two instruments were used as a post-test to determine if there was a significant difference in their metacognitive skills from Module 1 to Module 2 and pre/post MCAI scores. An analysis of the outcome is presented in the next chapter.
CHAPTER 4
RESULTS AND ANALYSIS

This research is being conducted to determine the effect of an intervention towards metacognitive skills and classroom math performance of middle school gifted students. There are three specific questions that this study seeks to answer (see chapter 1). The researcher is collecting data using two methods in order to answer these questions. Descriptive statistics have been used to analyze the pre- and post-test scores on Metacognitive Activity Inventory (MCAI) and the Edusoft test results of Module 1 and Module 2. The researcher also has used the paired sample t-test for both instruments to check if there is a statistically significant difference in the result of students’ scores.

This chapter will present the collected data from MCAI and Edusoft Tests. Visual and tabular presentations are shown to see the differences between pre and post-test results. These data were used to gather findings and reach conclusions for the review of findings in the next chapter.

The effect of GEAR Strategy Intervention towards the metacognitive skills of gifted students

In order to determine the effect of GEAR Strategy Intervention towards the metacognitive skills of gifted students, the researcher administer a pre- and post-test to one controlled and one experimental group. Cooper & Sandi-Urena (2009) validates the MCAI, which is an instrument used to assess the metacognitive skills of students. The MCAI (see Appendix A) has 27 items and uses a 5-point Likert Scale ranging from 1-Never through 5-Always (Delvecchio, F. 2011; Cooper, M., and Sandi-Urena, S 2009). There are eight items (items 20-27) that were coded inversely thus reversely scored to “avoid the effects of acquiescence (the tendency of respondents to agree with most of the statements presented to them)” (Cooper, M., & Sandi-Urena, 2009). The highest possible score that a student could obtain is 135 by adding together the points selected for each
item on the MCAI questionnaire. However, before any analysis of the scores, the researcher coded reversely the items that were negatively worded (items 20 – 27). The researcher converted each total score into a percentage form to be consistent with the results of all instruments used in this study. Below are the test results of both pre and post-tests of the MCAI.

Figure 5a shows that the MCAI pre-test of the controlled group has a mean of 70.95, standard deviation of 9.93, and a median of 71.85 while in Figure 5b its post-test shows that the MCAI has a mean of 73.70, standard deviation of 11.37 and a median of 73.70. It is noticeable that in the post-test there is a slight increase of students who scored between 85 to 90 percent; moreover, there was a decreased of the number of students who scored between 50 to 60 percent in the pre-test compared with the post-test.

The box and whisker plots are used to summarized the results of the controlled group pre- and post-test MCAI as shown in figure 6. It depicts that in the post-test 50 percent of the students scored between 73 – 91, compared to the 50 percent of the students in the pre-test which scored
between 71 – 85. In the first quartile, the pre-test scores are ranging from 50 – 65, yet in the post-test, the scores are ranging from below 50 – 67. Although, there is a slight increase of the median scores, statistically there is no significant difference between pre and post-test of the controlled group.

Figure 6. Control MCAI Pre and Post-test (Box and Whisker Plot)

In order to identify the number of students who answered Always, Often, Sometimes, Rarely and Never on each survey question, the researcher tallied each student’s responses on each survey question and acquired the sum of the number of students per Likert scale. Observation of the results focuses on questions 20 through 27, since the questions are negatively worded to avoid the effects of acquiescence. The results below show the tally sheets of both pre and post-test MCAI of the controlled group (see appendix A for each questions on the survey). Table 1 shows that there were a total of 14 responses for the scale of “Never” in the pre-test while there were a total of 21 responses in the post-test (see table 2). The increase of responses in this scale may indicate that
some students in the controlled group seem confused with the negatively worded questions. It appears that some of them need clarification regarding the wording of the questions.

In figure 7a and 7b, the controlled group pre-test survey has a combined 21% of the students who responded “Never” and “Rarely” and acquired the same percentage on the post-test. However, there was a total of 56% of the students who responded “Always” and “Often” on the
pre-test while in the post-test it increases into 61% combined number of students. A 7% increase under the Always Likert scale is a marginal improvement on student’s metacognitive skills.

In comparison, Figure 8a shows the MCAI pre-test result of the experimental group. The pre-test shows a mean of 71.75, standard deviation of 9.36, and a median of 71.11. The grades range from above 50 to below 90 with an outlier of 1 person having a grade of above 90. However,
after the intervention, Figure 8b shows the post-test that the mean has improve to 77.95, standard deviation of 10.33 and a median of 75.56. No student had a grade of below 60 and all students had a grade ranges from between 65 to 100.

![Box and Whisker Plot](image)

Figure 9. Experimental MCAI Pre and Post-test (Box and Whisker Plot)

The box and whisker plots for the experimental group pre and post-test MCAI, as shown in figure 9, represent that in the post-test, 50% of the students scored between 76 and above, compared to the 50% of the students in the pre-test which scored between 76 – 84. In the first quartile, the pre-test scores range from 61 – 67, yet in the post-test, in the first quartile, the scores range from 65 – 67. Figure 9 shows that there is an increase of the median scores between pre-and post-test MCAI scores of the experimental group.

Table 3 and 4 below shows the results of the tally sheets of both pre and post-test MCAI of the experimental group (see appendix A for each questions on the survey). Table 3 shows that there were a total of 22 responses for the scale of “Never” in the pre-test while there were a total
of 16 “Never” responses in the post-test (see table 4). The decrease of responses in this scale indicates that most of the students in the experimental group understand the negatively worded questions. It appears that none of the students of the experimental group chose the “Never” scale on questions 1 through 19, which are positively worded.

Table 3. MCAI Pre-Test Tally Sheet (Experimental)  

<table>
<thead>
<tr>
<th>Question(s)</th>
<th>Always</th>
<th>Often</th>
<th>Sometimes</th>
<th>Rarely</th>
<th>Never</th>
<th>n = 21</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1</td>
<td>10</td>
<td>8</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Q2</td>
<td>8</td>
<td>6</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>21</td>
</tr>
<tr>
<td>Q3</td>
<td>5</td>
<td>8</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>21</td>
</tr>
<tr>
<td>Q4</td>
<td>10</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>21</td>
</tr>
<tr>
<td>Q5</td>
<td>5</td>
<td>10</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>21</td>
</tr>
<tr>
<td>Q6</td>
<td>6</td>
<td>5</td>
<td>6</td>
<td>2</td>
<td>2</td>
<td>21</td>
</tr>
<tr>
<td>Q7</td>
<td>10</td>
<td>8</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Q8</td>
<td>9</td>
<td>5</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Q9</td>
<td>4</td>
<td>10</td>
<td>6</td>
<td>1</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Q10</td>
<td>6</td>
<td>10</td>
<td>3</td>
<td>2</td>
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<td>21</td>
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<tr>
<td>Q11</td>
<td>1</td>
<td>6</td>
<td>8</td>
<td>6</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Q12</td>
<td>5</td>
<td>7</td>
<td>7</td>
<td>2</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Q13</td>
<td>4</td>
<td>9</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>21</td>
</tr>
<tr>
<td>Q14</td>
<td>4</td>
<td>7</td>
<td>7</td>
<td>2</td>
<td>1</td>
<td>21</td>
</tr>
<tr>
<td>Q15</td>
<td>14</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Q16</td>
<td>9</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Q17</td>
<td>4</td>
<td>10</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>21</td>
</tr>
<tr>
<td>Q18</td>
<td>4</td>
<td>9</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>21</td>
</tr>
<tr>
<td>Q19</td>
<td>7</td>
<td>4</td>
<td>8</td>
<td>2</td>
<td>0</td>
<td>21</td>
</tr>
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<td>12</td>
<td>3</td>
<td>5</td>
<td>21</td>
</tr>
<tr>
<td>Q21</td>
<td>1</td>
<td>1</td>
<td>9</td>
<td>5</td>
<td>2</td>
<td>21</td>
</tr>
<tr>
<td>Q22</td>
<td>2</td>
<td>3</td>
<td>7</td>
<td>6</td>
<td>3</td>
<td>21</td>
</tr>
<tr>
<td>Q23</td>
<td>8</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>21</td>
</tr>
<tr>
<td>Q24</td>
<td>2</td>
<td>8</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td>21</td>
</tr>
<tr>
<td>Q25</td>
<td>7</td>
<td>5</td>
<td>7</td>
<td>1</td>
<td>1</td>
<td>21</td>
</tr>
<tr>
<td>Q26</td>
<td>2</td>
<td>5</td>
<td>12</td>
<td>1</td>
<td>1</td>
<td>21</td>
</tr>
<tr>
<td>Q27</td>
<td>1</td>
<td>6</td>
<td>8</td>
<td>5</td>
<td>1</td>
<td>21</td>
</tr>
<tr>
<td>Total</td>
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<td>167</td>
<td>154</td>
<td>62</td>
<td>35</td>
<td>567</td>
</tr>
<tr>
<td>Percentage</td>
<td>26%</td>
<td>30%</td>
<td>27%</td>
<td>11%</td>
<td>6%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 4. MCAI Post-Test Tally Sheet (Experimental)  

<table>
<thead>
<tr>
<th>Question(s)</th>
<th>Always</th>
<th>Often</th>
<th>Sometimes</th>
<th>Rarely</th>
<th>Never</th>
<th>n = 21</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1</td>
<td>10</td>
<td>9</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Q2</td>
<td>6</td>
<td>10</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Q3</td>
<td>6</td>
<td>11</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Q4</td>
<td>10</td>
<td>6</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Q5</td>
<td>7</td>
<td>6</td>
<td>7</td>
<td>1</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Q6</td>
<td>7</td>
<td>7</td>
<td>5</td>
<td>2</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Q7</td>
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<td>4</td>
<td>0</td>
<td>0</td>
<td>21</td>
</tr>
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<td>Q8</td>
<td>8</td>
<td>10</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Q9</td>
<td>9</td>
<td>7</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Q10</td>
<td>7</td>
<td>11</td>
<td>1</td>
<td>2</td>
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<td>21</td>
</tr>
<tr>
<td>Q11</td>
<td>5</td>
<td>4</td>
<td>8</td>
<td>4</td>
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<td>21</td>
</tr>
<tr>
<td>Q12</td>
<td>6</td>
<td>7</td>
<td>5</td>
<td>3</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Q13</td>
<td>7</td>
<td>5</td>
<td>7</td>
<td>2</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Q14</td>
<td>7</td>
<td>11</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Q15</td>
<td>15</td>
<td>4</td>
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<td>0</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Q16</td>
<td>7</td>
<td>11</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Q17</td>
<td>10</td>
<td>4</td>
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<td>0</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Q18</td>
<td>6</td>
<td>11</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Q19</td>
<td>10</td>
<td>10</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Q20</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>1</td>
<td>21</td>
</tr>
<tr>
<td>Q21</td>
<td>3</td>
<td>2</td>
<td>6</td>
<td>7</td>
<td>3</td>
<td>21</td>
</tr>
<tr>
<td>Q22</td>
<td>7</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>21</td>
</tr>
<tr>
<td>Q23</td>
<td>11</td>
<td>6</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>21</td>
</tr>
<tr>
<td>Q24</td>
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<td>7</td>
<td>5</td>
<td>2</td>
<td>3</td>
<td>21</td>
</tr>
<tr>
<td>Q25</td>
<td>9</td>
<td>2</td>
<td>5</td>
<td>2</td>
<td>3</td>
<td>21</td>
</tr>
<tr>
<td>Q26</td>
<td>7</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>21</td>
</tr>
<tr>
<td>Q27</td>
<td>3</td>
<td>2</td>
<td>9</td>
<td>5</td>
<td>2</td>
<td>21</td>
</tr>
<tr>
<td>Total</td>
<td>203</td>
<td>185</td>
<td>113</td>
<td>50</td>
<td>16</td>
<td>567</td>
</tr>
<tr>
<td>Percentage</td>
<td>36%</td>
<td>32%</td>
<td>20%</td>
<td>9%</td>
<td>3%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Looking at Figure 10a and Figure 10b, the pre-test grade of the experimental group has a total of 17% of the students who responded “Never” and “Rarely” on the Likert survey; that percentage decreased to 12% on the post-test (see figure 10b). Moreover, there was a total of 56% of the students who responded “Always” and “Often” on the pre-test, while on the post-test it
increases into 68% combined number of students. A 10% increase under the “Always” Likert scale demonstrates good improvement in their metacognitive skills.

Figure 10a. Experimental MCAI Likert Scale Pre-Test

![MCAI Likert Scale Pre-Test(Experimental Group)](#)

Figure 10b. Experimental MCAI Likert Scale Post-Test

In order to determine if there is a significant difference between the pre and post-test MCAI results of both groups, the researcher used the paired sample t-test (see table 5). The null hypothesis of no significant difference is retained for the controlled group because the absolute value of the t-stat is less than t-critical one-tail, t(17) =1.66, p ≤ 0.05 while the null hypothesis is
rejected for the experimental group because the absolute value of t-stat is greater than the t-critical one-tail, \( t (20) =3.22, p\leq0.05 \). Table 5 displays the result of MCAI pre and post-test where in the experimental group shows significant difference after the intervention from the controlled group. Therefore, there is a significant effect of the intervention GEAR Strategy towards the metacognitive skills of gifted students. GEAR strategy helps regulate cognition thus enhances the metacognitive skills of gifted students.

Table 5. MCAI Pre and Post-test Result of both Group

<table>
<thead>
<tr>
<th>Group</th>
<th>Measure</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>Median</th>
<th>df</th>
<th>t stat</th>
<th>t critical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controlled</td>
<td>Pre-Test MCAI</td>
<td>18</td>
<td>70.95</td>
<td>9.93</td>
<td>71.85</td>
<td>17</td>
<td>1.66</td>
<td>1.74</td>
</tr>
<tr>
<td></td>
<td>Post-Test MCAI</td>
<td>18</td>
<td>73.7</td>
<td>11.37</td>
<td>73.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimental</td>
<td>Pre-Test MCAI</td>
<td>21</td>
<td>71.75</td>
<td>9.36</td>
<td>71.11</td>
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<td>3.22</td>
<td>1.72</td>
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<tr>
<td></td>
<td>Post-Test MCAI</td>
<td>21</td>
<td>77.95</td>
<td>10.33</td>
<td>75.56</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The effect of Gear Strategy intervention towards the classroom performance score of gifted students

The researcher used the Edusoft test mandated by the district to assess the classroom performance score of gifted students. In order to determine if GEAR Strategy affects classroom performance of gifted students, the researcher conducted Module 1 Edusoft test as a pre-test. Figures 11a and 11b show the pre-test grades of both controlled and experimental groups, respectively.
The controlled group has a mean of 56.82, standard deviation of 19.67, and a median of 59.09. The controlled group’s grades ranged between 30 and 90 percent. For the experimental group, the mean is 55.19, standard deviation is 23.06, and median is 54.55. The experimental group’s grades ranged from 20 and 100 percent. After four weeks of intervention for the experimental group, both groups took Module 2 Edusoft as a post-test, and the results are shown below.

As displayed in figure 12a, the controlled group’s Module 2 Edusoft test has a mean of 71.67, standard deviation of 14.61, and a median of 70.00. Grades range between the grades of 40 and 90 percent. On the other hand, the experimental group’s Module 2 Edusoft test (see figure12b) shows a mean of 73.33, standard deviation of 15.24, and a median of 76.67. The grades range between 40 and 90 percent.
The box and whisker plots show each group’s progress from Module 1 to Module 2 Edusoft Test. Figure 13a shows the controlled group’s results. In module 1, 50 percent of the class earned a score of about 60 and above, while in Module 2, 50 percent of the class got a score of 70 and above. On the other hand, Figure 13b exhibits the experimental group’s results. In Module 1, 50 percent of the class received a score of about 55 and above, while in Module 2, 50 percent of the students got a score of 76 and above. Both group shows an increase between Module 1 and Module 2 tests as shown in the box and whisker plots.
In order to determine if there is a significant difference between Module 1 and Module 2 Edusoft tests of both groups, a paired sample t-test was conducted (see table 2). For the controlled group, the absolute value of the t-stat is greater than t-critical one-tail, \( t(17) = 4.58, p \leq 0.05 \) while the experimental group has an absolute value of t-stat greater than the t-critical one-tail, \( t(20) = 3.22, p \leq 0.05 \). The null hypothesis of no significant difference tail, \( t(20) = 3.22, p \leq 0.05 \). The null hypothesis of no significant difference is rejected for both group. This shows that both groups demonstrate significant difference from Module 1 to Module 2 Edusoft testing. Both groups have improved their grades with or without GEAR intervention. This implies that the absence of GEAR in the controlled group does not alter gifted students’ abilities in problem solving.

Table 6. Module 1 and Module 2 Test Result

<table>
<thead>
<tr>
<th>Group</th>
<th>Measure</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>Median</th>
<th>df</th>
<th>t stat</th>
<th>t critical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controlled</td>
<td>Pre-Test Module 1</td>
<td>18</td>
<td>56.82</td>
<td>19.67</td>
<td>59.09</td>
<td>17</td>
<td>4.58</td>
<td>1.74</td>
</tr>
<tr>
<td></td>
<td>Post-Test Module 2</td>
<td>18</td>
<td>71.67</td>
<td>14.61</td>
<td>70</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimental</td>
<td>Pre-Test Module 1</td>
<td>21</td>
<td>55.19</td>
<td>23.06</td>
<td>54.55</td>
<td>20</td>
<td>4.34</td>
<td>1.72</td>
</tr>
<tr>
<td></td>
<td>Post-Test Module 2</td>
<td>21</td>
<td>73.33</td>
<td>15.24</td>
<td>76.67</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The results of the Module 2 Edusoft test lead the researcher to look at all the scores on the Constructed Response part of Module 2 (see appendix C) for both groups. The highest possible score for Module 2 constructed response is 12 points. The researcher tallied all the scores from both controlled and experimental groups and the result is shown in Table 3. In the controlled group, there is one student who answered all questions perfectly, three students who got one mistake, four students who got a score of 10, one student who got a score of nine, three students scored eight, two scored seven, three scored six and one scored four. In the experimental group, no one scored perfectly but four students scored 11, another four scored 10, two students scored
nine, three scored eight, another three scored seven, two scored six, one scored five, one scored four, and one scored three.

Table 7 Module 2 Constructed Response Scores per Students

|       | 12 | 11 | 11 | 11 | 10 | 10 | 10 | 9  | 8  | 8  | 8  | 7  | 7  | 6  | 6  | 4  | Mean |
|-------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|
| Controlled | 12 | 11 | 11 | 11 | 10 | 10 | 10 | 9  | 8  | 8  | 8  | 7  | 7  | 6  | 6  | 4  | 8.6  |
| Experimental| 11 | 11 | 11 | 11 | 10 | 10 | 10 | 9  | 9  | 8  | 8  | 8  | 7  | 7  | 6  | 6  | 5  | 4    | 8.1  |

Computation of the mean, it shows that the controlled group has a mean of 8.6 while the experimental group has a mean of 8.1. Each student in both groups attempted to solve every problem. The score of no zero indicates that each students did write something correctly on their constructed response. This result shows that there is no significant difference between students’ scores on constructed response in module 2 Edusoft test. Therefore, the absence of GEAR strategy did not affect the scores of the controlled group in the constructed response type questions, which means that even without intervention gifted students could score high on the district given Edusoft Test.
CHAPTER 5
CONCLUSIONS AND IMPLICATIONS

This study examines if the GEAR Strategy intervention described herein enhances student metacognitive skills, simultaneously improving the classroom performance score of middle school gifted students. To determine the effect of GEAR strategy towards metacognitive skills, results of paired sample t-test of pre and post-tests of MCAI revealed that there is a significant difference between students who have received GEAR strategy compared with students who have not received the same intervention. The results imply that GEAR strategy does affect the metacognitive skills of middle school gifted students in problem solving. It enhances students’ ability to regulate their own cognition. GEAR helps students plan, monitor, and evaluate word problems in order to gain new knowledge and, thus, creates a habit of mind.

Results also show that students who receive GEAR intervention attempt to solve math problems by writing. Even when their answers are not always correct, the writing shows students have persevered in attempting to solve problems. In cases where shown work is required, even incorrect answers with written explanations receive some scoring points. GEAR strategy provides a problem solving procedure that eventually leads students to answer the question “What do you do when you don’t know what to do?” GEAR provides several different types of graphic organizing to help guide students thoughts as they approach math word problems.

To determine the effect of GEAR strategy towards classroom performance scores, results of paired sample t-test of Module 1 (before intervention) and Module 2 (after intervention) Edusoft test of each group shows that there is a significant improvement between these two tests. The controlled group, as well as the experimental group, demonstrates significantly improved scores on Module 2. Since there was no intervention for the controlled group, the study implies that gifted
students seemed to perform reasonably well on this test whether they receive GEAR intervention or not. While there is a slight improvement for the Module 2 (after intervention) in the means for the experimental group, however, the mean score of Module 2 test for both groups seemed to be statistically the same. Therefore GEAR intervention did not affect classroom performance of gifted students. It is also crucial that the intervention really did not hurt the controlled group. The increase in the mean of Module 2 of the experimental group is not considered statistically significant.

GEAR strategy appeared to enhanced metacognitive skills of gifted students. However, regulating one’s own cognition is not enough to be successful in problem solving. Students should also consider the other part of metacognition, the awareness of cognition, which was divided into three levels, namely, knowing about things, knowing about how to do things and knowing why and when to do things [Cooper, M. and Sandi-Urena, S. (2009)]. This study shows that gifted students are still capable of enhancing their metacognitive skills through the use of intervention in problem solving. However, this study also reveals that intervention to gifted students does not really affect their classroom performance score. Gifted students by nature have higher problem solving skills than average students, so a statistical significant change of their classroom performance is least expected. The experimental group actually had a slightly higher mean than the controlled group, therefore there was an improvement, but not a statistically significant one.

Results of this study shows implications to the following personnel:

1. Gifted Teacher (GT) – GT always thinks of what is best for the gifted class, and therefore need to spend more time in finding ways to develop a curriculum, assessment, and or professional development that connects mathematical practices to mathematical content in instruction. Spending time reading articles and books about giftedness always helps GT
teachers. In addition, staying abreast of any Common Core state standards updates and resources -- especially in connecting between standards for mathematical content and the standards for mathematical practice -- is a priority.

2. School Administrators (SA) – SA should focus more on helping GT teachers looking for adequate resources that are aligned to Common Core State Standards. SA should help in designing professional development that would provide maximum support to help GT teach and develop prodigy students. SA should support all teachers that seek improvement with their classroom teaching. Thinking about students’ success is as significant as thinking about teachers’ improvement. Although students are the center of education, let us not forget that teachers are the catalyst of change.

3. Parent of Gifted Students (PGS) – PGS should continue to support teachers in data collection studies such as this one. Only with further studies can education of future students be improved.

4. Gifted Students (GS) – GS should also take time in doing problems in a step-by-step method because solving a problem strategically may eliminate carelessness and disorganization of thought. GS should be open minded regarding the new approaches that their teachers introduce, discern which approach is best for their learning, and master it to achieve higher level thinking. GS also need to consider content knowledge to expect higher performance scores. Awareness and regulation of cognition are two components of metacognition and could easily be achieve if proper training of GS is conducted.

5. Future Researcher (FR) - Suggestion for further study could require students to write about how they thought through and solved a problem, perhaps in a journal. This would achieve a metacognitive approach, satisfy common core standards and attempt “writing across the
curriculum” standards as recommended by the National Council for Teachers of English (NCTE). GEAR strategy did not show a significant difference towards gifted students. However, some studies suggested to “evaluate multicomponent interventions that involve teaching a wide range of writing skills to students with Learning Disability (LD)” (Gillespie & Graham, July 2014 ). In fact, there is some evidence that programs targeting a range of writing skills are effective for students with LD [Bui, Schumaker, and Deshle (2006)].

Previous studies found in theses submitted for the degree of Master of Natural Science (MNS) under the program of Louisiana Math and Science Teachers Institute (LaMSTI) examine teacher-created activities and implement classroom strategies to improve student learning. A study by Duncker (2013), for example, is about the use of a graphic organizer. The study did not detect effect on perseverance but did help to create classroom conditions conducive to student engagement. An additional study from the same year by Bergstresser (2013) examines metacognitive training which shows that the classes receiving metacognitive training scored higher on a post-test compared with the class that did not receive the training. The study also concluded that there is a correlation between learning metacognitive skills and retaining content. A third researcher, Terry Armstrong (2013), hypothesized that implementing, managing, and enhancing self-assessment procedures may improve learning and concluded that an experimental group performed significantly better than the control group. Finally, Dr. Saundra McGuire, recipient of multiple awards -- specifically the Outstanding Conference Presentation Award at the LSU Teaching in Higher Education Conference in 2003, 2004, 2005, 2007 -- has been
implementing training that focuses on teaching students how to learn by equipping them with metacognitive learning strategies.

Dr. McGuire’s training program and these three studies from MNS-LaMSTI theses showed evidence that problem solving strategies affect learning, thus affect metacognition. These studies indicate the importance of researching metacognition. Further research about major intervention tested in a large number of students and among various teachers is also warranted. The studies are all promising and all suggest that teachers can increase the attention they pay to metacognition. With the implementation of Common Core State Standards, the research will surely find teaching approaches that will greatly contribute not only to teachers and students but to the entire realm of education.
REFERENCES


APPENDIX A: METACOGNITIVE ACTIVITY INVENTORY (MCAI)


Code Name: ___________________________

Please read the following sentences. Circle a value from 1 (never) to 5 (Always) for each statement to describe the way you are when you are trying to solve a problem. Think back to the problem you just attempted. What do you do before you begin a solution? What do you do while you are working on the problem? What do you do after you have finish working on the problem? There are no right answers. Please describe yourself as you are, not how you think you should be. This will not be graded.

Survey Scale: 1 = Never ... 5 = Always

<p>| | | | | | |</p>
<table>
<thead>
<tr>
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<th></th>
<th></th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I read the statement of a problem carefully to fully understand it and determine what the goal is.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. When I do assigned problems, I try to learn more about the concepts so that I can apply this knowledge to test problems.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. I sort the information in the statement and determine what is relevant.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Once a result is obtained, I check to see that it agrees with what I expected.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>5. I try to relate unfamiliar problems with previous situations or problems solved.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
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<tr>
<td>6. I try to determine the form in which the answer or product will be expressed.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>7. If a problem involves several calculations, I make those calculations separately and check the intermediate results.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>8. I clearly identify the goal of a problem (the unknown variable to solve for or the concept to be defined) before attempting a solution.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>9. I consider what information needed might not be given in the statement of the problem.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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<td>------------------------------------------------------------------------------------------------------------------------------------------------</td>
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<td>---</td>
<td>---</td>
</tr>
<tr>
<td>10</td>
<td>I try to double-check everything: my understanding of the problem, calculations, units, etc.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>11</td>
<td>I use graphic organizers (diagrams, flow-charts, etc) to better understand problems.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>12</td>
<td>I experience moments of insight or creativity while solving problems.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>13</td>
<td>I jot down things I know that might help me solve a problem, before attempting a solution.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>14</td>
<td>I find important relations amongst the quantities, factors or concepts involved before trying a solution.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>15</td>
<td>I make sure that my solution actually answers the question.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>16</td>
<td>I plan how to solve a problem before I actually start solving it (even if it is a brief mental plan).</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>17</td>
<td>I reflect upon things I know that are relevant to a problem.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>18</td>
<td>I analyze the steps of my plan and the appropriateness of each step.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>19</td>
<td>I attempt to break down the problem to find the starting point.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>20</td>
<td>I spend little time on problems for which I do not already have a set of solving rules or that I have not been taught before.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>21</td>
<td>When I solve problems, I omit thinking of concepts before attempting a solution.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>22</td>
<td>Once I know how to solve a type of problem, I put no more time in understanding the concepts involved.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>23</td>
<td>I do not check that the answer makes sense.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>24</td>
<td>If I do not know exactly how to solve a problem, I immediately try to guess the answer.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Statement</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>--------------------------------------------------------------------------</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25.</td>
<td>I start solving problems without having to read all the details of the statement.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26.</td>
<td>I spend little time on problems I am not sure I can solve.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27.</td>
<td>When practising, if a problem takes several attempts and I cannot get it right, I get someone to do it for me and I try to memorize the procedure.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1. Which equation shows equivalent forms of the expression $2^1 \times 2^{-4}$?

A. $2^1 \times 2^{-4} = 2^{-3} = -8$
B. $2^1 \times 2^{-4} = 2^{-4} = -8$
C. $2^1 \times 2^{-4} = 2^{-3} = \frac{1}{2^3} = \frac{1}{8}$
D. $2^1 \times 2^{-4} = 2^{-4} = \frac{1}{2^4} = \frac{1}{16}$

2. What is equivalent to $3^3 \times 5^{-3}$?

A. 675
B. $\frac{27}{25}$
C. $\frac{9}{10}$
D. $-270$

3. The radius of the solar system is approximately $5.9 \times 10^3$ meters. The radius of the Milky Way galaxy is about $3.9 \times 10^{20}$ meters. About how many times larger is the Milky Way galaxy than the solar system?

A. $2.3 \times 10^7$
B. $6.6 \times 10^7$
C. $1.5 \times 10^8$
D. $2.0 \times 10^8$

4. Which of the following expressions is not equivalent to $\frac{1}{25}$?

A. $5^3 \times 5^{-2}$
B. $5^{-1} \times 5^{-1}$
C. $5^{-3} \times 5$
D. $5^2 \times 5^4$
5. The area of Canada is approximately $1 \times 10^5$ square miles. The area of Italy is approximately $3 \times 10^3$ square miles. Which statement best describes the relative sizes of the countries?

A. The area of Canada is a little more than 30 times the size of Italy.

B. The area of Canada is approximately 100 times the size of Italy.

C. The area of Italy is a little more than 2 times the size of Canada.

D. The area of Italy is approximately 3 times the size of Canada.

6. One type of compact disc has data stored on a single spiral track that is $5 \times 10^4$ meters long and $5 \times 10^{-7}$ meters wide. The length of the spiral is how many times the width?

A. $10^1$

B. $10^0$

C. $10^1$

D. $10^{-8}$

7. Town A and Town B are planning to merge together to form Town AB. If the current population of Town A is $3.95 \times 10^5$ and the current population of Town B is $4.7 \times 10^4$, what will be the total population of Town AB?

A. $1.86 \times 10^9$

B. $4.42 \times 10^5$

C. $5.10 \times 10^4$

D. $8.65 \times 10^9$

8. Keith is working on the problem shown below.

$3.25 \times 10^2 = 0.00325$

What is the value of $x$?

A. $-5$

B. $-3$

C. 3

D. 5
9. The length of a bacterium is approximately $10^{-4}$ meter. The length of the nucleus of the same bacterium is approximately $10^{-4}$ meter. How many times longer than the nucleus is the bacterium?
   
   A. 2 times  
   B. 20 times  
   C. 100 times  
   D. 1000 times

10. The momentum of a moving object is found by multiplying the object’s mass times its velocity. Calculate the momentum of a $10^5$ kg truck traveling at $10^3$ m/min.

   A. $10^8$  
   B. $10^9$  
   C. $10^4$  
   D. $10^3$

11. Which is not equivalent to $10^{-3}$?

   A. $\frac{1}{10^3}$  
   B. $\frac{1}{1000}$  
   C. 0.0001  
   D. one thousandth

12. A bumblebee weighs $3.5 \times 10^{-2}$ grams. A fly weighs $8.3 \times 10^{-3}$ grams. How much more does the bee weigh than the fly?

   A. $2.67 \times 10^{-2}$  
   B. $2.67 \times 10^{-3}$  
   C. $4.8 \times 10^{-2}$  
   D. $4.8 \times 10^{-3}$
Answer numbers 13 through 15 on a separate sheet of paper.

**Short Answer**

13. A computer can do 1000 operations in $4.5 \times 10^{-6}$ seconds. How many operations can be done by this computer in one hour? Express your answer in scientific notation.

**Constructed Response**

14. 

**Part A:**

Fill in the boxes to complete the pattern of exponents and equivalent values. Rewrite the sequence on your separate sheet of paper replacing the boxes with your answers. Be sure to label your answers Part A and Part B.

- $10^5 = 100,000$
- $10^4 = 10,000$
- $10^3 = 1,000$

10 □ =

10 □ =

10 □ =

10 □ =

10 □ =

Part B:

Write the number in the box that is equivalent to the expression.

$10^{-5} \times 10^2 \times 10^9 =$
Grade 8 Mathematics

Module 2 Assessment

Congruency

2013-2014

East Baton Rouge Parish School System
Department of Accountability, Assessment and Evaluation
1. A 130° angle is rotated 180 degrees clockwise. What is the measure of the angle image?
   A. 50°
   B. 130°
   C. 180°
   D. 310°

2. Use the coordinate grid and triangles below to identify the transformation performed and the relationship between the original and the image.

3. Emma built a ramp for her toy cars. The cars travel 10 inches down the slope. The ramp is 5 inches tall.
   How long is the base of the ramp?
   A. \(\sqrt{5}\)
   B. \(\sqrt{15}\)
   C. \(\sqrt{75}\)
   D. \(\sqrt{125}\)

4. A 15-foot-high tower is supported by a wire cable connected to its highest point. The tower is perpendicular to the ground. The cable is attached to the ground 20 feet from the base of the tower. How long is the cable?
   A. 5 feet
   B. 13 feet
   C. 21 feet
   D. 25 feet
5. In the diagram, $AB \parallel CD$ and the measure of $\angle AGF = 112^\circ$.

What is the measure of $\angle FGB$?
A. $22^\circ$
B. $68^\circ$
C. $112^\circ$
D. $248^\circ$

6. In the diagram below, what is the value of $x$?

A. 42
B. 57
C. 65
D. 80

7. Randy’s laundry room is 9 feet wide and 12 feet long. In order to hang his clothes up, he installs a rope from one corner of the room to the opposite corner of the room. How long is the rope?
A. 10.5 feet
B. 15 feet
C. 16.5 feet
D. 21 feet
8. In this diagram, lines $m$ and $n$ are parallel.

\[ \triangle ABC \]

What is the measure of $\angle ABC$?
A. 40°
B. 50°
C. 60°
D. 70°

9. Two parallel lines are shown on the graph below. The lines are both rotated 90° clockwise about the origin and then reflected across the $y$-axis.

Which statement is true about the resulting lines?
A. They are parallel to the $y$-axis.
B. They are parallel to each other.
C. They are perpendicular to the $y$-axis.
D. They are perpendicular to each other.
10. A regular hexagon is shown on this coordinate plane. The figure is made up of six congruent triangles.

Which transformation can be used on $\triangle ABC$ to show that $\triangle ABC$ and $\triangle ACD$ are congruent?

A. a rotation of $60^\circ$ counterclockwise about Point $A$
B. a rotation of $60^\circ$ clockwise about Point $A$
C. a translation along the $x$-axis
D. a reflection over $AB$

11. A rancher built a cattle fence in the shape of a triangle.

- From one corner, the fence will go 200 yards south.
- Then, the fence will turn at a right angle and go 120 yards west.
- From there, the fence goes straight back to its starting point.

To the nearest yard, how much fencing did the rancher use?

A. 233 yards
B. 553 yards
C. 580 yards
D. 786 yards
12. The braces supporting the beam of a bridge form triangles. Which of these lengths of three sides belong to a right triangle?

A. 4 meters, 4 meters, 8 meters  
B. 4 meters, 5 meters, 7 meters  
C. 5 meters, 6 meters, 8 meters  
D. 6 meters, 8 meters, 10 meters

13. What happens to a vertical line if you rotate it 90 degrees clockwise?

A. The image is a horizontal line.  
B. The image is a line 90 inches long.  
C. The image is a vertical line.  
D. The image line is 90 times as long.

14. Two rectangles are shown on the coordinate plane below.

Which transformation can be used to show that rectangle $EFGH$ is congruent to rectangle $ZTXW$?

A. reflect rectangle $EFGH$ over the $x$-axis, then rotate it 90° clockwise about the origin  
B. reflect rectangle $EFGH$ over the $y$-axis, then rotate it 90° counterclockwise about the origin  
C. translate rectangle $EFGH$ 1 unit to the left, then rotate it 90° clockwise about the origin  
D. translate rectangle $EFGH$ 1 unit to the right, then rotate it 90° counterclockwise about the origin
15. Two pentagons are shown on this coordinate plane.

![Figure 1]

![Figure 2]

Which of the following transformations could not be used to map Figure 1 onto Figure 2?

A. Reflect Figure 1 over the x-axis, then translate it 8 units to the right.
B. Translate Figure 1 to the right 8 units, then rotate it 90° counterclockwise.
C. Rotate Figure 1 about the origin 180° clockwise, then translate it 8 units to the right.
D. Translate Figure 1 to the right 8 units, then reflect it over the x-axis.
16. Given: \( \overline{m} \parallel \overline{n} \) with \( \overrightarrow{p} \) as the transversal.

What is the name of the relationship of \( \angle 1 \) and \( \angle 5 \)?

A. vertical angles
B. complementary angles
C. alternate interior angles
D. alternate exterior angles

17. \( \overline{AC} \) is parallel to \( \overline{DF} \), and \( \overline{GH} \) is a transversal. The measure of \( \angle ABG \) is 60°.

What is the sum of \( \angle F EH \) and \( \angle CBE \)?

A. 120°
B. 180°
C. 240°
D. 300°
18. Jasper was riding his bicycle northeast on Chip Street toward Berry Avenue. He turned west onto Berry Avenue.

If Apple Avenue and Berry Avenue are parallel, what is the measure of the angle of the turn that Jasper made?

A. 55°  
B. 70°  
C. 125°  
D. 180°
Constructed Response

Answer the following questions on the separate constructed response answer sheet your teacher has given you.

19. A. Select all transformations from the list below that could transform the original to the image in the coordinate grid below. Circle your selections.

A. Rotate 180° about the origin.
B. Rotate 90° clockwise about the origin, translate down 6 units
C. Rotate 90° counterclockwise about the origin, translate down 6 units
D. Rotate 90° counterclockwise about the origin, translate down 1 unit and right 6 units
E. Rotate 90° counterclockwise about the origin, translate down 6 units and left 1 unit
F. Rotate 90° counterclockwise about the origin, translate down 1 unit, reflect over the y-axis
G. Rotate 90° clockwise about the origin, translate down 1 unit, reflect over the y-axis

B. In A above, the original is mapped onto the image. As a result, what do we know is true about the relationship between the original and the image?
20. Complete all parts. You may use a ruler to complete the task.

A. Rotate $\triangle XYZ$ 90° counterclockwise about the origin. Draw and label the image, $\triangle X'Y'Z'$.

B. If the $m\angle XYZ$ is 45°, what is the $m\angle X'Y'Z'$? Explain how you know.
21. Use the diagram below to answer the questions that follow.

$\overline{EF}$ is a transversal that intersects two parallel lines, $\overline{AB}$ and $\overline{CD}$.

A. If $\angle BGE = 125^\circ$, what is the measure of $\angle BGH$, $\angle HGA$, $\angle AGE$?

B. What is the relationship between $\angle AGH$ and $\angle GHD$? Explain how you know.
APPENDIX D: INSTITUTIONAL REVIEW BOARD DOCUMENTS

Application for Exemption from Institutional Oversight

Unless qualified as meeting the specific criteria for exemption from Institutional Review Board (IRB) oversight, ALL LSU research projects using living humans as subjects, or samples, or data obtained from humans, directly or indirectly, with or without their consent, must be approved or exempted in advance by the LSU IRB. This form helps the PI determine if a project may be exempted, and is used to request an exemption.

Applicant, Please fill out the application in its entirety and include the completed application as well as parts A-F, listed below, when submitting to the IRB. Once the application is completed, please submit the completed application to the IRB Office or to a member of the Human Subjects Screening Committee. Members of this committee can be found at: https://research.lsu.edu/Compliance/Policies/Procedures/InstitutionalReviewBoard%20BB%20%20%29/item24737.html

A Complete Application Includes All of the Following:

(A) A copy of this completed form and a copy of parts 3 thru F
(B) A brief project description (adequate to evaluate risks to subjects and to explain your responses to Parts 1 &2)
(C) Copies of all instruments to be used.
If this proposal is part of a grant proposal, include a copy of the proposal and all recruitment material.
(D) The consent form that you will use in the study (see part 3 for more information)
(E) Certificate of Completion of Human Subjects Protection Training for all personnel involved in the project, including students who are involved with testing or handling data, unless already on file with the IRB. Training link: (http://php.nihtraining.com/users/login.php)
(F) IRB Security of Data Agreement (http://research.lsu.edu/files/item26774.pdf)

1) Principal Investigator: Lorena A. Java
Rank: Graduate Student
Dept: MNS
Ph: 225-341-0700
E-mail: javaloren@gmail.com

2) Co-investigator(s): please include department, rank, phone and e-mail for each
If student, please identify and name supervising professor in this space
Ameznizani Harhad
LSU Instructor, Mathematics
225-578-1665
E-mail: aharhad@lsu.edu

3) Project Title: Learning Strategies to Enhance the Metacognitive Skills of Gifted Students

4) Proposal? (yes or no) No
If Yes, LSU Proposal Number
Also, if YES, either
☐ This application completely matches the scope of work in the grant
☐ More IRB Applications will be filed later

5) Subject pool (e.g. Psychology students) Middle School Gifted Students in Baton Rouge, La
*Circle any "vulnerable populations" to be used: children < 18, the mentally impaired, pregnant women, the aged, others. Projects with incarcerated persons cannot be exempted.

6) PI Signature Date 7/24/13 (no per signatures)

** I certify my responses are accurate and complete. If the project scope or design is later changed, I will resubmit for review. I will obtain written approval from the Authorized Representative of all non-LSU institutions in which the study is conducted. I also understand that it is my responsibility to maintain copies of all consent forms at LSU for three years after completion of the study. If I leave LSU before that time the consent forms should be preserved in the Departmental Office.

Screening Committee Action: Exempted ✓ Not Exempted Category/Paragraph

Signed Consent Waived?: Yes ☐ No √
Reviewer Mathews Signature Date 8/4/13
Parental Permission Form

Investigation on determining the learning strategies to enhance metacognitive skills of gifted students

Project Title: Learning Strategies to Enhance the Metacognitive Skills of Gifted Students
Performance Site: Westdale Middle School
Investigators: The following investigator is available for questions M-F, 8:00 a.m.-3:30 p.m.
Lorena Java
L.java@absschools.org
Westdale Middle School
(225)924-1308 / (225)341-0700

Purpose of the Study: To investigate if there are significant learning gains between gifted students who work in the small group vs. students who work individually.

Inclusion Criteria: Westdale Middle School Gifted Students

Exclusion Criteria: None

Description of the Study: At the beginning of the school year, all the participating students will be administered a pre-test to determine their level of metacognitive awareness, metacognitive skills and mathematics skills. Then, the experimental group will complete their assignment as small group while the control group will do their task individually. At the end of nine weeks the same students will retake (post-test) those tests to determine if there are significant learning gains between gifted students who work in group vs. students who work individually.

Benefits: The teachers will be aware of what learning approach the students will learn effectively. Students may be offered bonus points for completing the pre and post tests.

Risks: There are no known risks.

Right to Refuse: Participation is voluntary, and a child will become part of the study only if both child and parent agree to the child’s participation. At any time, either the subject may withdraw from the study or the subject’s parent may withdraw the subject from the study without penalty or loss of any benefit to which they might otherwise be entitled.

Privacy: Minimal information will be gathered. Specifically information from the pre and post-tests results. Moreover, the results of the study may be published, but no names or identifying information will be included for publication. Subject identity will remain confidential unless disclosure is required by law.

Financial Information: There is no cost for participation in the study, nor is there any compensation to the subjects for participation.

Permission

The study has been discussed with me and all my questions have been answered. I may direct additional questions regarding study specifics to the investigator. If I have questions about subjects’ rights or other concerns, I can contact Robert C. Mathews, Chairman, Institutional Review Board, (225) 578-8682, info@lsu.edu, www.lsu.edu/irb. I will allow my child to participate in the study described above and acknowledge the investigator’s obligation to provide me with a signed copy of this consent form.

Parent’s Signature: __________________________ Date:

Student Signature: __________________________ Date:

Study Exempted By:
Dr. Robert C. Mathews, Chairman
Institutional Review Board
Louisiana State University
203 B-1 David Boyd Hall
225-578-8682 / www.lsu.edu/irb
Exemption Expires: 8/13/2016
Child Assent Form

I, ________________, agree to be in a study to find ways to help gifted children enhance their metacognitive skills. I will have to do special school work to aide my teacher’s research work. I will do math work with the group or by myself. Sometimes I may get to play a game with another student. I have to follow all the classroom rules of Westdale Middle School, specially when I am working with my teacher and classmates. I can decide to stop being in the study at any time, and it will not affect my ability to remain at Westdale Middle School.

Child’s Signature: ___________________________ Age: ______

Date: ___________________________ Witness* ___________________________

(Parent or Guardian)

Date: ___________________________

* (N.B. Witness must be present for the assent process, not just the signature by the minor.)

Study Exempted By:
Dr. Robert C. Mathews, Chairman
Institutional Review Board
Louisiana State University
203 B-1 David Boyd Hall
225-578-6692 / www.lsu.edu/irb
Exemption Expires: 8/13/2014

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VITA

Lorena A. Java is a native of Cebu, Philippines. She received her Master of Education – Mathematics at Cebu Normal University in 2007 and her bachelor’s degree at University of San Carlos, Cebu Philippines in 2002. Upon graduation, she has dedicated her years in teaching high school mathematics. And in August 2008, she got accepted to teach in East Baton Rouge Parish School System. She will receive her master’s degree in August 2013 through the Louisiana Math and Science Teacher Institute (LaMSTI) program at Louisiana State University. The LaMSTI experienced has motivated her to pursue her doctorate degree as well as continue teaching upon graduation.