

**Traditional Whole Group Math Compared to Tabor Math Rotation
and Second Grade Math TCAP Scores.**

A Thesis

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By

Marcie Amanda Love

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Chapter One

Introduction to the Problem

East Side Elementary School, in Chattanooga, Tennessee, has adopted a new strategy to teach Math for the 2006-2007 school year. Tabor Rotation was introduced by Glenna Tabor, Consulting Teacher and Designer, as a way to focus on student's individual needs by small group instruction rather than traditional, whole group instruction driven by textbook, worksheets, and board work. This study will look at the differences, if any, in TCAP math scores from the 2005-2006 school year, when cohort 1 did not participate in Tabor Rotation Math and the 2006-2007 TCAP math scores after cohort 2 participated in Tabor Rotation.

Problem Statement

Will the difference, if any, in TCAP math scores increase after receiving Tabor Rotation during 2006-2007 and TCAP math scores that did not receive Tabor Rotation Math during the 2005-2006 school year?

Will the differences, if any, between male and female second grade students TCAP math scores change after receiving Tabor Rotation Math instruction?

Significance of Study

To the author's knowledge there have been no independent studies done on Tabor Rotation. There have been no published journals written. If so, this study will fill the void in the literature. If this particular study can show some difference, if any, in the TCAP scores, it may be most helpful in determining which approach to teaching math is most effective. The goal of this study is to determine if there is any difference in TCAP test scores using Tabor Rotation

Math instead of Whole Group Traditional Math, if there is proof of higher scores, it would be beneficial to adopt Tabor Math Rotation in other schools.

Hypothesis

The difference, if any, in Second Grade TCAP math scores between using traditional, whole group math instruction and Tabor math rotation will not be the same during the 2005-2006 and 2006 - 2007 school years.

Limitations

This study is limited to East Side Elementary of Hamilton County in Chattanooga, Tennessee. Since this is an ex post facto, meaning the data already exists, or causal-comparative research study the basic limitations should be recognized:

1. The independent variables cannot be manipulated.
2. Subjects cannot be randomly, or otherwise, assigned to treatment groups.
3. Causes are often multiple and complex rather than single and simple (Best & Kahn, 2003).

Other limitations that should be examined are the length of the study since only one year per treatment is assessed here. The teacher's style of teaching math in the ninety minute allotted time period should be examined. The learning styles of the children when presented with whole group instruction and small group instruction are important also.

Definitions

Tabor Rotation – a method using small-groups to teach mathematical concepts. The method that differentiates all instruction, engages children in practical, hands-on, meaningful activities that teach the concepts beginning with what is familiar to the students from their world and making connections to state competencies and test language.

T.C.A.P. – this is the Tennessee Comprehensive Assessment Program (TCAP), otherwise known as Terra Nova. An achievement test administered to students in grades 2-8 that measures the content area of math according to Tennessee’s State Curriculum.

Title 1 - Federally funded programs in high poverty schools that target children with low achievement (<http://www.k-12.state.tn.us/rptcrdterms.htm>).

Procedures

This study will be conducted by using second graders from East Side Elementary in Chattanooga, Tennessee. The first group will be from the 2005-2006 academic school year. This will be the control group for the research. This group has been taught math using the traditional, whole group instruction mainly from the Everyday Math program used. The second group will be from the 2006-2007 academic school year. They will be the experimental group. This group will have been taught math using Tabor Rotation. The first step will be to observe and analyze the 2005-2006 TCAP scores and categorize the males and females. The second step will be to observe and analyze the 2006-2007 TCAP math scores and group the same way. These two sets of scores will be compared in order to determine if test scores had any change due to Tabor Rotation being implemented into the Everyday Math routine. The existing data will be placed into a Microsoft Excel spreadsheet.

Sample/Population

A vast majority of the students at East Side Elementary come from a low socioeconomic background. East Side, a Title 1 school, consists of 96% students that receive free or reduced lunches. 98.5% of the students are economically disadvantaged. The school is made up of 26 (4.4%) Caucasian students, 364 (61.4%) African American students, and 202 (34.1%) Hispanic students. The school has approximately 600 students on roll. The research will be done on the

second grade from 2005-2006 and 2006-2007. The TCAP test scores will be looked at based on male and female.

Design

The design of this study will consist of descriptive, causal-comparative research since the events have already taken place. I will be studying the effects and test scores of two different teaching strategies on student achievement and TCAP scores. The data will be grouped into males and females. I will do this comparison using the same grade level, just different academic school years, however; different academic school years will be used.

Materials

Materials needed for Tabor Rotation are as follows:

- Manipulative- this center requires concrete objects such as unifix cubes, any kind of counters, base ten blocks, plastic and/or real coins, number generators (dice), etc.
- Application- this center required math journals, workbooks that contain previously learned skills.
- Games- this center requires students to compete against themselves or another person(s). The materials needed for this center consist of teacher made games or everyday math game kits. Computers may also be used at this center.
- Teacher Time- The teacher and students may use items such as literature books that have mathematical correspondence to a specific skill, manipulatives, and paper/pencil activities. The teacher determines what is needed at this center based on the student's individual needs.

Data Collection

The TCAP math scores will be collected for the 2005-2006 second grade academic school year and 2006-2007 second grade academic school year. The study will use student identification numbers to ensure student protection and privacy. Students will be categorized by treatment (traditional whole group math instruction compared to Tabor Rotation math instruction), gender, and second grade TCAP math scores. This data will be collected and organized using a Microsoft Excel spreadsheet.

Measurement and Instrumentation

“The purpose of the TCAP test is to provide users with norm referenced and criterion-referenced information on concepts, processes, and skills taught throughout the nation”. The test reports a developmental scale score, which ranges from approximately 100 to 900 and can be used to track student progress across the grade levels.

Reliability coefficients for the Complete Battery test ranges in the upper .80s to the lower .90s, given that the test has more items for each subject area (i.e. Math). Content validity was based on the correspondence between the test and instructional content (Mental Measurements Yearbook 1997 [6]).

Data Analysis/Statistical Procedures

This study is a two-way analysis of variance. The TCAP scores for both academic years as well as gender will be organized into a Microsoft Excel spreadsheet. The dependent variable will be the second grade math scores on the TCAP assessment. By completing a two-way analysis of variance, I am able to compare the control group (traditional whole group math instruction) and the experimental group (Tabor Rotation math instruction), organized by gender and academic school year. This study is an effective way to determine whether the means of

more than two samples are too different to attribute to sampling error (Best & Kahn, 1998).

These variables will be tested at the .05 level to discover any significant differences. If any of the interactions are significant, the appropriate cell means will be calculated, plotted, and interpreted.

Chapter Two

Review of Literature

There is no known literature that compares these two studies. There is research on ability grouping, differentiation, pre-teaching and re-teaching, and whole-class, or traditional, teaching covered in this paper. Studies have also been conducted, in some Texas schools that have shown the benefits of Ms. Tabor's ability to turn educational research into teacher friendly strategies. These strategies give a huge payoff, which is incredible student achievement. Ms. Tabor is currently in the process of writing her first book about Tabor Rotation; however, there is a DVD that demonstrates how to effectively implement Tabor Rotation Math into an everyday schedule.

Effects of ability grouping on academic achievement and self-concept of African-American and White students.

In this article, a study was conducted of the effects of ability grouping on academic achievement and self-concept among African-American and white students. This demonstrated that ability grouping and increased African-American student participation in the top-achiever groups can co-exist. There have been questions pertaining to the relative advantages and disadvantages of ability grouping. A lot of sentiment and research, both pro and con, concerning the merits of ability grouping have been recorded in this article. Review of past literature and syntheses have criticized the research designs and do not support the practice of ability grouping in increasing academic achievement, but the average educator seems to be convinced of its merits (Holmes & Ahr, 1994). For this very reason, educators still use the practice of ability grouping throughout the United States. Theoretically speaking, homogeneous ability grouping used for instruction is supposed to help reduce the wide range of variability in instructional

classes, and thus, permitting teachers to work more effectively with these groups of students nearly equivalent in their academic abilities.

Achievement testing is the major tool used for assigning students to ability levels. Since test scores tend to be different for students along the lines of race and social class, an unfortunate side effect of ability grouping has been the concentration of African-American students into lower achievement classes in increasing numbers far larger than their percentage of the school enrollment (Holmes & Ahr, 1994). A question that has been asked is whether differential percentage distributions of African-American and white students, grouped by ability, are related to outcome measures.

The study reported here measured the achievement and self-concept of African-American and white students when ability grouped into racially mixed classes in numbers approximately equaling their percentage of the school population as opposed to being ability grouped solely by achievement test score. The sampling procedure for this study consisted of 220 seventh-grade students enrolled in the only middle school in a small independent system in Georgia. The student population represented a mixed array of socio-economic statuses. The study included only those subjects that met the following criteria:

- Students who took the Iowa Test of Basic Skills (ITBS) as sixth graders (scores needed for stratifying and grouping purposes).
- Students who were not retained in seventh grade.
- Students who were not currently being served by special education services during mathematics or reading (these students were participating in individualized educational programs).
- Students enrolled at the start of the year (only those enrolled at the start of the year were randomly assigned at that time) (Holmes & Ahr, 1994).

These specific criteria were an essential part of the study to ensure that the complete data was available for each individual, and that random assignment to an experimental and control group and assignment to ability groups could be accomplished. Of the 220 chosen, only 204 met these necessary conditions for inclusion in this study. Of the participants, 44 percent were African-American. The students were assigned to two instructional teams using stratified random sampling. This was accomplished by rank ordering the 204 students separately by ITBS scores in math and reading. The subjects were also coded by racial ethnicity. After they were ranked and coded, they were assigned to two instructional teams by achievement level and race, to ensure that the two groups were as alike as possible. The experimental and control conditions were then assigned randomly. Only 174 participants completed the experimental year due to 30 students transferring out of the school system.

For the treatment, the experimental group was ability grouped into racially mixed classrooms in numbers approximately their percentage in the school population. The experimental group's percentage of African-American students remained relatively constant across the classes. The percentage of African-American students ranged from 3.8 percent to 93.7 percent across the control class. This difference was the result of the basis that the control group was ability-grouped solely on the basis of test score data. The highest achieving class consisted of 96.2 percent white, while the lowest achieving class contained 93.7 percent African-American students. All participants in each group received a total of one hour and fifty minutes of daily instruction in the academic areas of mathematics and reading. Two-way analyses of variance were used to test the hypotheses. The two main effects investigated were treatment-group membership and race, as the research addressed a possible interaction between the two.

Results show that when the ITBS scores were used as the dependent variable, no statistically significant difference was observed between the treatment groups, and no significant interaction was observed. If equality of educational and equal access to knowledge is a

fundamental basis of the educational system, then educators must look at the current state of ability grouping throughout the nation's schools. The results of this study show that the continued practice of ability grouping, frequently demanded by parents of high-achieving students, can co-exist with increased African-American student participation in the top-achieving groups.

Grouping and Achievement in Cooperative Learning

Cooperative learning is a very powerful teaching technique that has been shown to increase student achievement in a wide variety of studies (Baer, 2003). This type of learning is most often associated with heterogeneous grouping. When students are grouped for instruction based on past achievement, this is a controversial practice. High-achieving students normally achieve more when grouped homogeneously; therefore, the outcome for low-achieving students is more varied. Even though homogeneous and heterogeneous grouping is normally based on previous achievement at all grade levels, heterogeneous grouping is more common in elementary schools and homogeneous grouping is more widely accepted in secondary schools.

Some studies have compared the effects of different grouping practices, academic achievement is typically measured by grades in particular subjects, teacher recommendations, and/or test scores, and the subjects of such studies generally represent a wide and normally distributed range of student achievement (Baer, 2003). Comparisons in these groups are normally done in groups of high, average, and low in many studies. The majority of the effects of cooperative learning have been conducted in elementary and secondary schools. The impact of cooperative learning methods is different when used with college-aged students. An example of these differences is the use of group incentives is very crucial to the success of cooperative groups in the elementary school setting, but group incentives do not appear to influence achievement in the college-level cooperative learning studies (Baer, 2003).

So what exactly are the differences between homogeneously and heterogeneously grouped cooperative learning groups? This is actually one area where there has been little research even at the elementary school level, maybe because of the strong assumption in cooperative learning about the importance of heterogeneous groups to promote social interaction among groups that often do not interact under less-structured environments. The use of homogeneous learning groups has been rather unusual. The fact that almost all of the cooperative learning methods promoted in the past three decades, and almost all of the research on the effectiveness of cooperative learning, have used heterogeneous grouping (Baer, 1996). Even though almost all of the evidence looks at the importance of heterogeneous grouping in cooperative learning, there is actually little evidence of its effectiveness in comparison to homogeneous grouping. The little research that has been done in the elementary and secondary school setting sees a pattern similar to that found in non-cooperative learning settings: high achievers do much better in homogeneous groups; in the average and low achievers there is little difference between students in heterogeneous and homogeneous groups. Some high-achieving students often time have a poor attitude toward heterogeneous group work.

This study compared the impact of heterogeneous and homogeneous cooperative learning groups on achievement in an undergraduate setting. The purpose of this study was to compare the effects on achievement of placement in homogeneously versus heterogeneously grouped cooperative learning groups. This study was designed to allow overall comparisons of achievement as well as comparisons of the achievement of low, average, and high-achieving students in two kinds of groups. The study was conducted over the course of three semesters using 137 participants in six sections of an educational psychology class at a private liberal arts college with a large teacher-preparation program. These students' chosen had an average combined SAT score of 1060, with a minimum GPA of 2.5. The sample group was largely white (94 percent) and female (91 percent). Of the students who participated, 68 were assigned to

homogeneously grouped teams and 69 were assigned to heterogeneously grouped teams based solely on early achievement in the course. Six teams were formed of three or four students each based on the results of a multiple-choice quiz given during the fourth week of the fourteen-week course. Prior to this quiz, students had been randomly assigned to a team, and one week after the quiz, new teams were formed. All teams were given the same assignments. A typical assignment was to discuss a question given by the professor. The question generally asked the students things such as simply think and share ideas about some random topic, analyze an argument, critique a research design, or evaluate a conclusion, and finally apply a concept. The groups were occasionally asked to turn in a written response, which was unusual since these were never graded. Since the students were placed in classes randomly and random assignment was used to determine which classes received homogeneous or heterogeneous grouping, extraneous variables can be safe to assume to be equal between these two groups. The outcome of this study shows the multiple-choice portions of the midterm and final examinations. The homogeneous group outperformed the heterogeneously group significantly on the final examination and at a level of borderline statistical significance ($p < .10$) on the midterm exam. For the average and high achievers, homogeneous grouping was clearly preferable which led to substantial differences on the final exam between both groups. These results suggest that when using cooperative learning, homogeneous grouping in an undergraduate course results in higher achievement than heterogeneous grouping. The levels of statistical significance obtained strongly suggest that these differences were not the result of merely chance, but rather represent real differences.

The Development of the Idea of Mathematical Proof: A 5-Year Case Study

This is a longitudinal case study that presents a sequence of episodes that follow the mathematical thinking of one child, Stephanie, over a five-year period in grades 1 – 5. Stephanie did some small-group, whole-class, and individual interview work throughout this study. The

events indicate her progress in classifying, organizing, and reorganizing data. This study provides some significant insight to the process by which Stephanie learned to make proofs, within a setting that encouraged the development of her own ideas. The article states that there is increasingly more evidence that students, when presented with a problem task in a small-group setting, begin by constructing personal representations of the problem or, in attempting to do so, discover that they cannot. Many times these children end up initiating conversation with other peers and compare their ideas. This article found that when children have had sufficient time to work on an activity and when they are encouraged to share and discuss their own findings, unresolved differences frequently surface (Maher & Martino, 1996).

Many times certain incidents encourage students to open up conversation in the classroom. These include opportunities for students to work in a variety of social settings, flexibility in the curriculum for students to continue working on a problem, and teacher restraint from telling students what to do, just to name a few. Maher and Martino state that significant prior research on the development of justification and proof has focused either on the study of children in middle school or the study of students ranging from the upper elementary to the college level. The school, Kenilworth Public School, where Stephanie attended school teamed up with Rutgers University in 1984. The intent of this partnership was to establish learning environments where children would be actively engaged in their construction of mathematical ideas. The classroom teachers also set out to establish learning environments that aided in the importance of multiple settings and opportunities for children to explore their own ideas.

A class of 18 first-grade students became the subjects of a long-term longitudinal study initiated in 1989 and still continues today. These children represent the range of ability in this particular classroom. Six students were chosen as subjects for a case study. The children were videotaped doing mathematics, and they were interviewed individually or in small-groups during their first-through fourth-grade years. The long-term study included three of the original six

students and several others. In addition to the small-group setting in the classroom, individual follow-up interviews and small-group assessments are conducted as another way of gathering information about the subject's thinking. The case study followed Stephanie's development over the period from grade 1 through 5. The data consisted of videotapes, portfolios, and researcher notes from class lessons, student interviews, and small-group evaluations over the 5-year period. The results of this case study were analyzed using 11 critical events. The long-term case study enables the researchers to have a better understanding of the development of mathematical reasoning as a process rather than as a skill that is directly taught and acquired in formal ways. Maher and Martino state that the longitudinal case study of Stephanie has brought researchers one-step further in documenting how a student was successfully empowered in building the idea of mathematical proof over time.

Grouping Students for Increased Achievement

Placing students in classes according to intellectual ability is another common grouping practice (Holloway, 2001). When looking at the impact of having classmates with the same or different intellectual abilities, homogeneously grouped gifted students performed at a higher level than those that were grouped heterogeneously (Holloway, 2001).

In a study of multi age classrooms it was found that classes with a study age difference of 3 years showed consistently positive results. The overall effect, the median effect, showed that on achievement in multi age classrooms was +0.50, which showed a significant correlation between the use of the grouping and positive results were seen. Among all of the participants, research showed that smaller effect sizes for socialization (+0.02) and (+.011) for psychological adjustment. These results clearly show an academic advantage and no negative social and emotional effects for multi page grouping. Research also found that the diversity in a multi page classroom could benefit underachievers because a teacher that is committed to this grouping

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arrangement is more apt to know how to teach students at varying developmental levels. This study looked at only one activity where ability grouping was used. It was reported that research studies do not support full-time ability grouping. The study had two conclusions: average to below average students, of all races, can achieve academic success and prosper in a more rigorous academic environment and that midrange minority students perform as well as, or better than, white students in a curriculum that retracks general students into a college-preparatory curriculum (Holloway, 2001). Small group instruction is rewarding for students of all ability levels. It is more beneficial for high-ability students than for lower-ability students, and more helpful for elementary students than for university or college students (Holloway, 2001).

Effects of pre-teaching and re-teaching on math achievement and academic self-concept of students with low achievement in math.

This article states that low achieving students continue to be a growing population in schools. These needs of low achieving students in math alone tend to represent 4% to 7% of students (Lalley & Miller, 2006). Low achievers are labeled as students who are performing one to two years below grade level. As these low achievers fall further and further behind in their academics, effective instructional teaching strategies have become more important.

Supplemental instruction can be provided before (pre-teaching) and after (re-teaching) upon initial exposure to the academic content in the classroom. This article states that re-teaching is a very common strategy used for helping students acquire previously non-mastered academic material. Re-teaching is used to help increase academic achievement for low achieving students. A previous study by Hock found that post-instruction after-school tutoring (re-teaching) effectively increased math performance for low achieving students.

Lalley states that research involving the development and identification of effective math instruction has become of far greater importance due to increased attention on math standards.

The purpose of this study was to examine and compare the effectiveness of pre-teaching and re-teaching on math achievement and academic self-concept of students identified as having low achievement (Lalley & Miller, 2006). The study consisted of 24 academically low-achieving third-grade students from a suburban Western New York district. The sample included 20 females and 4 males. The samples were from three elementary schools in this particular district. They were selected based on similar socio-economic and ethnicity. Two instruments were used as assess the effectiveness of pre-teaching and re-teaching. The Iowa Test of Basic Skills (ITBS) and the Perception of Ability Scale for Students (PASS) were both used to measure academic self-concept. Each of the three schools used to two treatment conditions (pre and re-teaching). Students who met the criteria of inclusion were randomly assigned to one of the two intervention groups implemented in each school using stratified procedure based on gender and their qualification for free or reduced lunch. The breakdown of the results was 13 in the pre-teaching condition and 11 students in the re-teaching condition, and 6 teachers (3 pre-teaching and 3 re-teaching). The study took place over a 28-week period. A between-subjects, repeated measures MANOVA using the factor treatment (pre-teaching and re-teaching) was conducted to determine the effect of teaching method on the nine dependent variables. The multivariate result for treatment x time was not significant, thus indicating no significant differences between the groups, while the effect of time was significant, indicating that the entire sample had made significant gains from pre-test to post-test. The results indicated that both methods of instruction, pre-teaching and re-teaching, resulted in significant increases in math concepts, math problems, and math computation for low achieving third-grade students. Results from this study confirmed and extended the existing research on supplemental instruction. Lalley states the findings showed that both pre-teaching and re-teaching were effective in promoting achievement consistent with previous research indicating that supplemental instruction effectively improves achievement among low achievers. These results were based on a small sample of

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predominantly female third-grade students with low achievement. While stratified random assignment was used to generate comparable groups, the small sample from a single suburban school district restricts generalizations. The limitation appears most relevant to math achievement as students might be expected to make giant gains over the course of a typical school year. Lalley also states that the weaknesses identified for the current study should be considered in future research designs addressing this topic.

Students Perceptions of Learning and Success in Small Groups: A Case Study in Middle School Mathematics

Cohen defines cooperative learning as students working together in a group small enough so that everyone can participate on a task that has been clearly assigned. Cooperative learning is an extremely important part of the learning process when teaching mathematics. Cooperative learning is based on the idea that an individual can succeed only when the whole group succeeds (Nation, 2003). The students are required to not only learn academics, but also to learn how to work together to help each other learn.

Cooperative learning is not cooperative learning if students just sit together in groups and work on problems individually or let one person do all the work. Larowitz (1995) suggests that traditional whole-class instruction is not an effective way for students to academically or socially interact in a classroom because such integration encourages individualistic and competitive learning that usually only benefits strong students. Being in small groups allows students the opportunity to take safer risks compared with whole-class or traditional settings. A smaller group presents a less threatening environment where the sharing of thoughts and ideas is less difficult (Nation, 2003).

The purpose of this study is multifaceted. Nation states he became interested in learning about students' perceptions of a new mathematics program. He also wanted to learn about how

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individuals with different ways of understanding work together in small groups to achieve the objectives of an assignment in order for completion. The methodology of this study was founded on a qualitative inquiry approach, states Nation. Nation used surveys and questionnaires to present his study and his data. After completing different assignments in the classroom, he asked student's to give input on the strategies of learning in small groups. Some students stated advantages of working in small groups, and other stated disadvantages. Some students surveyed stated that "I was more successful because I learned to discuss it with others" or "I love working with people because they think differently." Other students surveyed stated, "I work better by myself" or "when someone doesn't listen or try to help, the group isn't as successful" (Nation, 2003). Therefore the survey showed, that in order for cooperative groups to be effective, students need to realize what it takes to reach a common goal.

A Comparison of Hands-On and Traditional Approaches for Teaching Eighth Grade Pre-Algebra

Silvis states that the purpose of this study was to determine if a hands-on approach to teaching mathematics improved student achievement and student attitudes toward mathematics more than a traditional approach. A pre-test-post-test nonequivalent control group design was used with the subjects being selected from six intact classes of eighth grade pre-algebra students from two different schools within the same school district in western Pennsylvania. Selected teachers that were chosen attended a weeklong summer workshop called HOME PLaTe (Hands-On Mathematics Education for Pennsylvania Learning and Teaching) (Silvis, 2007). The teachers explored ways to use more interactive activities within their mathematics lessons, and implement these strategies during the following school year.

The Mathematics Achievement Hypothesis was as follows: eighth grade pre-algebra students in the experimental group (who experienced hands-on instructional strategies) will have

higher scores on the eighth grade PSSA mathematics exam compared to eighth grade pre-algebra students in the control group (who experienced traditional instructional methods). Silvis states that the characteristics of hands-on instructional approaches can be summarized as being student-centered, with students assuming an active role in the classroom as they become engaged in the learning process. Students become active learners when they engage with hands-on materials in order to understand mathematical concepts (Silvis, 2007).

The research study is significant for several reasons. The end results of this study could influence instructional practices for other teachers. The results may also influence professional development practices. Silvis states that some teachers go to these professional development trainings, but do they incorporate what they learned within their lessons afterwards? Finally, the results of this study will bring the affective domain of instruction to the forefront. Researchers have indicated a pattern of increasingly negative attitudes towards mathematics as students' progress through their school years, which has been attributed to the traditional mathematics curriculum (Silvis, 2007).

Five research studies were conducted in order to investigate how hands-on instructional techniques compare with traditional instructional methods and to evaluate the methods utilized in each study. The classes studied consisted of a first grade mathematics classroom, a third grade geometry unit, a third grade multiplication unit, an accelerated high school mathematics and science program, and craft projects in elementary school. Silvis states overall, four of the five studies concluded that hands-on instructional methods improved student achievement. Three of the four research studies with positive academic achievement results for hands-on instructional methods utilized some form of standardized testing to measure student academic achievement.

Other research studies have concluded that traditional instructional methods limit students' ability to apply their mathematical knowledge, because the students are only familiar with solving problems to the examples given in school, and these students have not had the

chance to experiment with an open-ended problem solving approach. The hands-on instructional methods observed during this research study were evidence that students had more time to explore mathematical concepts in classrooms instructed by a teacher who had attended HOMEPLaTe.

Differentiated Instruction in Mathematics

This study was conducted in a New York City suburb school with a population of approximately 11,000 people. This particular study occurred in the elementary school that housed an estimated 550 students, and 75 staff members. Since one and only one method of teaching cannot address all the different needs of children, educators must expand their knowledge and explore a variety of ways to achieve student success through different teaching strategies. Stager suggests that the need of this study was to determine if differentiated instruction could be effective in increasing student knowledge of mathematical fractions. The conclusion of this study was that children needed to make a real life connection to fractions, but they did so in different manners, thus emphasizing that differentiating instruction for advanced concepts is necessary for student understanding (Stager, 2007).

Sixteen third grade students were chosen from the same classroom and participated in this study. Half were female and the other half were male. Two of these students received English as a Second Language (ESL) instruction Monday through Friday for 45 minutes everyday. The researcher was the actual teacher of this class. The study was conducted over a 5-week span with 45 minutes spent studying fractions everyday. Throughout this study, students received a daily mini-lesson from this teacher/researcher and completed tiered activities, which consisted of worksheets and workbook pages relating to the skills taught during the lessons (Stager, 2007). During the first week, the pre-test was given and the students were separated into their groups. The second week was for the students to compare fractions and solve word

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problems containing fractions. The third week consisted of student understanding of equivalent fractions, reducing fractions, and changing improper fractions into mixed numbers. In the fourth week, the students solved fraction number models using addition and subtraction, as well as reviewed previously learned skills. The fifth week the post-test was given, questionnaires and interviews were conducted as well.

The study incorporated testing to numerically evaluate student knowledge. Triangulating data allowed this researcher to obtain both quantitative and qualitative research (Stager, 2007). Results of the pre-test enabled this researcher to separate students according to ability. Four students achieved in the 0 – 40% range and were considered the basic group, or group A; six students achieved in the 41 – 60% range and were considered the average group, or group B; and 6 students achieved in the 61% and above range and were considered the intermediate group, or group C (Stager, 2007). Group A showed the largest gain with an increased test score of 30%; however, the standard deviation increased from 4.1 to 21.8, thus, indicating that some students in this small group still struggled with the concept of fractions. There was one child that showed no improvement. Groups B and C also made some respectable gains of 29.8 and 20 percentage points. Most of the students increased their scores from 11 to 24 points. One child only made a 2 point increase from the pre-test to post-test. The results of this study suggested that tiered activities may have helped motivate students to learn fractions. Not all students achieved mastery, but all three groups made considerable gains in their mean test score (Stager, 2007). Stager states that this study was limited in certain ways. Throughout the study, students were absent. The school was also closed for 2 days. The students in this study were placed in homogeneous groups based on ability. Differentiated instruction can also be implemented with mixed ability groups (Stager, 2007).

Does Whole-Class Teaching Improve Mathematical Instruction

There have been many viewpoints on this issue of traditional, whole-class teaching. Some say, yes, whole-class teaching improves mathematical instruction by cutting down on preparation time for teachers and providing teachers with a consistent method to assess student development. Others have said, no, whole-class teaching does not improve mathematical instruction; it is inefficient and ineffective except in situations where class size is very small and student ability falls into a narrow range (Paradise, 2007). This brings us the well-known question, how much is too much? Should class-time center around whole-class teaching methods, or should it be tailored toward individual needs? (Paradise, 2007)

Success is measured in a number of ways. Many times, test scores are used to measure success, which is otherwise known as academic achievement. In this article, it is pointed out that in Korea; an average class size is made up of 40 or more students. Some would say this allows teachers to implement a bigger variety of non-traditional teaching strategies more effectively. Success is also measured in ways such as student's confidence levels and ability to apply knowledge to real-life situations (Paradise, 2007). For many of the math-phobic and shy students, small-groups might allow these students to ask questions that might otherwise be too uncomfortable to ask in front of an entire class. Many students despise asking what many may consider a stupid question and would rather sit silently than look foolish in front of their peers. When the question is whether or not whole class learning is the best approach to teaching mathematics, one must think about the feasibility of class participation as a key element in the learning process (Paradise, 2007).

A teacher's job is to create an environment where learning can take place, but how does each teacher do that when students enter a classroom at different academic levels? Or should teachers focus on the detail work, breaking mathematical analysis up into smaller bits in the hope that individual needs will be met? (Paradise, 2007)

Mathematics can be taught in a variety of ways. Some content may be best taught using the whole-group method, while other areas may need that small group attention. Paradise states that the non-traditional approach embraces active rather than passive learning, which is said by some to bring an element of excitement into the classroom. Mathematics is taught separately from other courses in a traditional classroom setting. Math is somewhat force-fed to students as a set of necessary skills, and this type of force-feeding for the most part, turns off the majority of students (Paradise, 2007). Even though nontraditional teaching methodologies, including whole-class learning, are important new tools in the teaching of mathematics, older, traditional techniques still have an important place in the classroom. Homework, quizzes, and assessments, although often very unpopular, often act as motivators in a highly diverse classroom (Paradise, 2007). When students are divided into diverse groups in math classes, this gives everyone an opportunity to be exposed to a challenging curriculum. Paradise states that the best way to teaching mathematics is to combine traditional and nontraditional arrangements of students, individual, pair, small-group, and whole-group teaching so that all will become well versed in math, and to feel comfortable with their ability to perform necessary math skills.

A Comparison Study of Achievement Results Between Teacher-Centered and Student-Centered 9th-Grade Algebra Classrooms

In this article, Cathy Seely of the National Council of Teachers of Mathematics (NCTM) suggested that by looking at who's doing the talking in the classroom, the effectiveness of the instructional approach being used in the mathematics classroom can often be determined. In most classrooms, teachers lecture and students listen. Seely stated, in her 2005 presidential address, that this teacher-centered approach leads to lower achievement results. Many teachers do not plan their time and teach their lessons in ways that may help children learn. Many high school mathematics teachers do not use instructional strategies suggested by the reform

movement that support student-centered instruction (Granás, 2007). They believe that the traditional teacher-centered approach leads to higher achievement results that are measured by standardized achievement tests. This study was conducted on 9th grade algebra students in a suburban district of Colorado. Teachers used primarily teacher-centered instructional approaches during the 2004-2005 school year. 9th grade algebra students in the same district, where teachers used a primarily student-centered approach during the same academic school year were also used.

Granás states that despite the research showing that learning is increased when the classroom culture actively supports successful engagement of students in higher-level thinking and reasoning and despite materials developed by the NCTM, the reality of many classrooms continues to be that the teacher is the main active participant. The teacher is seen or looked at as the speaker of knowledge. The lessons should only follow the pattern that the teacher shows. The teacher assigns a lesson, and the students do the work. The purpose of this study was to compare student achievement scores on a district end-of-course algebra examination between students of teachers who used a primarily teacher-centered instructional approach and students of teachers who used primarily student-centered instructional approach. Granás, (2007) states that should the results of the study indicate that algebra achievement resulting from student-centered instruction as measured by the district end-of-course exam was equal to or greater than achievement resulting from teacher-centered instruction, district teachers who had been reluctant to respond to reform-based recommendations might reconsider. The scores from the two identified student data sets were compared to see if any statistically significant differences were found on the district's end-of-course algebra assessment (Granás, 2007). Results showed there appeared to be a lack of research data reflecting the connection, if any, between mathematics education reform and achievement measured by traditional achievement assessments.

Area Teachers and Students are Making the Most of Their Mathematical Minutes

Tabor Rotation is a comprehensive instructional strategy in mathematics that uses student-led, heterogeneous, collaborative small groups of students rotating through learning stations several times per week (www.glennatabor.com) Teachers have implemented Tabor Rotation, a method of using small-groups to teach mathematical concepts. The students are engaged in practical, hands-on, meaningful mathematical concepts beginning with what is familiar to them so that they can make connections to state competencies and test language.

Glenna Tabor worked with Albert Thomas Middle School and their math scores increased dramatically due to the implementation of Tabor Rotation. In 2006, Thomas Middle School's TAK results were as follows: 2006 sixth grade 36% proficient/advanced (before Tabor Rotation), 2007 sixth grade 44% proficient/advanced (after Tabor Rotation). 2006 seventh grade 35% proficient/advanced; 2007 seventh grade 52% proficient/advanced, 2006 eighth grade 48% proficient/advanced; 2007 eighth grade 73% proficient/advanced. Ms. Tabor states that math is typically taught to a whole group in a classroom with 15-40 students at the same time and in the same way. By using Tabor Rotation, this hands-on meaningful application of concepts engages children of all ages. Ms. Tabor also states that the direct classroom benefits of Tabor Rotation is that it optimizes the student-teacher ration, utilizes cooperative and collaborative learning, and it naturally and purposefully differentiates instruction while addressing multiple intelligences and various learning styles (www.glennatabor.com). At Gladys Noon Spellman in Cheverly, Maryland the teachers and staff were trained and then implemented Tabor Rotation in eleven classrooms over a one-year period. The results for third and fifth grade indicated an increase in scores of over 32% on the Maryland School Performance Assessment Program (MSPAP). Ms. Tabor states that year was the greatest gain by a school in the county in mathematics.

East Lake Elementary in Chattanooga, Tennessee reported that their fifth grade classes began the school year with only 25% of these students performing at or above proficiency level

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in mathematics. After Tabor Rotation was implemented, test scores at the end of the second semester showed that 82% of the same fifth grade students were at or above proficiency level in mathematics. The most important results are the responses from students whose teachers have implemented Tabor Rotation. Glenna Tabor is a former K-5 teacher and now a nationally recognized educational theorist and consultant.

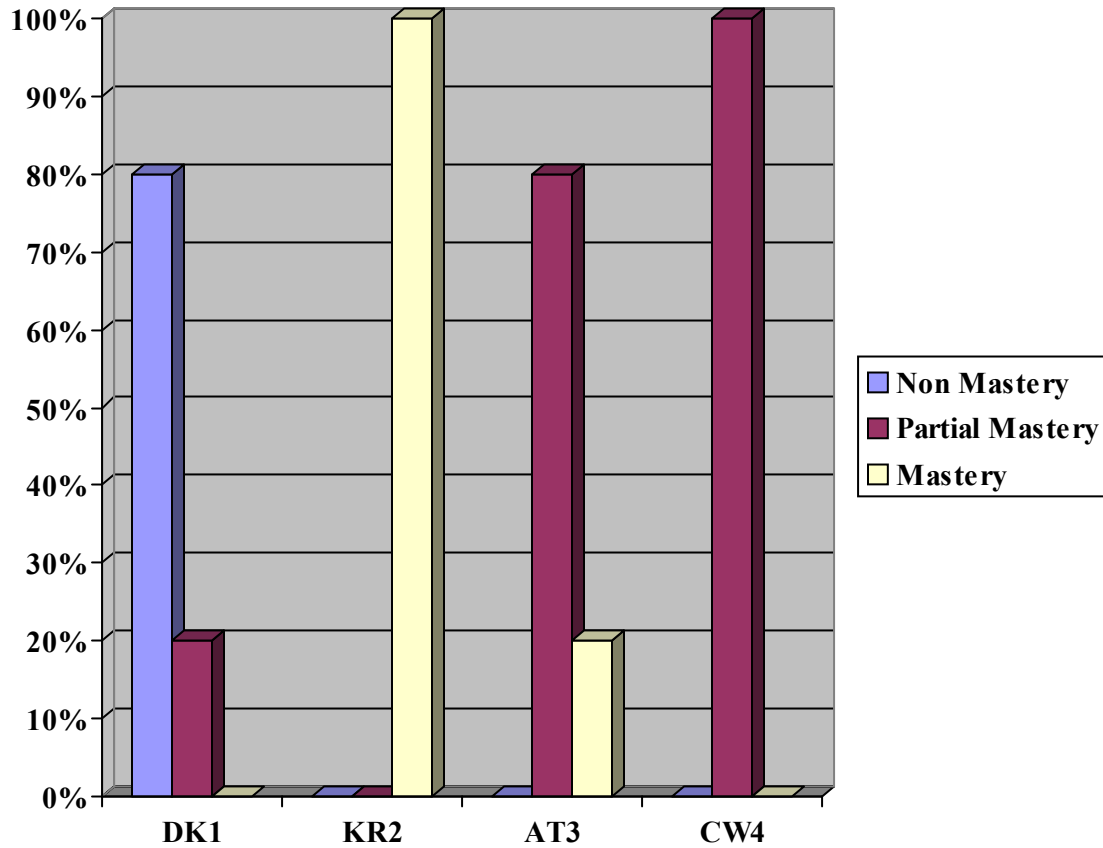
Summary of Literature

Currently, there is no specific research on TCAP scores relating to Tabor Rotation and Traditional Math Instruction; however, through this study, I hope to receive information through the students TCAP scores. Through this research, I have established that there are significant advantages to using Tabor Rotation to teach mathematics. One must realize that every child is different and not every child will learn the same as the next; however, if teachers are willing to put in the time and effort to use what is proven to work, it all depends on what is right for the students.

It needs to be noted that students who have been involved in Tabor Rotation do not hesitate to explain how they enjoy this learning process and the way it helps them learn. Students must have a feeling of comfort and safety in their environment to have full capabilities of success.

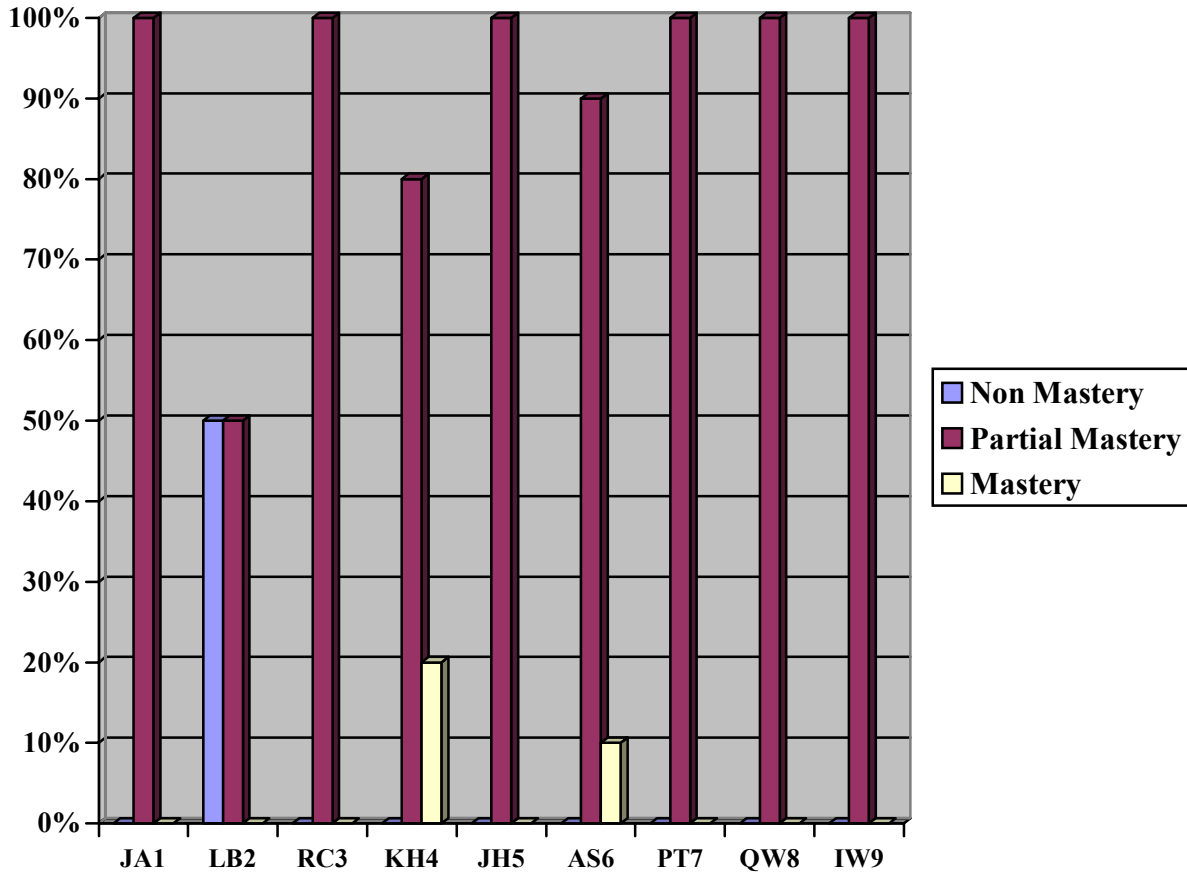
Chapter Three

2005-2006 Second Grade Math TCAP Scores for Girls-Class A



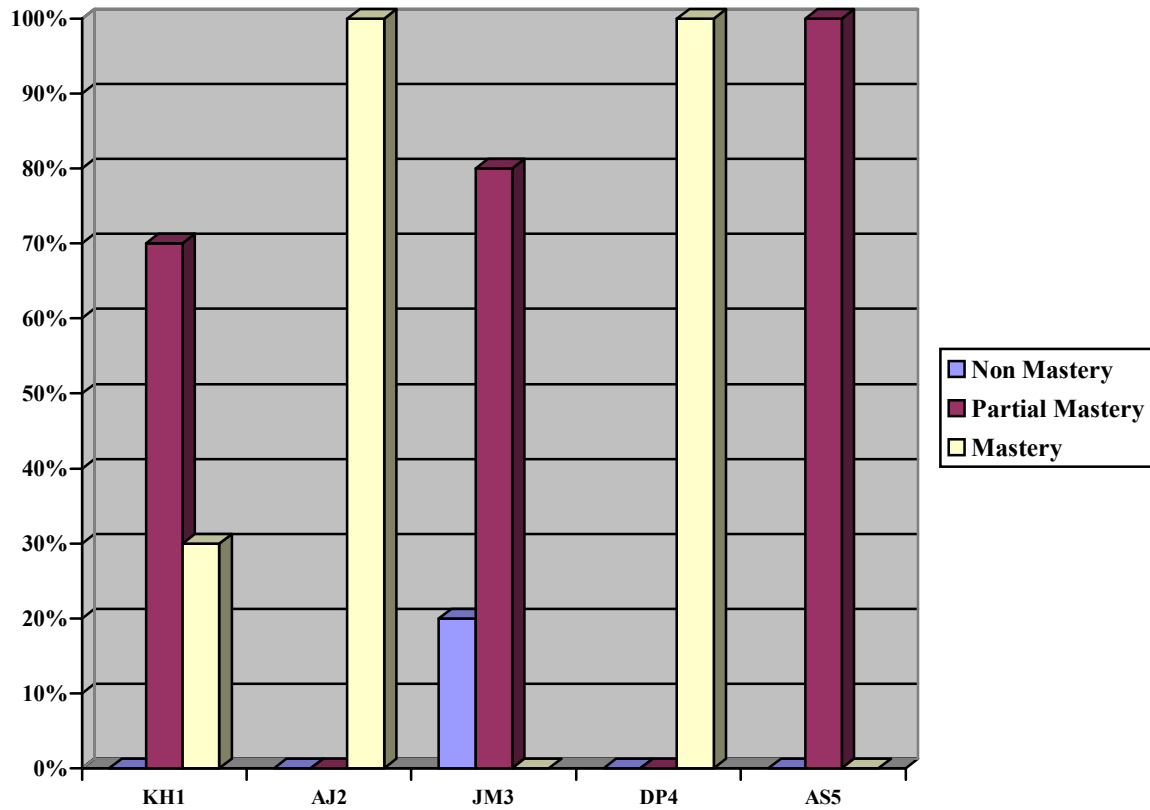
On the TCAP Math Assessment, 10 sub-groups are assessed in second grade. This graph reflects the percentage of non-mastery, partial-mastery, and mastery for each student. For example, student DK1 was shown to be non-mastery in 8/10 subgroups, equaling 80%. The same student demonstrated in 2/10 partial mastery equaling 20%. Overall, this graph shows more students did not master mathematical concepts than did.

2005-2006 Second Grade Math TCAP Scores for Boys-Class A



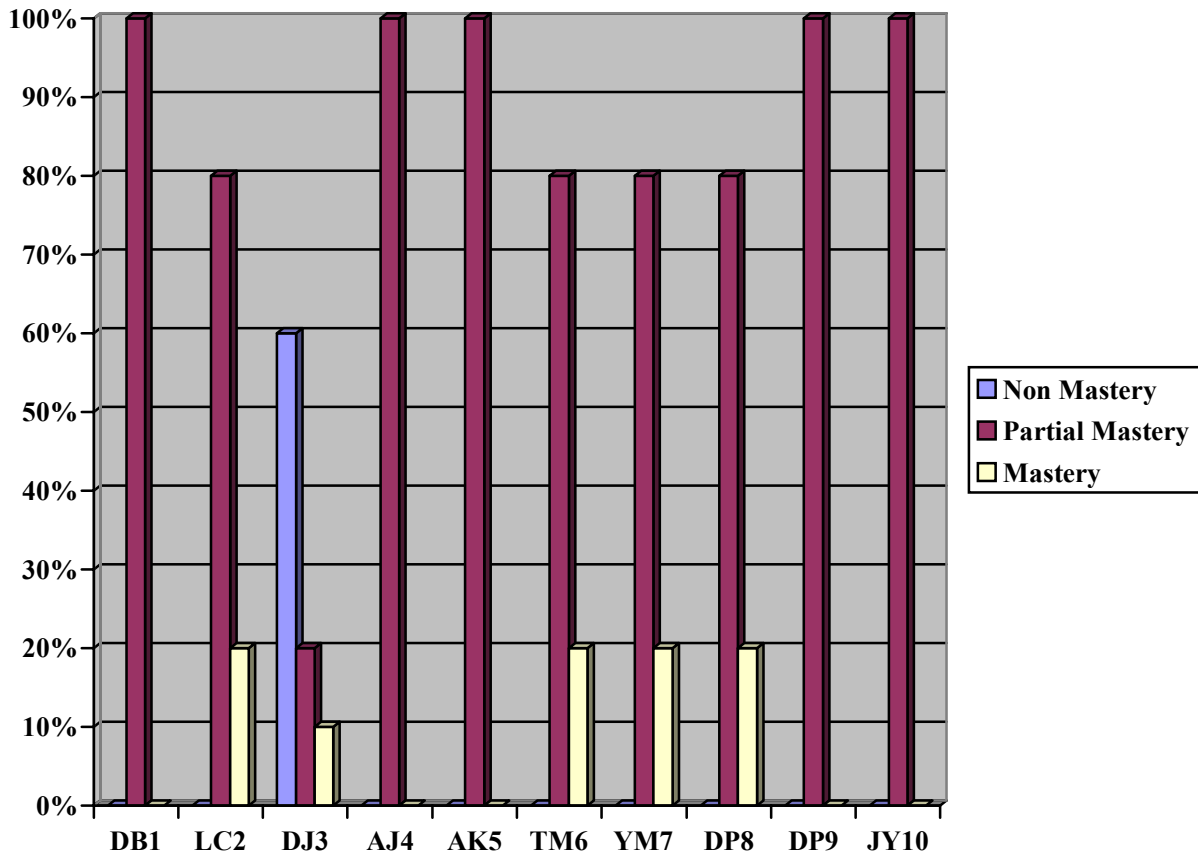
On the TCAP Math Assessment, 10 sub-groups are assessed in second grade. This graph reflects the percentage of non-mastery, partial-mastery, and mastery for each student. For example, student JA1 was shown to be partial mastery in 10/10 subgroups, equaling 100%. Overall, this graph shows more students did not master mathematical concepts than did.

2006-2007 Second Grade Math TCAP Scores for Girls-Class A



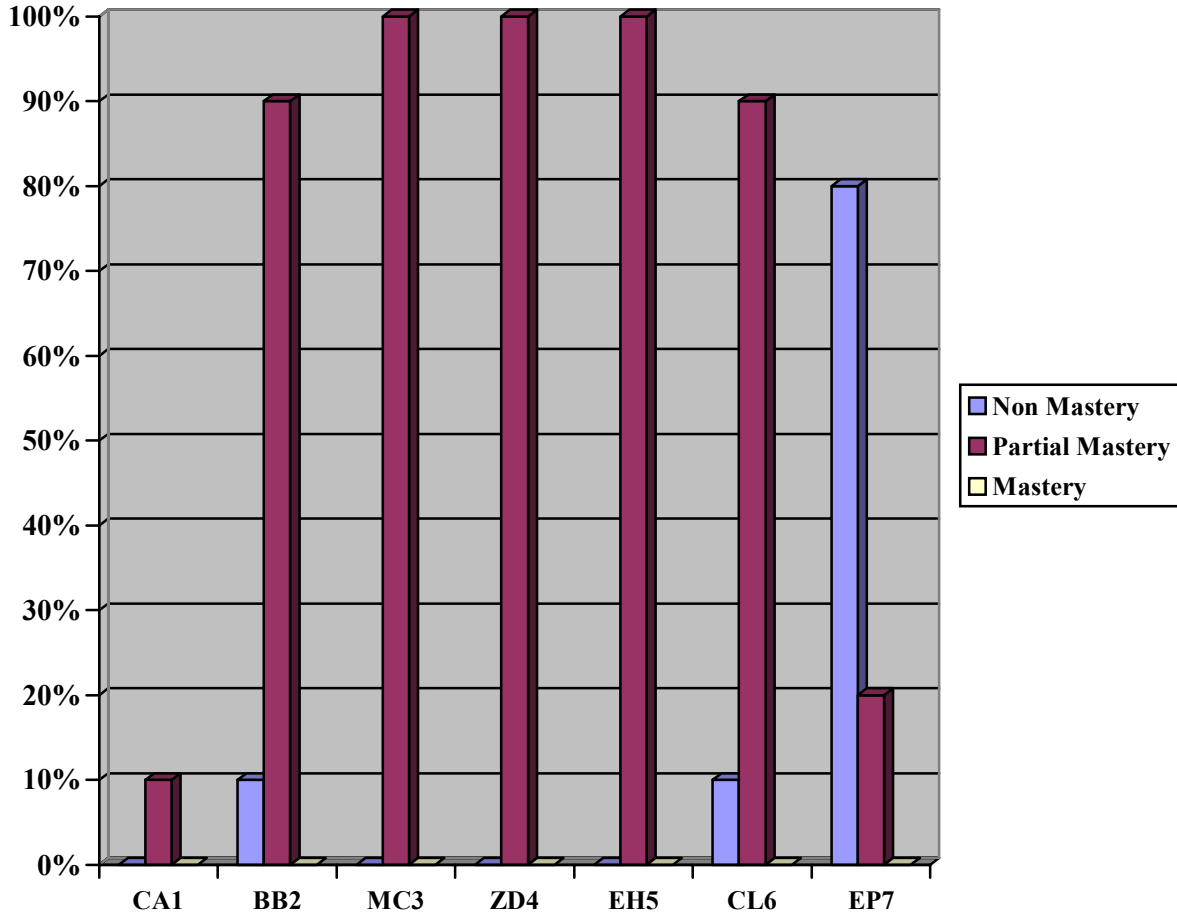
On the TCAP Math Assessment, 10 sub-groups are assessed in second grade. This graph reflects the percentage of non-mastery, partial-mastery, and mastery for each student. For example, student AJ2 was shown to be mastery in 10/10 subgroups, equaling 100%. Overall, this graph shows more students showed mastery level in mathematical concepts than did not.

2006-2007 Second Grade Math TCAP Scores for Boys-Class A



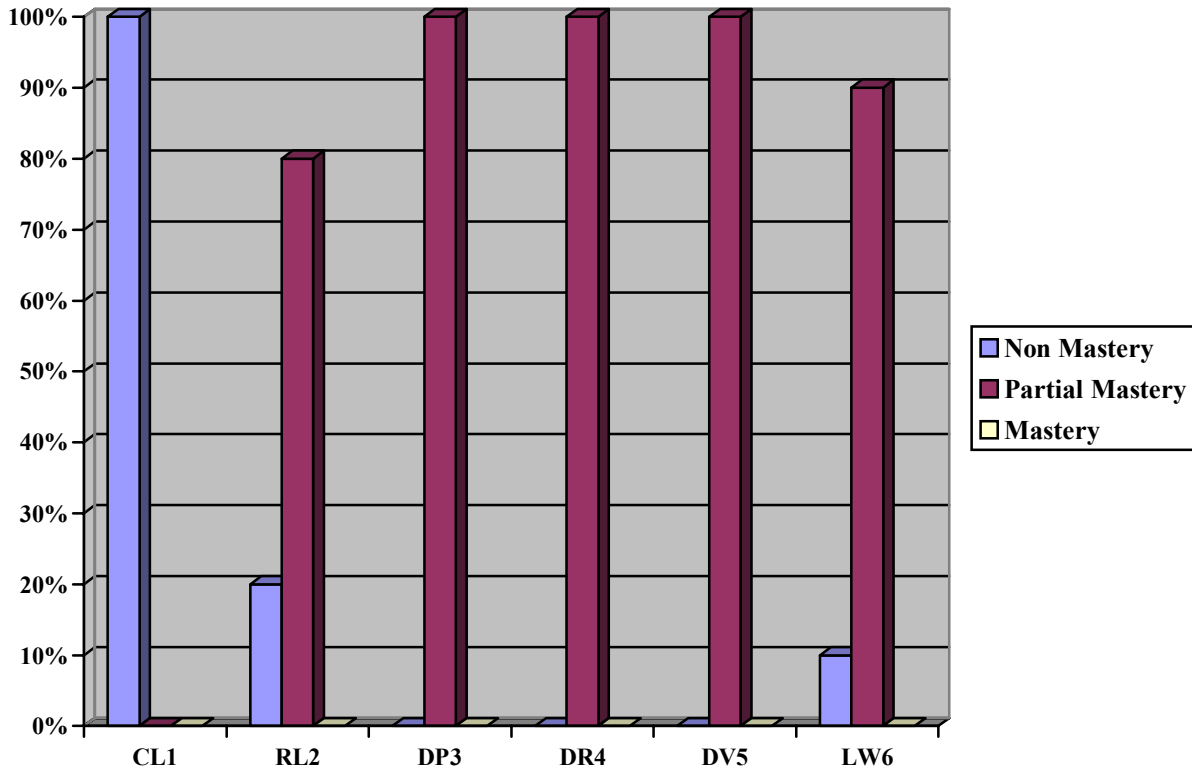
On the TCAP Math Assessment, 10 sub-groups are assessed in second grade. This graph reflects the percentage of non-mastery, partial-mastery, and mastery for each student. For example, student TM6 was shown to be partial-mastery in 8/10 subgroups, equaling 80%, and 2/10 in mastery, equaling 20%. Overall, this graph shows more students showed mastery level in mathematical concepts than did not.

2005-2006 Second Grade Math TCAP Scores for Girls-Class B



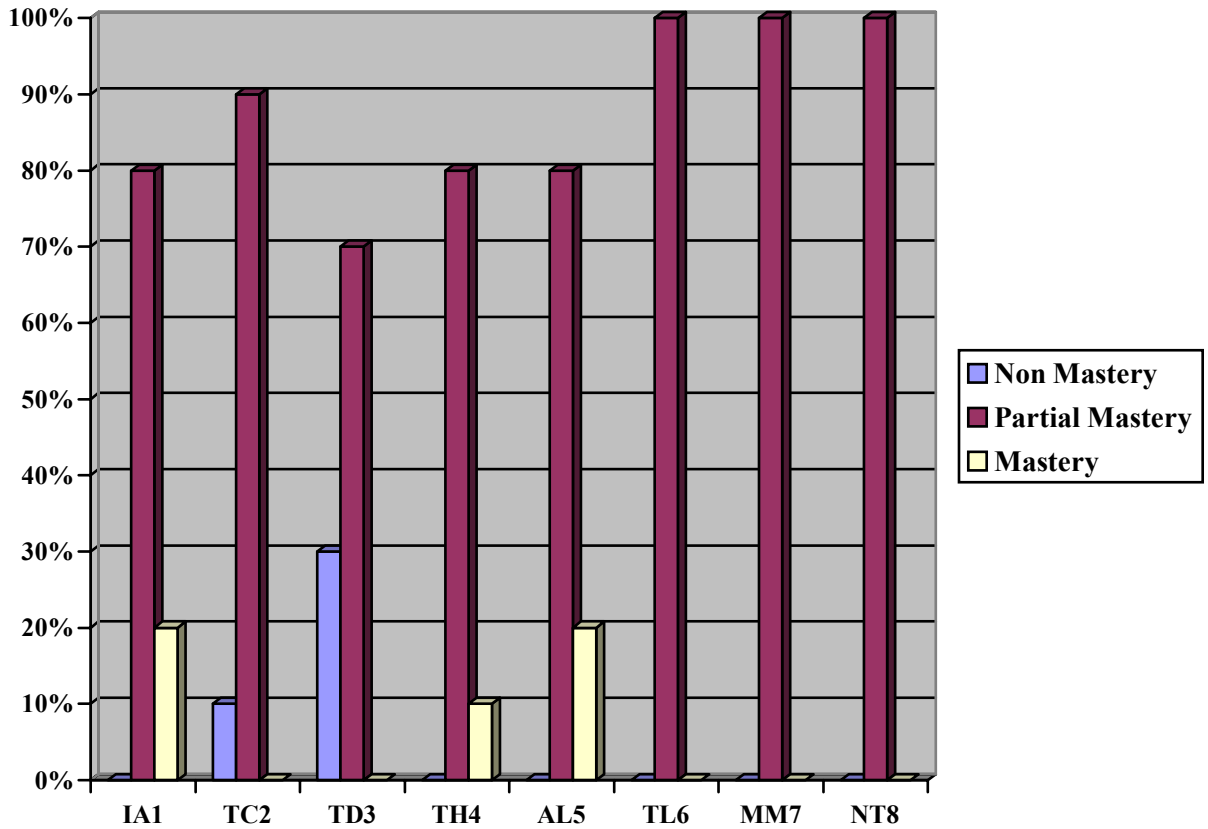
On the TCAP Math Assessment, 10 sub-groups are assessed in second grade. This graph reflects the percentage of non-mastery, partial-mastery, and mastery for each student. For example, student EP7 was shown to be non-mastery in 8/10 subgroups, equaling 80%. The same student demonstrated in 2/10 partial mastery equaling 20%. Overall, this graph shows more students did not master mathematical concepts than did.

2005-2006 Second Grade Math TCAP Scores for Boys-Class B



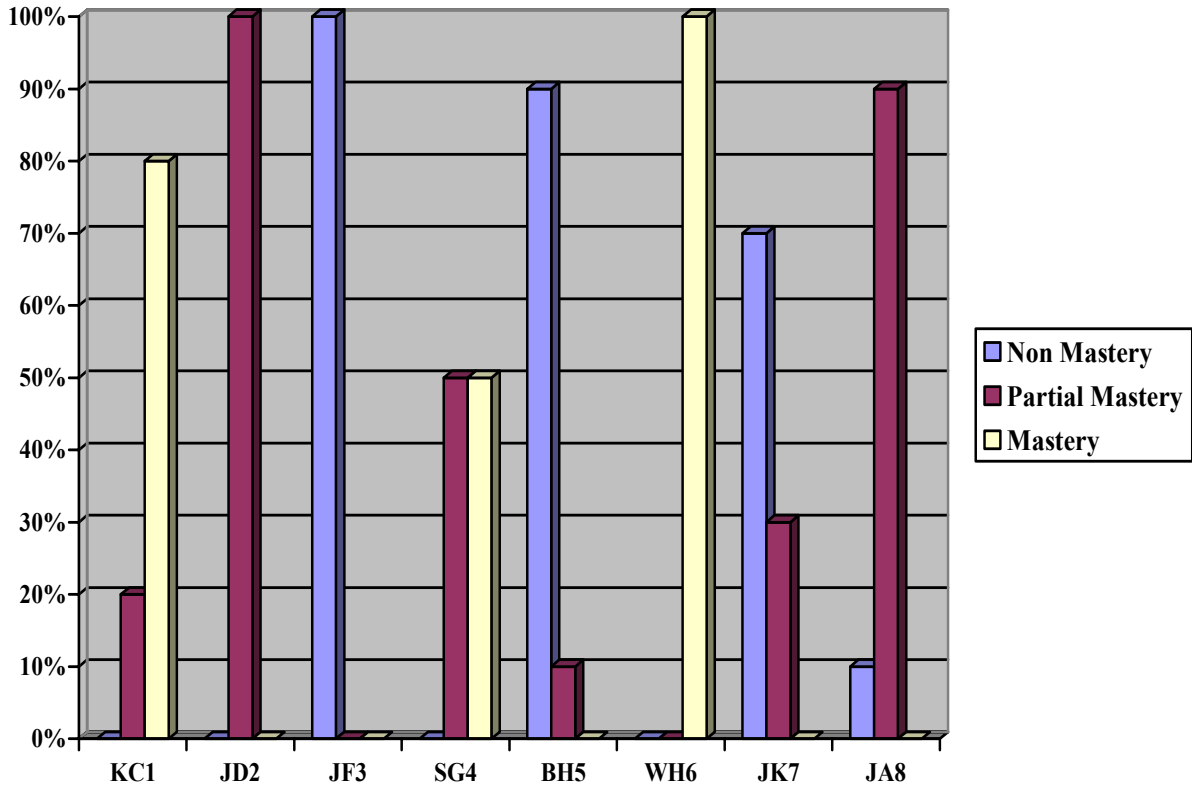
On the TCAP Math Assessment, 10 sub-groups are assessed in second grade. This graph reflects the percentage of non-mastery, partial-mastery, and mastery for each student. For example, student CL1 was shown to be non-mastery in 10/10 subgroups, equaling 1000%. Overall, this graph shows more students did not master mathematical concepts than did.

2006-2007 Second Grade Math TCAP Scores for Girls-Class B



On the TCAP Math Assessment, 10 sub-groups are assessed in second grade. This graph reflects the percentage of non-mastery, partial-mastery, and mastery for each student. For example, student IA1 was shown to be non-mastery in 8/10 subgroups, equaling 80%. The same student demonstrated in 2/10 mastery equaling 20%. Overall, this graph shows more students did not master mathematical concepts than did.

2006-2007 Second Grade Math TCAP Scores for Boys-Class B



On the TCAP Math Assessment, 10 sub-groups are assessed in second grade. This graph reflects the percentage of non-mastery, partial-mastery, and mastery for each student. For example, student WH6 was shown to be mastery in 10/10 subgroups, equaling 100%. Overall, this graph shows more students did master mathematical concepts than did not.

Chapter Four

Summary

To the author's knowledge there have been no independent studies done and there have been no published journals written on Tabor Math Rotation. This particular study did show some gains in the TCAP math scores from 2005-2006 to 2006 -2007. The goal of this study was to determine if there were any differences on TCAP assessment scores using Tabor Rotation Math instead of Whole Group Traditional Math. The studies did show proof of higher-level scores during the 2006-2007 school year in classes A and B. The graphs on pages 31-38 show that students scored more on the mastery level on the 2006-2007 TCAP Math assessment than on the 2005-2006 assessment. The percentages were found by using the 10 subgroups as the most a student could score. Some students only scored partial mastery on 8 out of the 10 subgroups equaling 80%and scored 2 out of 10 on the mastery level equaling 20% mastery in those math subgroups. The study also showed that males showed significant gains in the mastery level within the 10 subgroups than girls on the 2006-2007 assessment. The graphs show the

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percentage of non-mastery, partial-mastery, and mastery scores of second grade students from two different academic school years.

The 2005-2006 Female Class A graph shows that out of the four females tested, 1 scored 100% Mastery, 1 scored 100% Partial Mastery, 1 scored 80% Partial Mastery with 20% Mastery, and the last girl scored 80% Non Mastery with 20% Partial Mastery. On the 2006-2007 Class A Female graph, out of five females, 2 scored 100% Mastery, 1 scored 100% Partial Mastery, another scored 80% Partial Mastery with 20% Non Mastery, and the last female scored 70% Partial Mastery with 30% Mastery.

I suggest that teachers use Tabor Rotation to teach everyday math concepts. Tabor Rotation promotes use of heterogeneous, collaborative small groups rotating through learning stations several times per week. A week of Tabor Rotation also includes readiness grouping on an as-needed basis, whole-group mini-lessons, vocabulary activities, and journal writing. When teachers use Tabor Rotation, comparatively more students exchange mathematical ideas when they are in small work groups than in achievement groups. Tabor Rotation provides opportunities for peer interaction where many students develop the ability to work with others and use strengths that other students may bring to a certain area or task.

It is evident that using Tabor Rotation throughout the 2006-2007 academic school year increased student's math scores overall on the math portion of the TCAP assessment. Tabor Rotation provides teachers the one-on-one student/teacher attention that many students do not receive with Traditional Whole Group Math. I have seen first hand how the students learn more during Tabor Rotation time than sitting and listening to lectures about mathematical problem

solving. The children are enthusiastic about this method of Teaching and the test results prove that it works.

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