LETTER OF TRANSMITTAL

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TO WHAT EXTENT DOES A RELATIONSHIP EXIST BETWEEN NONSUPPORT AND SUPPORT STUDENTS WHEN THEY ARE GROUPED HOMOGENEOUSLY AND HETEROGENEOUSLY IN THE STUDENT'S MATHEMATICS COURSE AT LEE COUNTY HIGH SCHOOL

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Dedication

This doctoral project is dedicated to my wonderful family. Thank you all for your support and encouragement throughout this process. To my husband, thank you for keeping me centered and balanced. To my daughters, thank you for the laughs and for all of the edits.

Acknowledgments

Dr. Richardson, every dream has a beginning. Thank you for your vision of what could be and for creating this opportunity for me. Your encouragement means so much to all of us. The journey would not have been the same without you.

Dr. Lemoine, thank you for always keeping me on track. You answer every email, alter every course and handle every need. Thank you for always responding to my questions, concerns and comments. You keep me on course and guide my path.

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VITA

With the increase in graduation requirements and school accountability, high school educators explored new, cost effective ways focused on improved student assessment results. For high schools in Georgia, the addition of an approved support course allowed teachers an additional hour to remediate and reteach students with documented mathematical deficiencies. This course provided intervention time with the goal of improved student scores on the Georgia Milestone (GM) Analytic Geometry End-of-Course (EOC) assessment.

Within the current study, the researcher analyzed three different grouping practices based on student schedules. The groups included 1) students not scheduled for support; 2) students scheduled together homogeneously for support and the Georgia Standards of Excellence Analytic Geometry; and 3) students in support and heterogeneously grouped in the Georgia Standards of Excellence Analytic Geometry course.

The researcher noted the largest statistically significant difference in favor of the group not enrolled in the additional hour of support. This result was true for both research questions: 1) the population that included only the lowest 30% and 2) the entire tested population. Based on data from the 2014-15 assessment, schoolwide heterogeneous grouping without the additional support provided all ability level students the best advantage on the State's GM Analytic Geometry EOC assessment. The researcher noted as a stand-alone intervention, the additional hour of support provided no statistical benefit during this applicable year for this assessment.

ABSTRACT

Societal concerns and revolving federal initiatives linked State assessment scores to accountability measures which determined school success. In Southwest Georgia, one rural high school manipulated student schedules and provided an additional support course for individuals demonstrating documented mathematical deficiencies. The researcher examined the impact of three different grouping practices on the student's 2014-15 Georgia Milestone Analytic Geometry End-of-Course assessment. This State assessment served as the dependent variable and the student grouping practice served as the independent variable for this quasi-experimental design study. Student schedules were examined and the three groups investigated during this study included 1) a group of students not scheduled for the additional support course; 2) a group of support students grouped homogeneously within the geometry classroom; and 3) a group of support students grouped heterogeneously within the geometry classroom. The study analyzed the mean scale scores for both the lowest 30% of the tested population and the entire tested population.

For research question 1, the lowest 30% tested (N=111), the researcher utilized a one-way ANOVA and noted a statistically significant difference within the mean scale scores between the nonsupport group (p = .000) and the both support groups. However, no statistical difference existed between the two support groups (p = .065). Next, the researcher completed the Tukey post hoc test and noted the highest mean scale score for students not enrolled in support and placed heterogeneously within the regular geometry course. The scale score was higher for this group than both the support homogeneous

group (28.642, 95% CI [14.66, 42.62]) and support heterogeneous group mean (42.717, 95% CI [29.75, 55.69]).

For research question 2 (RQ2), the entire tested population (N=324), the researcher noted similar results outlined within research question 1. The researcher utilized a one-way ANOVA and noted the nonsupport course was statistically significantly different ($p = .000$) from each of the support groups, but the support groups were not significantly different ($p = .185$). The researcher compared the results of the Tukey post hoc test and noted the highest group once again included the nonsupport students. This group outperformed the homogeneous support course students by 23.3, 95% CI [11.54, 35.06] and the heterogeneous grouped students by 33.63, 95% CI [23.34, 43.92]. However, the difference of the scores between the two support course groups was only 10.33, 95% CI [-3.49, 24.15].

A major implication for educators was the determination that an additional hour of support as an intervention alone provided no statistical benefit to the state assessment mean score. Additionally, the use of homogeneous versus heterogeneous grouping strategies provided no statistically significant difference on the state assessment mean scores. With the increase in accountability measures linked to student assessment scores, the researcher recommended a closer investigation into professional development and instructional strategies specific to the limited abilities of the population served within the support course. Future research focused on longitudinal implications for this population would provide additional implications for educators.

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CHAPTER I:

INTRODUCTION

The autonomous nature of the local board of education (Cambron-McCabe, 2002) slowly disintegrated into new accountability reforms instigated by national legal precedents (Alexander & Salmon, 1995) and global societal concerns (Kress, Zechmann, & Schmitten, 2011). The new reforms obligated educators to become accountable (LaPrade, 2011) and administrators explored homogeneous or heterogeneous ability grouping within the school environment as a means of optimizing academic success (Cortes & Goodman, 2014). The student's unique achievement level was the determining factor when organizing the student's placement into the homogeneously grouped class or course (Becker, Neumann, Tetzner, Bose, Knoppick, et al, 2014; Hallinan, 1994). Conversely, school administrators that utilized heterogeneous grouping placed all academic achievement ability students together in the same room and created a purposeful mixed ability environment. (Becker, Neumann, Tetzner, Bose, Knoppick, et al, 2014; Hallinan, 1994; Slavin, 1988).

The practice of homogeneous grouping allowed students with similar academic abilities to be placed into the same classroom (Hallinan, 1994). Advocates argued in favor of homogeneous grouping and noted results that included improved student learning opportunities (Kelly & Carbonaro, 2012; Worthy, 2010) and increased academic achievement (Becker, Neumann, Tetzner, Bose, Knoppick, et al, 2014; Hallinan, 1994; Preckel, Gotz, & Frenzel, 2010). However, opponents claimed the practice of grouping students homogeneously allowed for segregation and decreased academic achievement in the lower level grouped classrooms. (Oakes, 1985). Additionally, unintended psychological outcomes (Becker, Neumann, Tetzner, Bose, Knoppick, Maaz, & Lehmann, 2014), lowered self-concepts (Hallam & Ireson, 2003; Kelly & Carbonaro, 2012), and decreased achievement and motivation (Hallinan, 1994; Wouters, De Fraine, Colpin, Van Damme & Vershueren, 2012) were all labeled as side effects of homogeneous grouping.

While early American education revolved around key community customs (Alexander & Salmon, 1995), evolving societal changes funneled educational resources toward disenfranchised students (Chicosky, 2015) and newly aligned curriculum standards (Chopin, 2013). The court system established rights for historically underrepresented groups (Chopin) and ignited social awareness for the plight of the disabled (Alexander & Salmon, 1995). The federal government responded to the new societal ideology and tied federal money to new, evolving educational initiatives (Alexander & Salmon). Additionally, presidents and other politicians included personal educational policies into the political platforms when running for election (Kress, Zechmann, & Schmitten, 2011). For example, President Obama's Race-to-the-top (RT3) initiative tied federal money to the academic achievement gap (Obama, 2011). This federal grant required each state develop a comprehensive, innovative plan which held systems, schools and teachers accountable to ensure all students were college and career ready by graduation (US DOE, 2009).

In 2012, The Georgia Department of Education (Ga DOE) embraced the federal RT3 initiative and developed the College and Career Readiness Index (CCRPI) as the new state accountability system (Barge, 2012). According to Hemelt and Marcotte (2013), this accountability initiative included measures for the teachers, administrators, schools, and districts. The Ga DOE's Teacher Keys Effective System (TKES) Handbook (2013) noted the following ways the accountability system utilized the student's exam score: 1) 50% of each certified teacher's yearly evaluation; 2) 70% of the school administrator's yearly evaluation; 3) multiple factors noted on the yearly CCRPI (Harter, 2014b) and 4) 20% of the student's final grade for the specified course assessment (Ga DOE, 2013).

In response to the rigorous new standards established in the CCRPI, the Ga DOE announced new graduation standards (Ga DOE, 2014f) which included increased mathematics credits for students earning a high school diploma (Ga DOE, 2015b). Specifically, the mathematics domain included the completion of the Georgia Standards of Excellence (GSE) Analytic Geometry (Ga DOE, 2015b). Placed into a series of four mandated units, the GSE Analytic Geometry course followed the first unit requirement, GSE Coordinate Algebra (Ga DOE, 2014f). Additionally, the CCRPI component aligned course standards with the End-of-Course (EOC) state assessment, Georgia Milestone Analytic Geometry EOC (Ga DOE, 2015a).

To help augment the academic rigor of the new geometry course standards, the Ga DOE added an additional course labeled "mathematics support" (Ga DOE, 2014b). Within the response-to-interventions framework, this Tier 2 support course was scheduled in addition to the geometry curriculum. This elective course provided support for students who historically struggled with mathematics and needed more in-depth attention and extra time to master the standards presented in the GSE Analytic Geometry course (Ga DOE, 2014f). Accordingly, the support course allowed students additional opportunities to retest, relearn, and reapply the information presented in the geometry course. The state allowed local districts to set the criteria for student enrollment but included the students previous test results, course aptitude and teacher recommendations as a few guidelines (Ga DOE, 2014f).

Collins and Gan (2013) noted homogeneous placement of students based on previous testing marks offered positive results for all groups when academic achievement data was examined. A closer examination of homogeneous grouping revealed positive gains based on specific parameters. Referred to as “double-dosed,” the addition of the support course correlated to a ninth grade Algebra course in Chicago had positive longitudinal effects when linked to increased instructional time, pedagogy, and rigor (Cortes & Goodman, 2014). While not double-dosed, researchers also noted positive mathematics results for low and high ability level elementary students in Dallas (Collins & Gan, 2013). For first grade students in Kenya, Duflo, Dupas, and Kremer (2011) noted stronger gains linked to targeted professional development for the same ability level population. The researchers (Cortes & Goodman, 2014; Duflo, Dupas & Kremer, 2011) theorized homogeneous grouping of students allowed for targeted instructional strategies. In theory, the positive outcomes of the targeted instruction compensated for the negative effects typically associated with the low level homogeneous grouping of students (Cortes & Goodman).

The total school cluster approach utilized both homogeneous and heterogeneous strategies when grouping students into classrooms (Gentry, 2014). Prior to scheduling, administrators determined the student’s academic ability, grouped them homogeneously and then placed each specific ability level into each classroom (Matthews, Ritchotte & McBee, 2013). The researchers noted this flexible, heterogeneous grouping created an equitable classroom of mixed ability students and posited the positive academic gains of all students in the room (Gentry & Owen, 1999). Longitudinal achievement within the mathematics course work when elementary students were grouped heterogeneously was also noted as a benefit (Matthews, Ritchotte & McBee, 2013). Big-fish-little-pond effect (BFLPE) theorist focused on the positive psychological effects associated with heterogeneous grouping students within the classroom (Marsh & Parker, 1984). BFLPE researchers indicated grouping practices psychologically impacted the individual student's self-concept and academic self-concept (Marsh & Hau, 2003; Marsh & Shavelson, 1985).

Educational researchers exposed demographics of various student populations and pinpointed key variables involved in the mathematics achievement gap (Cheema & Galluzzo, 2013). Additionally, researchers noted variables which included anxiety (Maree, Fletcher, & Erasmus, 2013; Putwain, 2007; Von Der Embse, Barterian, & Segool, 2013), race (Martin, 2013; Oakes, 1985; Sandy & Duncan, 2010), socioeconomic (Hembree, 1988; Putwain, 2007; Sandy & Duncan, 2010), gender (Cheema & Galluzzo, 2013; Duncan & Sandy, 2013; Lowe & Lee, 2008; Voyer & Voyer, 2014), and school setting (Sandy & Duncan, 2010; Von Der Embse & Hasson, 2012) impacted student achievement. In an effort to improve student achievement, school systems focused on the research to pinpoint ways to better educate the students (Darling-Hammond, Wilhoit & Pittenger, 2014).

Policy procedures dedicated to appropriate and equitable (Oakes, 1985) student placement were two factors administrators confronted when assigning teachers to specific student groups in an effort to optimize academic gains (Coleman, 2016). Society's definition of academic success revolved around changing expectations which required school leaders to become more resilient as they struggled with local, state, and federal demands (Allison, 2012). As a result, instructional decisions within the public school focused on each student's academic success and was now one of the most critical responsibilities of school level administrators (Slavin, 1988). Gibson and Tarrant (2010) theorized a resilient organization not only bounced back from adversity; but rather, bounced forward if it embraced the uncertainty and grew from the experience (Allison, 2012).

Statement of the Problem

Researchers noted mixed student academic, social, and emotional results based on the instructional strategies that revolved around grouping students based ability levels. However, research was lacking when analyzed for the impact an additional, correlating support course had on the student's Georgia Milestone (GM) Analytic Geometry End-of-Course (EOC) assessment score. This research study analyzed data to determine whether GM Analytic Geometry EOC scores were impacted by grouping practices during the 2014-15 school year. The purpose of the study was to determine if the mean scores of the assessment for both the identified bottom 30% student population and the entire geometry population was effected by scheduling practices which included no support or support in conjunction with the homogeneous or heterogeneous mathematics placement.

Research Questions

Research Question 1 (RQ1): For students identified as the bottom 30%, did the mean of the scores on the 2014-15 GM Analytic Geometry EOC for nonsupport students have a statistically significant difference when compared to support students grouped homogeneously or heterogeneously within the mathematics classroom.

Null hypothesis 1 ($h_0 1$): The mean scores will have no significant difference between the lowest nonsupport and lowest support course (sc) grouped homogeneously (ho) or heterogeneously (ht) within the mathematics classroom. $h_0 1$: ($\mu_{lownonsupport} = \mu_{lowscho} = \mu_{lowscht}$)

Alternate hypothesis 1 (H_1): The mean scores will have a significant difference between the lowest nonsupport and lowest support course grouped homogeneously (ho) or heterogeneously (ht) within the mathematics classroom. $H_{1:}$ ($\mu_{lownonsupport} \neq \mu_{lowscho} \neq \mu_{lowscht}$)

Research Question 2 (RQ2): Did the mean of the scores on the 2014-15 GM Analytic Geometry EOC for nonsupport students have a statistically significant difference when compared to support students grouped homogeneously or heterogeneously within the geometry course?

Null hypothesis 2 ($H_0 2$): The mean scores will have no significant difference between the means of the three groups. $H_0 2$: ($\mu_{nonsupport} = \mu_{schomo} = \mu_{schetero}$)

Alternate hypothesis 2 (H_2): The mean scores will have a statistically significant difference between the means of the three groups. H_2: ($\mu_{nonsupport} \neq \mu_{schomo} \neq \mu_{schetero}$)

Conceptual Framework

The conceptual framework for this study included a review of the literature focused on ability grouping. Specifically, the conceptual framework included (a) positive and negative characteristics of homogeneous and heterogeneous grouping, (b) academic achievement of each type of grouping practice, and (c) impact of support course on student achievement involving grouping practices. Academic achievement grouping based on assessment data was commonly used to determine the student's ability level. Homogeneous and heterogeneous grouping were the main models of ability grouping discussed within the review of literature.

The flow chart, Figure 1, illustrated the structure of the conceptual framework. The first box to the left, labeled "a", specified the entire population of students enrolled in the GSE Analytic Geometry course during 2014-15 in the high school located in rural South Georgia. Line arrows connected the first box to the ovals in the middle of the figure. The ovals represented the different scheduling options that were investigated during this research study. The first group, located at the top in box "b", represented students enrolled only in the GSE Analytic Geometry course and not enrolled in the corresponding support course. The second group, located in the middle in box "c", represented the students grouped homogeneously within both the GSE Analytic Geometry course and in the corresponding support course. These students received all mathematical instruction as a homogeneous group. The third and final group, located at the bottom in box "d", were grouped homogeneously in support, but received GSE Analytic Geometry instruction within a heterogeneous group. Some of the students in this room were also in support, but others were not scheduled for support. Block arrows connected the ovals to the box on the far right, labeled "e." This box represented the GM Analytic Geometry EOC assessment scale scores from students enrolled in GSE Analytic Geometry during the 2014-15 school year.

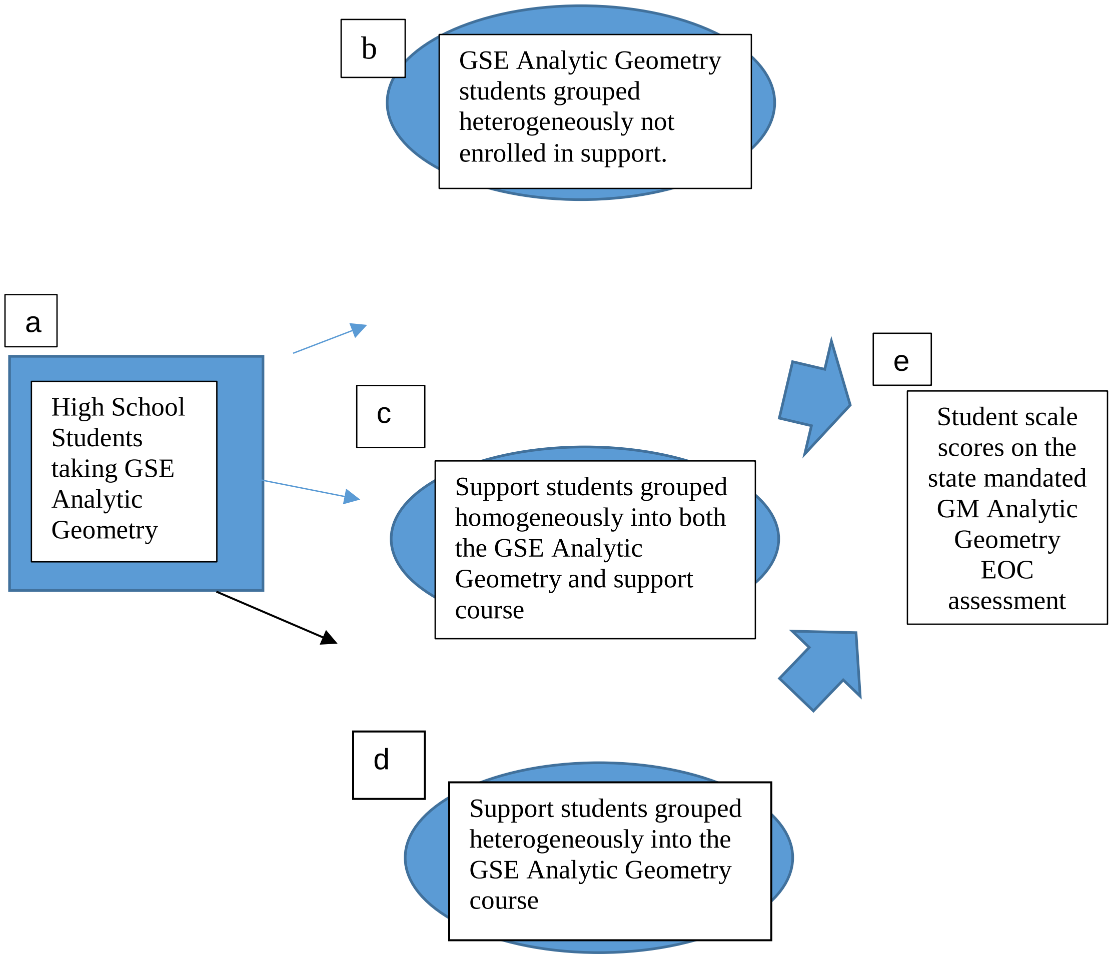

Figure 1. **High School Grouping and GM Analytic Geometry EOC scores May, 2015**

Importance of the Study

As a new high school principal, it was important to determine which grouping strategy provided higher assessment results. The results of this study impacted policy and accountability measures related to scheduling procedures for mathematics support students at the local high school. The researcher analyzed data to evaluate how students performed on the state mandated milestone assessments when grouped without support or with an additional support course and grouped heterogeneously or homogeneously during their required GSE Analytic Geometry class. Additionally, the researcher examined the predetermined lowest 30% of students demonstrating mathematical deficiencies within all three groups. Accountability based on assessment results impacted various groups within the building. For the student population, the EOC accounted for 20% of the student's overall semester average in the associated course. Additionally, the student scores impacted teacher and administrator yearly evaluations. The importance of this study included future policy decisions that optimized instructional grouping strategies for the rural system.

This study involved 10^{th} grade students enrolled in GSE Analytic Geometry during the 2014-15 school year. The researcher presented the findings of the study to building administrators and mathematics teachers. The local superintendent and instructional supervisor viewed the outcomes of the research information and helped formulate parameters for homogeneous and heterogeneous grouping decisions. The results of the study impacted future policy grouping decisions and targeted instructional professional development for this high school. As the principal of the high school, the findings of this research guided best practice scheduling decisions for the next school term.

Procedures

The researcher focused this study on students enrolled in GSE Analytic Geometry at Lee County High during the entire 2014-15 school year. Inclusion in the study involved predominately 10^{th} grade level students who completed the course for the first time. Research Question 1 focused on students in the predetermined lowest 30%. During May 2014, students completed the GM Coordinate Algebra EOC which served as the pretest and validated the inclusion/exclusion into the research study over the lowest 30% population. Only students that completed both the GM Analytic Geometry and GM Coordinate Algebra assessment were included in the study. Any partial data (e.g. students that did not take both assessments) were removed from the study. The following outline illustrated the steps completed for the quantitative research study:

1. The participant's scheduling and demographic information was collected from the school's Student Information System, Infinite Campus, for all individuals enrolled in the GSE Analytic Geometry course during the 2014-15 school year. This information was placed into an excel spreadsheet.
2. Scheduling information detailed grouping practices (nonsupport, homogeneous or heterogeneous) and was added to the excel document.
3. Standardized GM Analytic Geometry EOC scores were obtained from the Ga DOE platform and correlated to the appropriate participant.
4. Standardized GM Coordinate Algebra EOC scores were obtained from the Ga DOE platform and correlated to the appropriate participant.
5. Removed all partial data fields (e.g. students without both EOC scores)
6. All information – demographics, assessment scores and grouping application was double checked.
7. Students were assigned random ID codes and names were removed.
8. GM Coordinate Algebra scores were ranked to determine lowest 30% of scores.
9. All information was uploaded to SPSS.

The researcher utilized the SPSS computer program and completed an analysis of the variance (ANOVA) and Tukey post hoc test which examined the different group means for statistical relevance.

The different groups represented in this analysis included:

- Group 1: Nonsupport - A control group of 2014-15 GSE Analytic Geometry students who were not scheduled for mathematics support and were grouped heterogeneously in the geometry classroom.
- Group 2: Support course homogeneous mathematics class. A test group of support students who were enrolled together for both GSE Analytic Geometry and support. Within this regular mathematics section, only these specific students were grouped together homogeneously in the additional support course. Students in this group did not interact with other mathematic ability level students during this block of time.
- Group 3: Support course heterogeneous mathematics class. A test group of students who were enrolled in support, but were placed heterogeneously into GSE Analytic Geometry. Within the regular mathematics section, some of the mixed ability students were in the additional support course, while others were not enrolled in mathematics support.

Assumptions

Based on the review of literature, as well as the requirements for being enrolled in a mathematics support course, the researcher assumed results would be different for each of the two research questions analyzed. For research question 1, the lowest 30% of the population, the “double-dose” theory researchers indicated positive results for students enrolled in the additional mathematics support course (Cortes & Goodman, 2014). Between the two support groups, the researcher assumed the heterogeneous group had a higher mean scale score based on big-fish-little-pond research (Marsh & Parker, 1984). For research question 1, based on the review of literature, it was assumed the mean scale score for the support students grouped heterogeneously in geometry exceeded the mean scale score for the support students grouped homogeneously and both support groups exceeded students not enrolled in the support course for additional instruction.

For research question 2, the entire population, the researcher assumed the change in population altered the mean scale score for the different groups analyzed. While question 1 focused only on students with mathematical deficiencies, this question focused on all students tested and included a larger population of scale scores. Based on the review of literature, the researcher assumed the mean scale score for students grouped heterogeneously without the additional support course was higher than the mean scores for the two support groups. Additionally, based on big-fish-little-pond theory research, the researcher noted the heterogeneous support group mean scores were higher than the homogeneous support scale score mean.

Limitations/Delimitations

A delimitation of the research included the availability of the student schedules and standardized assessment scores which made this study possible. During spring registration, each high school student requested seven courses based on individual graduation requirements and elective choice selections. While geometry was required for all students, only a percentage of students requested the recommended correlating support course. Next, the scheduler software placed the support sections during periods with limited conflicts such as 10th grade band and athletic weight training. Once sections were created, the scheduler randomly and evenly distributed the applicable student population to both the geometry and geometry support sections. Student assignment into specific sections was based on the availability of the support during specific periods and allowed the student population to be evenly dispersed between the allotted sections. This increased the randomization of the sample of the analyzed population within both research questions and was a delimitation of this study.

Another delimitation to the study included student placement with the same teacher for the geometry support course and the GSE Analytic Geometry course. This placement allowed a cohesiveness between the expectations of the teacher for both the support and the geometry course. The same teachers also taught the geometry course for students not enrolled in support. This allowed for similar expectations and assessments throughout the various sections and placements. The curriculum, lesson plans and unit assessments were the same among all four of the teachers. Additionally, local and state professional development was similar for all four teachers. Overall, the grouping of the students with the same teacher allowed some generalization to take place.

Based on the enrollment of the rural high school, one limitation included the population size. This study was limited to one course which involved predominately 10th grade students enrolled in one rural high school during one school year. For data collection purposes, only the students enrolled the GSE Analytic Geometry course (N=324) served as the participants of the study. An even smaller portion of this population also enrolled in the corresponding support course (N=111). Students were recommended for the corresponding support course during the previous spring semester.

The teacher recommendation was completed prior to state assessment scores being determined.

While specific guidelines for enrollment into the support section included students failing previous mathematics state assessments, the current teacher recommendation was the main weighted factor for support during the previous spring registration. Nevertheless, students in the support course demonstrated a standard of mathematical deficiency based on teacher input and/or assessment results. While all students were placed into support based on teacher recommendations, current mathematics deficits and test assessment results, a limitation to the study was based on the understanding that not all students in the support scored in the bottom 30% on the previous assessment. However, the bottom 30% was dispersed throughout all three groups.

Another limitation included the altered state curriculum and assessments for the geometry course over the last decade. Curriculum changes to the mathematics course content resulted in gaps in student knowledge when key components were moved from one grade level to the next without compensating current level students. The inability of the researcher to investigate longitudinal data and determine if support and nonsupport students had similar mathematical deficiencies prior to enrollment was a limitation. An additional limitation included the use of assessments that were not correlated based on the same curriculum (e.g. the pretest, GM Coordinate Algebra, and one posttest, GM Analytic Geometry). Individual students were removed from the study if scores from GM Coordinate Algebra or GM Analytic Geometry EOC were missing. A final limitation included the teacher impact on the assessment scores. The use of fear appeals and teacher labeling bias, as well as the student’s academic self-concept, impacted the single high-risk assessment results. The teacher's professional development was not considered as a variable in the study. The lack of targeted interventions and professional development impacted assessment results and was a limitation of the study.

Definition of Terms

Academic Self-concept: A student's academic self-concept was partly based on the individual student's evaluation of academic achievement and partly based on an internal comparison of the peer group academic achievement level in the same school environment. Seaton, Marsh, and Craven (2009) noted the academic self-concept manipulated how the student felt about himself/herself academically; however, how the student felt they performed in a specific setting correlated with the student's academic achievement.

Achievement: According to Seaton, Marsh, and Craven (2009), achievement was based on indicators involving student performance in a specific setting.

Big-fish-little-pond effect (BFLPE): This theory, established by Marsh and Parker (1984), posited that academically strong students, when placed in higher homogeneous academic levels, were no longer considered the top student in the classroom, or figuratively, they were no longer the big-fish-in-a-little-pond; but rather, they were academically an average student or small fish in a large pond full of brighter, bigger fish.

College and Career Readiness Index (CCRPI): The Georgia Department of Education's developed CCRPI as an accountability measure aligned with the federal Race-to-the-top initiative. It was a comprehensive, innovative plan which included a rubric with multiple criteria which evaluated seventeen differentiated standards at the high school level (Barge, 2012).

Dependent variable: Laerd Statistics indicated the dependent variable was sometime called the outcome variable. Within the research experiment, the independent variable was manipulated to determine the effect on the dependent variable (Laerd Statistics, 2015). Within the current research study, the dependent variable was the GM Analytic Geometry EOC assessment scores.

Generalization: Applied in academic research, generalization allowed findings from a small population to be extended to the larger population. While not absolute, the findings were deemed probable.

Geometry Support: In Georgia, the support course at the high school level was deemed eligible for an elective unit towards high school graduation and was aligned to the geometry course curriculum. The students involved previously displayed a historically weakness within the mathematics curriculum. The course allowed teachers time to address content specific missing information. While placement into the support course was a local decision, the guidelines included the students previous test results, course aptitude and teacher recommendations (Ga DOE, 2014f).

Georgia Milestone (GM) Analytic Geometry End-of-Course (EOC) assessment: This assessment was produced and scored by the Georgia Department of Education and correlated to the standards presented in the Georgia Standards of Excellence Analytic Geometry course. For the current research study, the assessment was provided during May 2015 and served as the dependent variable post-test.

Georgia Milestone (GM) Coordinate Algebra End-of-Course (EOC) assessment: This assessment was produced and scored by the Georgia Department of Education and correlated to the standards presented in the Georgia Standards of Excellence Coordinate Algebra course. For the current research study, the assessment was provided during May 2014 and served as the pre-assessment.

Grouping: The purposeful organization of students within the realm of education (Plucker & Callahan, 2014).

Georgia Standards of Excellence (GSE) Analytic Geometry: The Comprehensive Course Overview documentation indicated this course involved an understanding of geometric shapes within many different context (Ga DOE, 2015b).

Heterogeneous Grouping: Heterogeneous grouping involved sorting mixed ability students into one common, equitable group (Becker, Neumann, Tetzner, Bose, Knoppick, et al, 2014; Hallinan, 1994; Slavin, 1988)

Homogeneous Grouping: Homogeneous grouping involved sorting similar ability level students together into one class based on the student's unique ability level (Becker, Neumann, Tetzner, Bose, Knoppick, et al, 2014; Hallinan, 1994).

Independent Variable: This variable was also known as the experimental or predictor because it was manipulated during the research process to gauge the impact of the dependent variable on the outcome (Laerd Statistics, 2015). Within this study, the three independent variables groups included no support and support with homogeneous or heterogeneous geometry.

One-way ANOVA(ANOVA): Researchers utilized the one-way analysis of variance test to determine whether a statistically significant difference existed between two or more independent variables (Laerd Statistics, 2015)

Professional Development: In education, the term references a variety of training aimed towards improving educators content knowledge, skill and effectiveness.

Response-to-Intervention: A multi-tiered approach for at-risk students which included universal screening, targeted interventions, and high-quality instruction. The three tiers each provided specific characteristics/interventions which enhanced the students' knowledge of the curriculum (Dobbins, Gagnon, & Ulrich, 2014).

Student Growth: Student growth impacted teacher evaluations and was determined by comparing individual student assessment results with results of other students across the state with similar prior achievement (Ga DOE, 2014g).

Student Learning Objective (SLO): Certified high school personnel not teaching mandated assessment courses (Ga DOE, 2013) created approved pre- and post-assessments with specified target growth expectations to provide growth scores for the courses taught by these particular educators (Ga DOE, 2014b).

Teacher evaluations: Georgia law with the passing of Bill 244 during the 2012-13 session (Ga DOE, 2013) implemented the new teacher evaluation system in Georgia. Full implementation included a Teacher Effectiveness Measure (TEM) which consisted of calculations based on a 50% split between 1.) Academic achievement based on student growth scores and 2.) Teacher assessment on performance standards (Ga DOE, 2013; Nichols & Cuenca, 2014)

Tracking – Researchers noted tracking allowed for the fixed long-term placement into a specific level of curriculum based on the student's academic ability (Mulkey, Catsambis, Steelman, & Crain, 2005; Plucker & Callahan, 2014).

Tukey post hoc test: Within statistics, the one-way ANOVA determined if a statistical difference occurred between the independent variables. Once the statistical difference was determined, the researcher ran the Tukey post hoc test and determined where the difference occurred between the analyzed groups (Laerd Statistics, 2015).

Universal Screening: The use of an assessment to systematically analyze individual students' to identified academic or behavioral growth. Typically, the assessment was administered three times per year and identified individuals at-risk of falling behind the expected growth (Regan, Berkeley, Hughes, & Brady, 2015).

Variable: Within statistics, the dependent or independent variables were measured or manipulated during the experiment (Laerd Statistics, 2015).

SUMMARY

Policy initiatives linked to appropriate and equitable grouping practices impacted the sorting of students within the school environment. Specific student placement based on ability grouping was an instructional strategy administrators utilized when assigning teachers to specific students with the intention of increasing academic scores on the state standardized assessments. Previously conducted research noted both positives and negative results when homogeneous and heterogeneous ability grouping was utilized. However, a review of the literature did not find the impact an additional correlating support course had as a variable on the student's GM Analytic Geometry EOC assessment when all three grouping practices were utilized within one population in South Georgia. This study examined the relationship between the GM Analytic Geometry EOC scores from May 2015 and the grouping practices for both the predetermined lowest 30% of the tested population and the entire tested population. The specific analyzed groups included: 1) no support course; 2) support course linked to the homogeneous grouped geometry course and 3) support course linked to the heterogeneous grouped geometry course.

The introduction of support for students who historically struggled in mathematics forced the researcher to focus on grouping practices designed to optimize achievement gains. The federal and state emphasis on accountability correlated to the GSE Analytic Geometry assessment impacted individual entities in the following ways: (a) assessment score accounted for 20% of the student's final grade; (b) assessment growth scores accounted for 50% of the teacher's evaluation score; (c) assessment growth scores accounted for 70% of the administrator's evaluation score; (d) assessment scores accounted for a portion of the schools CCRPI score. GM assessment scores impacted students, teachers, administrators and schools and optimum grouping strategies for the rural system needed to be investigated.

CHAPTER II:

REVIEW OF RESEARCH AND RELATED LITERATURE

This chapter presented a review of applicable research and related literature aligned to this study. The chapter began with an introduction which provided an overview of the provided literature. Next, the background information was provided which included educational reform, school accountability, mathematical curriculum and accountability in Georgia. The major topics section incorporated research that surrounded the organization of students grouped homogeneously and heterogeneously. Next, this section detailed student perceptions and grouping implications which impacted mathematics achievement. Additionally, the section outlined relevant literature which focused on grouping practices applied to race, achievement gap, gender, and psychologic impact. The final section provided a summary of the chapter.

Introduction

According to Allison (2012), effective school leaders and organizations became more resilient as they struggled to meet society's constant changes and demands. Evolving political and legal precedents forced local systems to evaluate curriculum, instructional and assessment issues within the building. School leaders examined local policy decisions aligned with student scheduling practices to effectively and efficiently meet these shifting requirements. Homogeneous verses heterogeneous grouping practices were two instructional strategies administrators utilized while struggling to successfully comply with the newest federal, state and local expectations.

Educational reform in America encountered numerous advances since the community, church-centered colonial period. For instance, the progressive era aligned standards and utilized taxes to help fund schools to hire educated professionals with the focus of educating all students. However, the modern era entwined legal and civil rights movements into schools with the focus centered on equal rights and desegregation. Sputnik sparked an outcry from the masses which involved America's reexamined of itself as a world power and focused society's attention on the people in charge of schools, the standards of the curriculum of the courses, and the underrepresented groups of students. Finally, the accountability era thrust education into the center of the political dialogue to meet the established expectations of federal, state and local governments. Each era enriched the acceptance of the public's scrutiny and encouraged the accountability movement school systems faced. Race-to-the-Top, tied to federal funding, provided the criteria Georgia used to create the federally approved College and Career Readiness Index (CCRPI).

Within the CCRPI, student achievement scores affected more than just the students involved in the assessment. Rather, this index provided differentiated components which held educations, schools and districts accountable for the student learning and college and career preparation. The overarching mathematical components of the CCRPI focused on the student's assessment and examined scores to account for 60% student achievement, 25% student progress, and 15% student gap in achievement. The total CCRPI was used as a mathematical standard which informed the public and government on the school and districts progress toward the established standards. Additionally, student growth on the applicable assessment directly impacted teachers and accounted for 50% of the yearly evaluation. For teachers with courses involving geometry support students, this link to their yearly evaluation caused considerable concern. Students placed into the support course had previously documented mathematical deficiencies yet were expected to perform with the peer group on the state mandated Georgia Milestone (GM) Analytic Geometry End-of-Course (EOC) assessment. This assessment was linked to the school report card and teacher evaluation which emphasized the need to maximize options that revolved around student scheduling and success.

Kelly and Carbonaro (2012) noted the educational trend away from rigid all-inclusive, school-wide homogeneous tracking began in the eighties. In 2007, Georgia removed the leveled tracks for graduation but many systems still utilized homogeneous and heterogeneous grouping when scheduling students for specific courses or grade levels. While homogenous grouping allowed systems to place all students with similar academic abilities in a room, heterogeneous grouping provided a mixed academic level of students in a room. An examination of the literature revealed positive and negative examples of achievement, motivation and self-concepts for both grouping practices. Additional studies focused on the phenomenon identified by Marsh and Parker (1984) as big-fish-little-pond effect (BFLPE).

Researchers (Marsh & Hau, 2003; Marsh & Parker, 1984) noted that academically strong students were figuratively considered big fish in a little pond within a heterogeneously grouped environment. However, once all of the “big fish” were placed together in the same pond, or homogeneously grouped academically, they were no longer all big fish academically. In fact, these same students became academically average or even small fish in a pond full of bigger, academically stronger fish (Marsh & Hau, 2003; Marsh & Parker, 1984). Additionally, the application of BFLPE was examined for implication in regards to gender, mathematical achievement, and test anxiety. Additional research covered the effect of anxiety, race, gender and setting on assessment scores.

An investigation of the literature revealed a gap when examining lower level students placed in homogeneous and heterogeneous grouped classroom for only a specific course at the high school level. While the literature provided studies on the impact of BFLPE for students identified with multiple levels, the literature included nothing surrounding the use of a support course and homogeneous or heterogeneous grouped geometry. Additionally, BFLPE studies focused on the higher academic level students not the lower academic level students placed in an academically challenging environment ending with an academically challenging assessment.

Educational Reform Background

Social, Political and Economic Impact on Education.

Formation and changes.

According to Allison (2012), society’s constant changes and increased demands forced school leaders and organizations to become more resilient. Gibson and Tarrant (2010) speculated a resilient institution not only bounced back from difficulty; it incorporated the change and sprang forward (Allison, 2012). Throughout United States history, educational policy evolved and reflected the commingling of society’s current social, political, and economical beliefs (Daniel & Walker, 2014). Over the last seven decades, criticism and reform impacted education (Marzano, Marzano, & Pickering, 2003). According to Cambron-McCabe (2002), the autonomous nature of the local public education slowly dissolved into reforms and accountability, historical legal precedents (Alexander & Salmon, 1995), and societal concerns (Kress, Zechmann, & Schmitten, 2011).

The Tenth Amendment of the United States Constitution mandated that all authority not specifically assigned to the federal government deferred to each individual state (Cambron-McCabe, 2002; Chicosky, 2015). Because the founding fathers failed to specifically mention education in the constitution, states and local communities determined the direction and expectation of the local public schools (Alexander & Salmon, 1995; Versteeg and Zackin, 2014). Public schools were not established to teach just rudimentary skills (Alexander & Salmon, 1995); but rather, the school was the catalyst that provided an educated population focused on liberty and equality (Chicosky, 2015; Versteeg and Zackin, 2014).

Established in 1635, the first public school (Chicosky, 2015) lacked federal government involvement (Chopin, 2013). However, state involvement began in 1642 with a Massachusetts law focused on the responsibility of local citizenry to confirm educational duties (Versteeg & Zackin, 2014). According to Alexander and Salmon (1995), a pivotal 1647 law titled "Ye Olde Deluder Satan" established a precedent of state involvement in education by allowing states to set educational requirements and collect taxes linked to educational funding resources.

Progressive era taxation and education.

During the Progressive Era, the Industrial Revolution embraced major societal changes that influenced the formation of school districts, education professionals, and aligned standards (Chopin, 2013). Horace Mann, Massachusetts Secretary of Education, shifted educational philosophy when he pushed for a required (Chicosky, 2015; Kress, Zechmann, & Schmitten, 2011), tax-supported public education (Alexander & Salmon, 1995) for all children (Chicosky, 2015). From 1890 to 1930's student attendance in high school for school-aged children increased from approximately 10% to more than 70%. Kress, Zechmann, & Schmitten (2011) theorized during this transition, society's expectation shifted from mere attendance to the belief that students would finish high school. In 1867, the Federal Office of Education was created but maintained no accountability power; rather, it existed as an advisor and provided information to teachers across the country (Chopin, 2013).

Modern era of legal and civil movements.

The Modern Reform Era hosted dramatic legal and civil movements that proved to be pivotal in re-shaping society's expectation of public education (James, 2015; Kress, Zechmann, & Schmitten, 2011). From a legal standpoint, the United States Supreme Court shaped educational grouping guidelines with the 1896 finding of *Plessy v. Ferguson* when it ruled in favor of the philosophy of "separate but equal" (James, 2015; LaPrade, 2011). In 1954, propelled by additional court cases including *Sweatt v. Painter* and *McLaurin v. Oklahoma State Regents for Higher Education*, the United States Supreme Court unanimously overturned *Plessy v Ferguson* with *Brown v. Board of Education* and cited equal protection under the 14th amendment (Daniel & Walker, 2014). This ruling instigated the path towards desegregation (James, 2015; LaPrade, 2011) and shifted society's focus towards the disenfranchised children in public education (Chicosky, 2015).

Sputnik, politics and underrepresented groups.

During the Post World War II Era, Chopin (2013) stressed that the launching of Sputnik in 1957 sparked the American public reevaluated not only the direction of public education, but examined the people in charge. Because of Sputnik, the nation no longer viewed itself as a world leader in science and technology, and this public realization increased the push for educational reform (Chopin, 2013). In 1965, Congress passed the Elementary and Secondary Education Act (ESEA) which focused on school systems that served low income families and provided districts with monetary incentives for desegregation (US DOE, 1965). Additionally, the courts established rights for historically underrepresented groups including females, minorities, and disabled individuals (Chopin, 2013). Two prominent federal court cases sparked social awareness for the plight of the disabled, and the federal government responded with the passing of the Individual Disabilities Educational Act (Alexander & Salmon, 1995). This act tied federal funding to the equal education for disabled individuals (Alexander & Salmon, 1995; Chicosky, 2015). The federal money and court dictates forced state government involvement which acted as the go-between for the federal government and local public entities (Chopin, 2013).

Accountability in education.

During the accountability movement, federal involvement received another opportunity and expanded its immersion into public education when President Ronald Reagan's National Commission on Excellence in Education published the report titled *A*

Nation at Risk: The Imperative for Educational Reform (Chopin, 2013). This groundbreaking 1983 report publically listed educational failings (Cambron-McCabe, 2002) and fostered national security fears associated with the Cold War (Kress, Zechmann, & Schmitten, 2011). Throughout the 1970's, many states established educational competencies that illustrated the minimum proficiency expected for students within the state. Many states developed "consequential accountability" which focused on specific curriculum goals that were measurable and held educators accountable for student results (Kress, Zechmann, & Schmitten). The standards-based era instigated changes in educational accountability (Cambron-McCabe, 2002) and provided a political platform for presidential educational agendas (Kress, Zechmann, & Schmitten, 2011).

President Clinton's 1994 law, *Goals 2000: Educate America Act,* listed eight educational goals and included national standards like graduation rates, assessments, and academic proficiencies (Chopin, 2013). Additionally, President Clinton signed a consecutive law reauthorizing ESEA 1965 titled *Improving America's Schools Act (IASA)* which continued to focus on poor income students but established accountability measures which demanded the same standards for all groups (Kress, Zechmann, & Schmitten, 2011). Kress, Zechmann, & Schmitten (2011) argued that by 2000 thirty-nine states had self-mandated assessments and predetermined consequential accountability measures for success and failure of schools and systems. Additionally, the states held the schools and systems responsible for results and provided incentives and penalties based on the outcomes of the predetermined measurements (Kress, Zechmann, & Schmitten).

In 2002, President Bush enacted legislation titled *No Child Left Behind Act (NCLB)* which provided the newest iteration of ESEA 1965 (Chicosky, 2015; Chopin, 2013; Mead, 2007). Chopin (2013) noted some of the additional NCLB criteria for success included assessments and accountability measures for teachers, schools, and states. The criteria for NCLB provided a mathematical way to calculate a school's adequate yearly progress (AYP) to help monitor the attainment of the standards outlined in NCLB (Chopin). Unlike previous federal mandates, NCLB tied funding to success, and it heavily sanctioned schools deemed "failing" (James, 2015).

In 2011, President Obama advised the nation that "Accountability is the right goal. Closing the achievement gap is the right goal. And we've got to stay focused on those goals" (Obama, 2011, para. 15). According to Sagar and Rosser (2009), Max Weber's theory of bureaucracy provided a checklist of criteria that included organizational structures, rules, and competencies. Georgia's accountability measures outlined in President Obama's Race-to-the-top (RTTT) waiver displayed many of the rule-bound, checklist items discussed in Max Weber's bureaucracy (Sagar & Rosser, 2009). This federal initiative allowed states to request a waiver from the 2001 ESEA provided the waiver met the specific standards outlined in the president's RTTT grant (US DOE, 2009). The grant forced each state to develop a comprehensive, innovative plan that included standards and assessments to ensure students were college- and career-ready by graduation. It also required a method that adequately differentiated accountability for the achievement results (US DOE, 2009). RTTT focused accountability not just on the student; but rather, on the educators, schools, and districts (Hemelt & Marcotte, 2013).

School Accountability Measures in Georgia

In the modern era of high-stakes testing and increased teacher accountability, Betebenner (2009, p. 42) insisted that “achievement data derived from state assessment programs have led to widespread enthusiasm for statistical models suitable for longitudinal analysis.” Smith and Fischbach (2009) noted that the public perceptions, amplified by the media, impacted policy making throughout the United States. Over the last two decades, high-stakes testing moved the pendulum in Georgia’s accountability away from individual students and toward educators and schools (Mclntosh, 2011). Georgia’s high school graduation test for students entering the ninth grade prior to 2011 provided student accountability linked with graduation eligibility (Mclntosh). Unfortunately, high-stakes testing that included grade-retention often penalized the most vulnerable, at-risk students (Huddleston, 2014). The Ga DOE altered student assessments in 2011 (Mclntosh, 2011). Unlike the previous assessment that directly affected the individual students right to graduate, the new assessment only impacted 20% of the student’s final course average in the corresponding course and allowed students to potentially pass the course without passing the assessment (Mclntosh).

The position of the federal government within education was broad and focused on changes that crossed state lines (Alexander & Salmon, 1995). The Georgia Department of Education (Ga DOE) embraced the federal grant criteria and was granted a flexibility waiver from ESEA with the acceptance of the CCRPI accountability (Barge, 2012). Based on Georgia’s waiver documentation, schools and school systems were held accountable based on Georgia’s CCRPI composite score which utilized a rubric that included 60% student achievement, 25% student progress, 15% student achievement gap (Harter, 2014b; U.S. DOE, 2012d).

Georgia Milestone End-of-Course Assessment Weight

In 2013, the Ga DOE (2014f) studied data derived from the state mandated Milestone End-of-course (EOC) assessments submitted the previous year and determined the calculations for school accountability. For high schools, the accountability rubric separated the achievement portion, which accounted for 60% of the overall indicator, into three components: content mastery, post-secondary readiness, and graduation rate (Harter, 2014b). The first section of the CCRPI focused on content mastery and looked exclusively at the percentage of students meeting or exceeding the EOC (Ga DOE, 2014a). The second section analyzed a wide range of college-and-career-indicators to include college credit, career pathways, Lexile scores, and attendance to post-secondary readiness. The final section on the rubric focused on the high school's graduation rate for a 4-year and 5-year cohort (Ga DOE, 2014a). The achievement portion of the accountability index was determined by calculating 40% mastery, 30% readiness, and 30% graduation rate (Harter, 2014b).

College and Career Readiness Indicators Weight

The second section of the CCRPI rubric focused on student progress and reported 25% of the overall score (Harter, 2014c). In this category, individual student growth was calculated by comparing an individual student's assessment results with results of other students with similar prior assessment scores (Ga DOE, 2014h). The eight EOC assessments were divided into four groups based on subject area: Literature, Math, Science and Social Studies (Harter, 2014c). Next, individual students were assigned a student growth percentile (SGP) based on the assessment results within these categories. For each assessment category, the sum of the students meeting typical or high growth was divided by the total number tested (Harter). This final number was multiplied by the 25% assigned by the CCRPI and determined the overall progress points earned (Ga DOE, 2014h; Harter, 2014c).

Achievement Weight

The third and last component of the rubric deviated schools' accountability away from Adequate Yearly Progress (AYP), which focused exclusively on the pass rates of each EOC assessment, and toward achievement change and gap size on these same assessments (Harter, 2014a). For example, the 2012 data was utilized by the state determined the baseline score for the state mean and deviation. The school's mean score was subtracted from the state's mean score for the lowest percent of students and placed into a rubric (Harter). The state compared the school's previous and current year gap size for each EOC and arrived at the achievement gap number. These numbers were placed into a different rubric and determined the gap change from one year to the next for each school. Finally, the state focused on the highest number, from gap size or achievement, and divided the total by the possible points allowed. This performance score was multiplied by 15% and determined the final achievement gap score (Harter, 2014a). Rebell (2012) insisted that decreasing the achievement gap and increasing academic standards topped both state and national concern.

Darling-Hammond, Wilhoit, and Pittenger (2014) supported a multifaceted approach to school accountability because it provided statistical data that illustrated what was and was not working in the individual school. Additionally, schools and systems pinpointed areas of growth and improvement which was used to make informed decisions towards best practice in the classroom (Darling-Hammond, Wilhoit, & Pittenger, 2014). Georgia’s CCRPI provided a differentiated rubric comprised of three sections which included 40% mastery, 30% readiness, and 30% graduation rate (Harter, 2014b). This accountability format calculated scores for each public high school and met the accountability portions of RTTT (Ga DOE, 2014h; Harter, 2014b).

Mathematics and Support

Georgia Geometry Graduation Requirement

Throughout the nation, states required an integration of geometry into their graduation expectations (Dobbins, Gagnon, & Ulrich, 2014). For Georgia, the new mathematics courses included the Georgia Standards of Excellence (GSE) Analytic Geometry and included standards geared towards students becoming college and career ready Ga DOE (2014b). In 2007, the state removed the tiered diploma track and adopted new rigorous graduation standards (Ga DOE, 2014f) which required 23 credits in specified domains (Ga DOE, 2014g). For the mathematics domain, students completed four required credit units which included the completion of one specific unit of GSE Analytic Geometry (Ga DOE, 2015b). The state placed this course second in the series and served as the link between the required GSE Algebra and GSE Advanced Algebra (Ga DOE, 2014f). The Comprehensive Course Overview for GSE Analytic Geometry asserted that geometry involved an understanding of geometric shapes within many different context (Ga DOE, 2015b). The GSE Analytic Geometry course was divided into seven units: 1) Similarity, congruence, and proofs; 2) Right triangle trigonometry; 3)

Circles and volume; 4) Extending the number system; 5) Quadratic functions; 6) Modeling geometry; and 7) Applications of probability (Ga DOE, 2014c).

Students enrolled in the GSE Analytic Geometry were required to complete the Georgia Milestone (GM) End-of-Course (EOC) assessment which measured the achievement of the specified standards of the course (Ga DOE, 2015a). This assessment accounted for 20% of the student's final course average. The comprehensive exam included 53 questions and involved selected response, constructed response and extended constructed response (Ga DOE, 2014c). The standards tested included approximately 60% geometry, 18% expressions, equations, and functions; 11% number and quantity; and 11% statistics and probability (Ga DOE, 2014b).

Response-to-Intervention (RTI)

Students with noted deficiencies struggled with the high mathematical expectations and were at risk of failing geometry without interventions of support (Dobbins, Gagnon, & Ulrich, 2014). Within the response-to-intervention (RTI) framework, multiple tiers provided increased interventions designed to meet the needs of the students who struggled with the established curriculum (Bemboom & McMaster, 2013). For best results, RTI required quality classroom instruction, targeted interventions, and universal screeners (Regan, Berkeley, Hughes, & Brady, 2015).

Within the RTI framework, three specific academic tiers were identified (Dobbins, Gagnon, & Ulrich, 2014). The first level, Tier 1, provided primary prevention on a universal level to all students (Lembke, Hampton, & Beyers, 2012) enrolled in the geometry course. Additionally, within this tier, the teacher monitored student learning, implemented differentiated strategies, and provided high quality instruction to all students (Dobbins, Gagnon, & Ulrich, 2014). The second level, Tier 2, was more strategic (Lembke, Hampton, & Beyers, 2012) and focused on students not progressing at the Tier 1 instructional level (Dobbins, Gagnon, & Ulrich, 2014). This supplemental instruction was delivered in addition to the classroom curriculum and was design for a smaller group meeting four to five times a week (Lembke, Hampton, & Beyers, 2012). For the mathematics curriculum, this supplemental instruction included explicit, step-by-step instruction (Lembke, Hampton, & Beyers). Finally, students who were not successful within this tier were moved to a Tier 3 level. This level included an even smaller population, sometimes made up of students with identified disabilities, who received one-on-one instruction (Lembke, Hampton, & Beyers, 2012).

Geometry Support Course – Tier 2

In Georgia, a course labeled "Mathematics Support" was implemented as an elective (Ga DOE, 2014b) and provided additional assistance for students previously determined to struggle with mathematics. Some of the assistance outlined by the state included in-depth, personal attention and extra time to master the standards discussed in the regular GSE Analytical Geometry course (Ga DOE, 2014f). The curriculum of the support course allowed students an additional class period which focused on concepts missed, emphasized information previously presented, and reassessed the students if necessary. While placement into the support course was a local decision, the guidelines included the students previous test results, course aptitude and teacher recommendations. However, the support course was not a graduation requirement (Ga DOE, 2014f).

Teacher Accountability in Georgia

Baker, Oluwole, and Green (2013) linked President Obama's RTTT program to new Georgia legislation designed to increase teacher accountability by connecting student performance to the classroom teacher's yearly evaluation (US DOE, 2009). Georgia's implementation of the new state-wide teacher evaluation system was mandated by Georgia law with the passing of Bill 244 during the 2012-13 session (Ga DOE, 2013). Full implementation of the new Teacher Effectiveness Measure (TEM) consisted of calculations based on a 50% split between 1) Academic achievement from student EOC assessments and 2.) Teacher assessment on performance standards (Ga DOE, 2013; Nichols & Cuenca, 2014). The TEM score utilized data based half on student growth and/or achievement and half on evaluations which, in turn, indicated the effectiveness of the classroom teacher based on a rubric provided by the state (Nichols & Cuenca, 2014).

Teacher Keys Effective System (TKES)

According to the Ga DOE TKES Handbook (2013), 50% of each certified teacher's yearly evaluation score factored data acquired from the Student Growth Measure (SGM) and/or Student Learning Objective (SLO) assessments. For high school courses that included a Milestone assessment, the SGM calculated "a student's growth relative to his/her academically similar peers – other students with similar prior achievement" (Ga DOE, 2013, p. 66). During a speech in 2009 to the United States Hispanic Chamber of Commerce, President Obama (2009) intimated that teachers provided the most influence inside the classroom and school. He indicated that the federal government was focused on preparing teachers for this task and "encouraging them to stay in the professions" (Obama, 2009, p 26).

Controversy of High-stakes Testing on Teacher Performance

In 2009, The National Academies sent a letter outlining concerns with the presidents RTTT plan (Letter Report, 2009). The researchers quoted statisticians, psychometricians, and economist that cautioned states that adopted high-stakes testing to proceed with caution (Baker, Barton, Darling-Hammond, Hartel, Ladd, et al, 2010). The writers referenced problems associated with the lack of specific knowledge, broad standards and questioning techniques associated with data use as a tool for evaluation (Letter Report, 2009). Other researchers (Baker, Barton, Darling-Hammond, Hartel, Ladd & et al, 2010) noted multiple testing variables outside the control of the teacher that impacted scores. Some variables included environment, home life, community, multiple instructors, previous knowledge, course content, broad standards, block schedules, student attendance and classroom equity (Baker, Barton, Darling-Hammond, Hartel, Ladd & et al, 2010; Baker, Oluwole, & Green, 2013; Ehlert, Koedel, Parsons, & Podgursky, 2012; Letter Report, 2009).

Faced with the evaluation model that utilized high-stakes testing as a component, researchers (Baker, Oluwole, & Green, 2013) indicated two main areas that placed teachers at a disadvantage. The first, structural problems, were discovered in 20 states where, like Georgia, student assessment results were placed on a rubric without variables that were out of the teacher's control. Second, teachers were placed into categories based on numeric cut scores that were not clear or made unfounded distinctions (Baker, Oluwole, & Green). Researchers (Ehlert, Koedel, Parsons, & Podgursky, 2012) noted that SGPs were not intended to correlate to teacher effectiveness and that the SGPs were the "least successful" method available. Additionally, classes with a higher number of disadvantaged students often scored lower on the assessment (U.S. DOE, 2013). Specifically cited were unrealistic assumptions and inexact or insufficient inferences made based on results of the student assessment (U.S. DOE).

Regardless, in compliance with the requirements outlined in the RTTT initiative, Georgia implemented changes in accountability for schools and teachers (U.S. DOE, 2012d). For schools, the state linked each school's accountability to the CCRPI score (Ga DOE, 2014a). For teachers, accountability linked student growth to the teacher's yearly evaluation (Ga DOE, 2013; Nichols & Cuenca, 2014). Ryser and Rambo-Hernandez (2013) noted the importance of such models, and claimed that "using assessment data to determine student growth has become an integral part of the accountability movement . . ." (p.17). Researchers (Nichols & Cuenca, 2014) argued the new Georgia teacher initiatives resulted from educational reforms focused on outcomes based accountability. However, other researchers (Sloan & Kelly, 2003) examined the different state assessments utilized and emphasized the problematic difficulties involved when states use one assessment to determine accountability for both the student growth and teacher ranking.

Major Topics

Organization of Students within the School Building

Societal changes forced educators to become accountable as they investigated manageable and equitable forms of instruction (LaPrade, 2011). One of the most critical responsibilities school administrators faced revolved around instructional decisions associated with grouping students to achieve the highest possible academic success

(Slavin, 1988). Coleman (2016) discussed the importance of administrators assigning teachers to specific students for optimal gains (Oakes, 1985) that were appropriate and equitable. For many schools, the ability to sort students for academic gain utilized minimal resources (Collins & Gan, 2013). Student behaviors, student scores, and teacher experiences were some of the variables administrators considered when sorting students into specific groups (Collins and Gan).

The terms surrounding achievement grouping often conflicted (Gentry & MacDougall, 2008) and confusion prevailed when student sorting and achievement were investigated based on vague definitions and applications (Loveless, 2013). Educational terms such as tracking, homogeneous grouping, heterogeneous grouping, achievement and ability were utilized by researchers within a variety of parameters (Gentry & MacDougall, 2008). For instance, various grouping strategies organized students with flexibility from one level to the next (Plucker & Callahan, 2014). A student's achievement level was considered fluid and underwent change based on applied educational strategies, experiences and opportunities (Gentry and MacDougall, 2008). Conversely, a student's ability level was often equated to the student's intelligence level and considered to be more stable and fixed (Gentry & MacDougall).

Homogeneous grouping.

Educational studies and debates over the grouping of students within the academic classroom hit its height during the 1970s and 1980s (LaPrade, 2011; Worthy 2010). Streaming, setting, tracking and ability grouping were all terms used to describe some form of homogeneous grouping scenarios utilized within the educational arena (Zevenbergen, 2003). Homogeneous grouping allowed for students of similar academic achievement to be separated and placed into groups based on the student's unique achievement level (Becker, Neumann, Tetzner, Bose, Knoppick, et al, 2014; Hallinan, 1994). Advocates rationalized this grouping centered on improved student learning opportunities (Kelly & Carbonaro, 2012; Worthy, 2010) and increased academic achievement (Becker, Neumann, Tetzner, Bose, Knoppick, et al, 2014; Hallinan, 1994; Preckel, Gotz, & Frenzel, 2010). Additionally, advocates for gifted students emphasized homogeneous grouping increased opportunities and challenged the advanced students (Cortes & Goodman, 2014). When groups included mixed ability students, the high level ability students were not as prepared or challenged (Cortes & Goodman). Conversely, critics stipulated the homogeneous grouping of students allowed for lowered academic achievement (Oakes, 1985), unintended psychological outcomes (Becker, Neumann, Tetzner, Bose, Knoppick, et al, 2014), depressed self-concepts (Kelly & Carbonaro, 2012; Marsh & Parker, 1984), and decreased achievement and motivation (Hallinan, 1994; Wouters, De Fraine, Colpin, Van Damme & Vershueren, 2012).

Tracking.

Tracking, one type of student grouping, involved long-term placement into courses or diploma tracks based on the student's past achievement (Mulkey, Catsambis, Steelman, & Crain, 2005; Plucker & Callahan, 2014). Researchers noted the tracked path allowed very little flexibility (Loveless, 2013) or the opportunity for movement into other achievement tracks once placed into a specific level (Gentry & MacDougall, 2008). Tracking was predominately found within secondary schools and took place between classes (Loveless, 2013). Oakes (1985) argued in favor of "detracking" schools due to gaps in outcomes for low achievement level students. Conversely, other researchers argued lower achievement level students would benefit from homogeneous grouping provided the classroom teacher kept high expectations and modeled lessons geared towards the higher level student in the specified classroom (Duflo, Dupas, & Kremer, 2011).

Detracking in georgia.

For the state of Georgia, high school student's graduation course requirements varied depending on student's placement into the College Preparatory or Technical/Career-preparatory diploma track when a student enrolled in ninth grade (Ga DOE, 2007). The different levels of tracking aligned with different levels of curriculum and required courses for graduation which aligned with different levels of instruction within the different subjects (Loveless, 2013). The educational trend away from rigid all-inclusive, school-wide homogeneous tracking began in the eighties (Kelly & Carbonaro, 2012). In 2007, the Ga DOE (2007) embraced the de-tracking movement and instigated a single graduation diploma track which removed the previous "tiered" tracks.

Not tracking, but still grouping.

Despite the state adoption of this single diploma track, Worthy (2010) argued that educational systems still promoted grouping when they utilized advanced, honors, and general academic courses to group the students homogeneously. For example, students in a high achievement group were placed into courses labeled honors or advanced geometry while the remaining students were placed into the regular geometry course (Loveless, 2013). However, at the foundational level, many schools still homogeneously grouped by grade, achievement level and/or course selection (Becker, Neumann, Tetzner, Bose, Knoppick, et al, 2014; LaPrade, 2011; Worthy, 2010). The Ga DOE TKES Handbook

(2015c) for Georgia specifically identified the homogeneous grouping of students into advanced coursework based on their gifted eligibility. While the statement included the capacity for non-gifted students to participate in the offered advanced level courses, additional stipulations existed for the non-gifted student's admittance into the program (Ga DOE TKES Handbook).

Boaler (1997) suggested that the era of accountability encouraged educational systems to move away from equality and back towards grouping in an effort to increase academic gains. This movement was especially for the student's that were identified as a higher ability level student (Boaler). Both tracking and grouping involved institutions sorting students based on an established curriculum aligned to the students' ability as established by previous achievement parameters (Loveless, 2013). Standardized test scores and teacher perceptions were often the main factors centered around homogeneous student groups (Useem, 1992). Proponents of homogeneous grouping for gifted students argued similar ability students provided positive gains when grouped together (Cortes & Goodman, 2014). Additionally, proponents argued the gifted student's learning was inhibited when high level students were placed into heterogeneously grouped classrooms (Cortes & Goodman). However, Callahan (2001) stipulated gifted students were not necessarily academically advanced across all content areas. Educational entities focused on the needs of this population would not provide homogeneous content based on a gifted title (Callahan).

Teacher perceptions.

Researchers (Becker, Neumann, Tetzner, Bose, Knoppick, et al, 2014; Kelly & Carbonaro, 2012) indicated that the use of homogeneous grouping into low, regular or advanced classrooms, affected both student and teacher expectations. According to Shavelson (1973), “Any teaching act is the result of a decision, whether conscious or unconscious, that the teacher makes after the complex cognitive processing of available information” (p.18). Duflo, Dupas and Kremer (2011) theorized within the classroom environment, teachers taught to the middle ability level of the students in the room. In a synthesis of over 500,000 studies, Hattie (2003) indicated multiple variables associated with student achievement and argued 30% was influenced by the classroom teacher. Of this 30%, 3% was based on teacher knowledge and education, the remaining 97% incorporated some of the following qualities: Feedback, instructional quality, direct instruction, remediation, and challenge of goal (Hattie).

Robertson (2013) noted positive outcomes of homogeneous grouping and suggested educators encouraged a student’s ability level to increase achievement. Oakes (1985) argued teacher perceptions when homogeneous grouping took place allowed for clear expectations for each group. Students in high achievement groups were seen as brighter or smarter and low achievement groups were viewed as slower and less intelligent (Oakes). Additionally, leading theoretical researchers postulated the negative impact of ability grouping determined set opportunities for certain students while denying opportunities to others (Boaler, 1997).

The teacher’s belief system directly impacted the teaching skill displayed (Borko & Putnam, 1996). The lower group explored lower level materials and frequently completed repetitive assignments which limited the amount of curriculum covered (Lleras & Rangel, 2009). Researchers (Hallam & Ireson, 2003; Hallinan, 1994) asserted that in the lower level groups, teachers dealt with more discipline, non-instructional task, and lowered enthusiasm. Hallinan (1994) theorized within homogeneous grouping, curriculum and pacing were significantly increased in the high academic level due to the teachers' ability to proceed at a faster, more in-depth pace. Kelly and Carbonaro (2012) argued that 90% of the teachers in the study expected students in the higher group to attend college compared to the 40% in the low group.

Researchers noted that the teacher's perception of grouping was influenced by the grouping practices at the teacher's school, the curriculum the teacher taught, and the experience that the teacher provided (Hallam & Ireson, 2003). Mathematics course work included knowledge of perceived procedural patters and logical thinking (Chiu, 2012). Hallam and Ireson (2003) theorized that the mathematics curriculum dictated the necessity for correct answers which in turn prompted the teachers' desire for students to be homogeneously grouped so that they were academically similar. Mathematics curriculum teachers indicated a stronger desire to group students by ability than other academic areas (Zevenbergen, 2003).

Heterogeneous grouping.

Heterogeneous grouping did not separate the students into classes based on achievement level; rather, it mixed all academic abilities together and formed one common, equitable group (Becker, Neumann, Tetzner, Bose, Knoppick, et al, 2014; Hallinan, 1994; Slavin, 1988).

Between-class – the school cluster concept.

Matthews, Ritchotte and McBee (2013) distinguished between two different flexible models of achievement grouping: between and inside the classroom grouping. Between-class achievement grouping, or school cluster approach, assigned students to a specific classroom based on the student's previous achievement or prior assessment (Matthews, Ritchotte & McBee). The school cluster scheduling concept grouped students by achievement and placed every level within the classroom (Gentry, 2014). This scheduling approach was flexible and determined a student's achievement to form equitable, heterogeneous classrooms that included high-ability students in all rooms, not homogeneously placed together (Gentry). Additionally, this scheduling concept provided targeted professional development to the classroom teacher and utilized differentiation to meet the needs of all levels in the room (Gentry & MacDougall, 2009). Gentry and Owen (1999) completed a qualitative and quantitative study and noted increased achievement scores for all levels when the heterogeneous cluster grouping was utilized and compared to a similar school district. Matthews, Ritchotte and McBee (2013) examined the academic achievement scores of students and noted an increase in mathematic achievement in both the gifted and non-gifted students when schools utilized this grouping method. Additionally, between-class achievement grouping was flexible and took place at the school, subject or class level (Gentry & MacDougall, 2008).

Within the classroom - differentiation

Gentry and MacDougall (2008) referred to the second type of achievement grouping as within classroom flexible grouping instigated by the classroom teacher. Depending on the lesson, activity or student ability, the classroom teacher utilized homogeneous or heterogeneous grouping to maximize student opportunity for learning (Gentry & MacDougall). Tomlinson, a leading expert in the area of classroom differentiation, stressed the importance of educators insuring the equity of the access to excellence within the classroom environment (Tomlinson, 2003). Effective differentiation allowed the teacher to stretch the learning of all students in the classroom (Tomlinson & Strickland, 2005). Within the Ga DOE TKES Handbook (2015c), differentiated instruction allowed the classroom teacher to challenge and support “each student’s learning by providing appropriate content and developing skills which address individual learning differences (p. 36).

Remediation, acceleration or enrichment activities which engaged the student in higher learning was the cornerstone of the teachers differentiated lesson plan (Ga DOE, 2014h). The teacher utilized a variety of assessment data and created differentiated instructional lesson plans based on the prior learning and ability of the students (Ga DOE). The researcher argued that students heterogeneously grouped learned best when the teacher planed for a variety of learning situations that met the needs of all students involved (Tomlinson, 2001). In a differentiated classroom, the classroom teacher examined the student taught, not just the curriculum taught (Tomlinson, Hockett, & Kiernan, 2005). This variation of instruction included opportunities for the classroom teacher to differentiate the curriculum content, process, or product based on the ability and learning style of the students within the classroom (Tomlinson & Strickland, 2005).

Teacher perceptions.

Veteran teachers indicated a higher level of comfort and favored the heterogeneous, ability-grouped classroom over the homogeneous grouped classroom (Hallam & Ireson, 2003). Additionally, humanities and English teachers favored heterogeneous grouping while mathematics and foreign language teachers favored homogeneous grouping practices (Hallam & Ireson). Worthy (2010) argued the homogenous grouping of students did not positively affect student outcomes while

(Hallam & Ireson, 2003) heterogeneous grouping provided the lower achievement level students a positive achievement model which helped student growth both emotionally and socially.

Grouping preference and expectations.

Researchers (Becker, Neumann, Tetzner, Bose, Knoppick, et al, 2014; Bernhardt, 2014; Kelly & Carbonaro, 2012; Mulkey, Catsambis, Steelman, & Crain, 2005) investigated student outcomes and teacher expectations that were evident in heterogeneous and homogeneous grouped classrooms. The highest influence on the student's grouping preference was based on the student's previous experience and comfort with either heterogeneous or homogeneous classrooms (Hallam & Ireson, 2006). The overwhelming reason provided by the students in favor of homogeneous grouping focused on the work assigned matching student's needs (Hallam & Ireson, 2006).

Researchers (Preckel, Gotz, & Frenzel, 2010) noted a link between boredom and higher achievement level grouped students that received under-challenging work in the mathematics classroom. Researchers (Foust, Hertberg-Davis & Callahan, 2009) emphasized increased pride in coursework and intellectual challenges high-level students experienced in Advanced Placement (AP) and International Baccalaureate (IB) courses. Oakes (1985) argued students in lower groups viewed education and teacher involvement different then the students placed in higher achievement groups. When placed into homogeneous classrooms, students were very cognizant of the assigned "group" and the expectations of the curriculum (Lleras & Rangel, 2009) which affected the student's self-esteem (Hallam & Ireson, 2003).

Self-fulfilling prophecy.

Researcher Zevenbergen (2003) completed a qualitative study and indicated students were very aware of the group dynamics and the expectations of the classroom. Student perception included less opportunities, higher vigilance, and negative feedback. Conversely, student perception of the high level group indicated more opportunities, positive feedback, higher academic expectations and increased privileges (Zevenbergen). According to Chang (2011), teacher expectations aligned with a phenomenon known as a self-fulfilling prophecy. The impact of the teacher's perception of the student's academic ability influenced the student's perception of their own ability (Rubie-Davies, 2006). The far reaching implications connected to the self-fulfilling prophecy, or Pygmalion effect, implied incorrect assumptions induced a new behavior which in turn made the original assumption become reality (Chang, 2011). If teachers expected high results from a group of students, the students performed to this level (Chang). However, some researchers (Hauser-Cram, Sirin & Stipek, 2003) argued the negative impact self-fulling prophecy had on low-income and disenfranchised students.

Researchers (Duflo, Dupas, & Kremer, 2011) provided experimental evidence which involved 121 first grade schools in Kenya and centered around the premise that the classroom teacher taught to the middle ability level of the student population within each classroom. Based on this student composite, homogeneously grouped classrooms were not as diverse in ability and allowed teachers to meet specific student needs. The researchers concluded the high and low level students demonstrated growth and benefited from grouping based on prior achievement in the tracked classroom. Additionally, lower tracked groups showed larger gains in basic skills, while the higher group showed larger gains in advanced skills. For students in the non-tracked environments, but assigned to higher achieving peers, the following growth conclusions were noted: top students became stronger, middle students were “absent” and low level students were strong (Duflo, Dupas, & Kremer).

Collins and Gan (2013) examined 9,000 students within 135 elementary schools in Texas. The researchers concluded that both low and high level students benefited from homogenous grouping especially when placed into groups based on previous testing data. Specifically, special education and gifted students noted positive mathematical achievement when grouped homogeneously (Collins & Gan). However, Gentry (2016) argued research completed by Collins and Gan failed to consider teacher experience and differentiation which impacted student achievement. Kerckhoff (1986) analyzed the findings of a study based on Great Britain students which examined data from the National Child Develop Study focused on achievement scores from students when they were 7 and 11 years old. The researchers compared student data within schools that were homogeneously grouped into high, medium, low and remedial achievement levels and contrasted the achievement results of other schools that heterogeneously grouped the students. The researcher noted the lower achievement level students learned less than the student’s peers that were heterogeneously grouped (Kerckhoff). Multiple studies argued higher grouped students learned more and lower grouped students learned less when compared to students that were grouped heterogeneously (Lleras & Rangel, 2009).

Double-dose grouping and mathematic achievement

Mathematical course data from seventh and eighth grade students noted lower level student achievement and indicated less improvement, but the higher level students “learned” more than the heterogeneously grouped population (Hoffer, 1992). However, different researchers (Betts & Shkolnik, 2000) compared student growth within mathematics when placed into a school that utilized achievement level grouping and one that did not group. The researchers noted the school level data revealed little effect based on grouping but did not note any individual examination (Betts & Shkolnik). In a different study, researchers (Cortes & Goodman, 2014) examined the use of homogeneous grouping of ninth grade students based on previous academic scores below the national average. Students were homogeneously placed into the required Algebra course and an additional hour of support. The researchers examined targeted instructional pedagogy and higher expectations during the support course to augment the previously determined negative consequences of tracking. The researchers indicated a higher gain for the high and middle level students in this grouped environment. Cortes and Goodman (2014) specified additional time, higher expectations and better pedagogy offset the typical negative impact of tracked students in previous research.

Variables impacting assessment scores.

Researchers (Seaton, Marsh, & Craven, 2009) noted students in high achievement schools had a lower mathematics based self-concept than the student’s counterparts in heterogeneous grouped schools. William and Bartholomew (2004) argued mathematics achievement level grouping had little overall effect, but led to achievement gains in the upper level students. The application of big-fish-little-pond effect (BFLPE) noted students had a stronger identity with same-gender classmates and the effect was greater in classes with smaller numbers versus large class sizes (Thijs, Verkuyten, & Helmond, 2010). Over the last two decades, multiple researchers have investigated positive and negative psychological outcomes associated with grouping students based on the individual, documented academic achievement level (Goetz, Preckel, Zeidner, & Schleyer, 2008; Makel, Olszewki-Kubilius, Lee & Putallaz 2012; Marsh & Hau, 2003; Nagengast & Marsh, 2012; Thijs, Verkuyten, & Helmond, 2010).

For educators, the expectations and the loss of opportunities for the students clearly locked into a lower group added to the negative outcome of teacher perceptions of ability grouping (Zevenbergen). Teacher and student perception data indicated more enthusiasm for learning in the higher level while the lower group fostered a negative school concept and motivation (Hallam & Ireson, 2003). Researchers (Kelly & Carbonaro, 2012) suggested that both the students and teachers responded with lower student engagement and academic rigor in the lower achievement level grouped classroom even if the students were in high levels for other courses during the day. According to researchers (Becker, Neumann, Tetzner, Bose, Knoppick, et al, 2014), the negative psychological and emotional outcomes associated with grouping were explored through countless studies under Marsh's phenomenon known as BFLPE.

Effect of race on assessment scores.

Societies' perception of the objectivity surrounding standardized assessments was based on the understanding that the assessments included identified content standards, scoring rubrics, and administration security scenarios for every student involved in the assigned assessment (Sireci & Faulkner-Bond, 2015). Researchers indicated assessments were often created based on the majority of the students involved and that attention to subgroup bias needed to be considered (Sireci & Faulkner-Bond). Unfortunately, minority subgroups were insubstantially represented and conceptualized within the framework of mathematics (Stinson, 2011; Weissglass, 2002). Furthermore, the bias of assessments, which were normalized based on white students as representing all students, provided unfair disparities towards other racial groups (Martin, 2012). Stinson (2011) cited research (Parks & Schmeichel, 2011) which investigated peer review articles from 2005-2010 and determined that race or ethnicity descriptors within mathematics only accounted for 3.8% of the articles. Martin, Gholson, and Leonard (2011) questioned the minimal progress the supplied research provided as underrepresented groups were underserved despite advances in curriculum and cognition.

Brown-Jeffy (2006) argued that school systems with a larger population of minority students were considered to have negative connotations of student outcomes. According to the US DOE (2012), which utilized data from the National Assessment of Educational Progress (NAEP) test, twelfth grade assessments revealed an increase in curricula, credits and GPA within all racial tested groups compared to 1990 test results. Additionally, of the graduates included in this assessment 48% of Asian/Pacific Islander completed an Algebra I course while in middle school compared to 29% White, 17% Hispanic, and 12% Black (US DOE).

Brown-Jeffy (2009) studied racial impact on mathematics achievement and utilized data from the High School Effectiveness Study which contained 3,392 students in 177 high schools in all 50 states. The researcher noted the achievement gap between African-Americans and White students throughout all grades; however, the researchers noted the change in score results on students from 10^{th} grade to the 12^{th} grade and indicated the following statistics: Asians outscored Whites by 5 points; White students outscored African-American by 10 points; and White outscored Hispanic by 8 points.

Okazaki and Sue (1995) argued that grouping individuals together for the purposes of comparison led to stereotyping and many researchers interchanged the terms ethnicity, culture and race. Furthermore, Martin (2013) stated

> “how well-intentioned actors, including teachers, can reinforce white supremacy and deficit-oriented views of Black, Latina/o, and Native American children by uncritically embracing ‘achievement gap’ rhetoric and ideology, which posit their inferiority, and interpreting the closing of such gaps to mean ‘raising these children to the level of White and Asian children’ (p 323).

Brown-Jeffy (2009) noted that race was the largest factor in the achievement gap predictions and when a school’s racial minority composition exceeded 50%, scores for the entire student body was lowered.

Effect of gender on assessment scores.

Sandy & Duncan (2010) argued that the variables of race and socio-economic disadvantages as the largest contributing factor within the urban school setting. Cheema and Galluzzo (2013) investigated mathematics data from an international assessment and stated that an achievement gap between races existed even when variables of gender, anxiety, and self-efficacy were controlled. Researchers indicated that race was the highest single predictor of achievement even though the sample was formed from a homogeneous group based on age, language proficiency and psychological disability (Cheema & Galluzzo).

Researchers (Catsambis, Mulkey, & Crain, 2001; Duncan & Sandy, 2013) argued society stereotyped mathematics as a male dominated field while literature was classified as more female dominated. Consequently, expectations of achievement for the two groups influenced mixed achievement goals and self-esteem outcomes (Catsambis, Mulkey & Crain). A meta-analysis included 142 test-anxiety, gender-focused studies and maintained that females at all grade levels scored a significantly higher than males (Hembree, 1988). Other researchers (Karimi & Venktesan, 2009; Lowe & Lee, 2008) postulated that females were statistically higher than males on the debilitating anxiety factors, but found no significant difference on performance. However, Brown-Jeffy (2009) noted that males had a higher mathematics achievement score when compared to females in a study that examined 10^{th} and 12^{th} grade students from all 50 states.

Catsambis, Mulkey and Crain (2001) compared all students in a homogeneous and heterogeneous grouped middle school and investigated gender based mathematics achievement differences when race and socioeconomic backgrounds were analyzed. The researchers noted that only the male students were affected and further indicated that high-ability males in the tracked school had the largest negative impact (Catsambis, Mulkey, & Crain). Liu and Wilson (2009) theorized males had the largest advantage in the mathematics domain of space and shape and males also statistically outperformed females on the complex multiple choice items of the assessment.

Conversely, a meta-analysis of 369 samples that examined gender differences in achievement scores and teacher marks suggested females consistently scored higher than males in every component of the analysis (Voyer & Voyer, 2014). Additionally, the researchers found a smaller positive effect size in achievement scores results for females in mathematics and a larger effect size for this group in language courses (Voyer &Voyer). Other researchers (Else-Quest, Hyde & Linn, 2010) noted nations with gender equity had a lower gender mathematics achievement gap than societies without equity.

Researchers (Cheema & Galluzzo, 2013) utilized mathematics data from an international assessment and suggested that the gender achievement gap disappeared once student demographics and variables were controlled. However, the US DOE (2009) utilized data from the National Assessment of Educational Progress (NAEP) test and reported males still outscored females on the twelfth grade assessments even with the increase in rigorous mathematics course and GPA's for both groups.

Effect of setting on assessment scores.

According to The Nation's Report Card (2012), results from the mathematics portion of the National Assessment of Educational Progress (NAEP) test indicated urban schools had more students below the basic level then other schools. Researchers indicated several factors of urban schools contributed to the lowered academic expectations, including concentrated levels of low income families (Sandy & Duncan, 2010), unemployment (Peng, Lee, Wang & Walberg, 1992), adequate school funding (Alexander & Salmon, 1995).

While the size and location of the school was not the critical factor when examining achievement, the socio-economic and racial factors within the school had a causal effect on the achievement scores (Brown-Jeffy, 2006). However, researchers (Von Der Embse & Hasson, 2012) did not find a significant correlation to indicate that school setting, urban versus suburban, impacted a student's level of test anxiety. However, the researchers noted the strongest negative correlation associated with test anxiety on the mathematics assessment between the settings (Von Der Embse & Hasson). Sandy and Duncan (2010) examined the differences between urban and suburban scores on the Armed Services Vocational Aptitude Battery (ASVAB) and noted that urban students accounted for 75% due to student characteristics including race and income. However, individual school differences including class size and school quality had little effect on the gap size (Sandy & Duncan).

Psychologic impact and big-fish-little-pond effect.

Chiu (2012) speculated that educators maximized a student's academic potential by better understanding the psychological processes based on internal and external self-concepts. Researchers (Marsh & Hau, 2003; Marsh & Parker, 1984) examined the psychological impact of homogeneous grouping on the student's self-concept. Marsh and Parker (1984) theorized students compared their own ability with the peer group in the current, specific academic environment and this comparison impacted the individual student's self-concept. Within a heterogeneous grouped classroom, the higher academic students were figuratively the big fish in a little pond. However, when homogeneous strategies were utilized, all of the academically strong students, or all of the big fish, were grouped together in the same pond. For student comparison purposes, this new pond impacted the student based on the premise all students were no longer big fish academically. In fact, many of the academically strong students became academically average or even small fish in a pond full of bigger, stronger fish (Marsh & Hau, 2003 Marsh & Parker, 1984).

Researchers examined many aspects of grouping based on academic ability; however, BFLPE researchers focused on the psychological impact of grouping practices on the student's self-concept (Marsh & Parker, 1984; Nagengast & Marsh, 2012) external academic self-concept (Makel, Olszewki-Kubilius, Lee & Putallaz, 2012; Marsh & Hau, 2003; Seaton, Marsh, & Craven, 2009; Thijs, Verkuyten, & Helmond, 2010; Wouters, De

Fraine, Colpin, Van Damme, & Vershueren, 2012) and external/internal academic self-concept (Chiu, 2012).

Social, external self-concept.

Marsh and Shavelson (1985) first examined the diverse nature of an individual's self-concept and internal perception to determine how external variables impacted an individual's overall self-concept. Marsh and Parker (1984) argued an individual's self-concept was developed based on the individual student's social comparisons to other students. According to Chiu (2012), the BFLPE implication indicated that each student determined an internal self-concept based on that student's comparison of other students in the class and school. Seaton, Marsh, and Craven (2009) expanded the previous narrow BFLPE educational research and conducted a cross-cultural, 41 country study which once again revealed homogeneous, high achievement level students suffered lower self-concept than the student's academic peers which were heterogeneous grouped (Seaton, Marsh, & Craven).

Academic and nonacademic self-concept.

Marsh and Shavelson (1985) BFLPE study correlated with other prominent research and concluded an individual's self-concept was more than just a social comparison. The researchers theorized that an individual's self-concept was broken down into hierarchical model that flowed from an individual's overall general self-concept into an academic and non-academic layer. The non-academic layer flowed into three distinct categories made up of physical, emotional, and social. The researchers noted that this distinction between academic and nonacademic was more evident in pre-adolescents and decreased as the student's age increased. For educational purposes, older students had a broader perspective of individual abilities that was not dependent on peer comparison (Marsh and Shavelson).

Academic self-concept.

Marsh and Hau (2003) previously focused on an individual student's academic self-concept (ASC) and acknowledged that it is partly formed based on the student's evaluation of the individuals own academic achievement and partly based on the academic achievement of student's peers in the same school. During an empirical research project, Marsh and Hau (2003) included academically selective high schools in 26 countries and provided significant cross-cultural additional emphasis connecting higher achievement with a lower reported academic self-concept on individuals other than the previously researched gifted and special education students. Researchers postulated that this new academic comparison lowered the individual's academic self-concept and this had implications for educational policies (Marsh & Hau, 2003; Marsh & Parker, 1984).

Based on the BFLPE phenomena, high ability students noted higher self-concept when placed into the low academic group and lower self-concepts when moved to a higher academic classroom (Chiu, 2012). A close examination of career choices illustrated BFLPE influence on individual students (Nagengast & Marsh, 2012). The application of BFLPE focused on the negative effects of academic self-concepts within the ability leveled classroom. The high-achieving students with lower self-concepts selected career paths below the individual's potential ability. For society, this meant that the highest ability students selected career goals not matching their potential which would have a lingering negative impact (Nagengast & Marsh).

Multiple ponds and academic self-concept.

Chiu (2012) intimated that a student's ASC was not based strictly on external comparisons; but rather, it included an internal comparison of the student's own achievement within different educational domains. For example, how a student compared the student's own knowledge in mathematics to the student's own knowledge in science would be used as an internal academic comparison (Chiu). Seaton, Marsh, and Craven (2009) noted the student's academic self-concept manipulated how the student felt about himself/herself academically. Conversely, the student's academic achievement indicated how the student felt they performed in the same setting. Researchers (Wouters, De Fraine, Colpin, Van Damme, & Vershueren, 2012) argued that females indicated a lower academic self-concept than males. For educational implications, a student's frame of reference influenced course selection and changed the individual's academic self-concept (Marsh & Hau, 2003).

In contrast of previous BFLPE studies, researchers (Makel, Olszewki-Kubilius, Lee, & Putallaz, 2012) found no decreased ASC and an increased in the nonacademic areas when high-ability students completed a competitive three-week academic supplemental summer program. The researchers theorized students' self-concept did not alter depending on environment or peer group and that students in educational environments were not in just "one pond." While most BFLPE research findings indicated negative reasons for achievement grouping, this research indicated positive effects of supplemental programs on high-ability grouping in older students (Makel, Olszewki-Kubilius, Lee, & Putallaz).

Changing ponds and assessment scores.

Unlike previous examples that examined students in a set group, researchers (Wouters, De Fraine, Colpin, Van Damme, & Vershueren, 2012) completed a longitudinal study and examined the effect changing groups had on a high school student's academic self-concept and achievement. In line with the BFLPE theory, students moving from a higher group to a lower group experienced a positive lift in the individual student's academic self-concept (Wouters, De Fraine, Colpin, Van Damme, & Vershueren). However, in-line with previous documentation provided by Eccles and Roeser (2011), the researchers (Wouters, De Fraine, Colpin, Van Damme, & Vershueren, 2012) emphasized that achievement scores also suffered and initial drop for students that moved to a lower group. For educational applications, the researchers noted that the drop was more pronounced for students in lower grades then in high school (Wouters, De Fraine, Colpin, Van Damme, & Vershueren). A closer examination of the available research indicated lower grade-level tracking had a higher BFLPE impact than it did on older aged student (Salchegger, 2016). Researchers noted the impact of social comparison on a younger, insecure student was more invasive than the lingering impact on a more stable high school student with a firmly established self-concept (Salchegger, 2016).

Effect of anxiety on assessment scores.

The increase use of high-stakes testing encouraged researchers to investigate the impact test anxiety had on student achievement to validate authentic scores for students and schools (Von Der Embse, Barterian, & Segool, 2013; Von Der Embse & Hasson, 2012) Anxiety was an unpleasant emotional state without a specific cause that included feelings of apprehension or worry Putwain, 2007). However, test anxiety was a specific form of anxiety that occurred during an assessment or evaluation situation (Kurbanoglu & Nefes, 2015; Salend, 2012). Researchers defined test anxiety as multidimensional (Hong, 1998; Salend, 2012) and included a student's cognitive (Hong, 1998; Kelly, 2011; Putwain, 2007; Putwain & Symes, 2011; Sparks, 2011), emotional (Putwain, 2007; Putwain, 2009; Putwain & Symes, 2011) physiological (Hong, 1998; Huberty, 2009; Putwain, 2007; Salend, 2012) and behavioral (Hong, 1998; Huberty, 2009; Salend, 2011) responses associated with consequences of failing on an assessment.

Emotional and cognitive factors.

Emotional and cognitive factors were psychological and impacted the development of test anxiety (Lowe & Lee, 2008). According to the *American Test Anxieties Association* (2015), 16 – 20% of school age students reported high test anxiety and another 18% experienced moderate test anxiety. Huberty (2009) indicated that up to 30% experienced severe anxiety which affected test performance. Kelly (2011) noted the increased brain-based research over the last decade offered educators insight into how the brain worked and impacted student learning. Recent neuroscience researchers examined the brain to better understand how mathematics anxiety interfered with a student's ability to solve problems (Sparks, 2011). The brain first processed the provided problem in the amygdala, or emotional center, and then routed the prioritized information to the prefrontal cortex which dealt with critical thinking and memory. This was the point stress and anxiety clearly interfered with the brain and impacted the individual's ability to remember or answer correctly (Sparks).

The brain and neuroscience

Educational neuroscience offered educators interventions applicable to classroom practice (Samuels, 2009). The understanding of how the brain worked and interpreted the information presented allowed educators improved learning opportunities (Jensen, 2001). Researchers (Putwain & Symes, 2011) acknowledged the psychological aspects associated with test anxiety and further defined student tension as a reference to perception. According to Putwain (2007) worry was cognitive and involved negative self-talk elicited by external and internal cues associated with self-evaluation and potential consequences of failure. Salend (2011) indicated self-talk included negative statements, pessimistic expectations, and negative social comparisons. Putwain (2007) maintained that increased test anxiety formed worry clusters in the brain that eventually affected long term memory. Putwain and Symes (2011) also referenced previous research which found that the negative effect of test anxiety, with the worry component, was association with lower performance scores (Hembree, 1988; Putwain, 2008).

Classroom teacher and fear appeals.

Putwain and Symes (2011) examined the longitudinal psychological implication on academic achievement on secondary mathematics students when the classroom teacher used fear appeals, highlighting failing consequences, instead of positive achievement outcomes. The correlation of fear added to mathematical failure increased an emotional element to the anxiety (Ma, 1999). This suggested that the use of fear appeals by teachers formed the antecedent of test anxiety (Putwain, 2009). Later research noted neither the frequency nor motivation of the fear appeal; but rather, the student’s internal perception as threatening that led to increased anxiety and a fear of failure which in turn impacted students during testing (Putwain & Symes, 2011). As a result, students that suffered from test anxiety viewed fear appeals as more threatening than peers not suffering from test anxiety (Putwain & Symes).

Unlike worry, Putwain (2007) classified emotionality as physiological component specific to test anxiety triggered by the external cue of the immediate testing situation. Previous failure during a similar experience increased the individuals worry which triggered emotionality and increased test anxiety (Putwain). Stomach issues and headaches were listed as indicators of the physiological application of test anxiety (Putwain & Symes, 2011). Additionally, sleeping issues, muscle tension and localized pain were included as possible physiological characteristics associated with test anxiety (Huberty, 2009). According to Salend (2011), physical symptoms associated with test anxiety included any of the following: rapid heartbeat, sweaty palms, excessive perspiration, or nausea.

Behavioral traits of anxiety.

Behavioral character traits of anxiety included the following off-task student actions during an assessment: unnecessary questions, inappropriate comments, crying, cheating, forgetting, or being overwhelmed (Salend, 2011). Huberty (2009) also included task avoidance, erratic behavior and perfectionism to the list of traits identified. Additionally, the researcher argued many students suffering from test anxiety may have suffered from all three areas. For example, during the assessment a student was worried (cognitive), flushed (physiological) and demonstrated increased activity (behavioral). According researchers (Huberty, 2009; Salend 2011), students with disabilities found the assessments more challenging and test anxiety often increased within these students.

Mathematic assessment scores and anxiety.

Students who scored higher on test anxiety also scored lower on achievement when compared to students with lower reported test anxiety (Hurren, Rutledge, & Garvin, 2006). When 10th grade students were examined, a direct correlation between mathematic anxiety and a negative correlation mathematics performance was suggested (Karimi & Venktesan, 2009). Additionally, mathematics performance was directly impacted by both memory and anxiety (Prevatt, Welles, Li & Proctor, 2010). Mathematics anxiety had a negative effect on mathematics achievement (Prevatt, Welles, Li, & Proctor) and further emphasized that mathematics anxiety was a predictor of mathematic achievement (Maree, Fletcher & Erasmus, 2013).

Summary

Evolving federal intitiatives linked school and educator accountability measures to state assessment results. Consequently, researchers investigated key factors involved in high performance outcomes. Specifically, researchers investigated demographics of various student groups to pinpoint criteria applicable to the mathematics achievement gap. Researchers examined test anxiety, race, socioeconomic, gender, and school setting focused on academic performance. Additionally, big-fish-little-pond effect researchers examined the psychological impact on a student's self-concept (Marsh & Parker, 1984).

The intense focus of the educational research allowed schools and leaders access to information to better educate the students. Various researchers noted positive and negative results based on grouping practices within the school setting. Homogeneous grouping allowed school leaders to group students with similar skills and academic achievement into the same classroom. Teachers argued the homogenous grouping allowed for specific remediation and acceleration when all students were similarly skilled. However, proponents argued homogeneous placement allowed for segregation and negatively impacted lower level students. While the higher level students were challenged, the lower level group focused on basic skills without high impact expectations.

Students grouped homogeneously and then strategically placed into classrooms so that each ability group was represented allowed for school grouping clusters and positive academic gains. This heterogeneously grouped classrooms involved students from each skill level. Advocates noted the classroom teacher's ability to differentiate provided deep learning experiences and promoted academic growth for all levels.

Big-fish-little-pond-effect advocates indicated the heterogeneous grouping provided the best psychologic experience for students. The student's self-concept was developed based on the social comparison of students in the room. High level students mixed heterogeneously were figuratively the big fish in the little pond. However, if leaders placed all high level students homogeneously in a room together, some of the previously identified big fish moved to the little fish in the small pond.

The change in graduation requirements and accountability measures forced Georgia educators to examine scenarios to improve assessment scores on the GSE Analytic Geometry EOC. The Georgia Department of Education included an elective support course to help systems remediate students with noted mathematical deficiencies. Researchers in Chicago theorized homogeneous grouping and targeted professional development increased mathematic scores for students who were "double-dosed" when they completed a support course in conjunction with the mandated mathematics Algebra course. The researchers theorized the increase in rigor expectations and additional professional development which targeted pedagogy specific to this population, compensated for negatives traditionally associated with homogeneous grouping.

Table 1

Concept Analysis Chart

Study	Purpose	Participa nts	Design/ Analysis	Outcomes
Cortes & Goodman (2014)	Mathematics Explored double-dose Algebra support	9^{th} grade students in Chicago	Quantitative	Double-dose 1. Homogeneous only 2. Targeted instructional strategies during support 3. Additional hour of mathematics support 4. Positive academic outcome for high & medium level students 5. Positive long-term outcomes 6. Professional development & targeted pedagogy compensated for negatives of homogeneously grouping students.
Duflo, Dupas, & Kremer (2011)	Mathematics Homogeneous grouping	121 first graders in Kenya	Experimental evidence	Examined premise- teachers teach to the middle of the class ability 1. Homogeneous grouping 2. Targeted professional development 3. Teacher could focus on specific needs 4. Results – High ability increased advanced skills; lower ability increased basic skills; middle group was absent" 5. Lower level students benefited

Collins & Gan (2013)	Homogeneous grouping	135 elementary schools 9,325 students Dallas independent school district	Quantitative correlational	Homogeneous grouping = effect of sorting on student performance Specifically, special education and gifted students 1. Low and high benefited 2. Mathematics had positive effect when grouped
Gentry & Owen (1999)	School cluster grouping	Elementary	Qualitative and quantitative Longitudinal, causal comparative	Grouped homogeneous and then placed each level in the room for heterogeneous group Positive gains for all student levels
Matthews, Ritchotte and McBee (2013)	School Cluster	Elementary 68 – gifted 186 – non-identified students	Quantitative Longitudinal Ex post facto	Heterogeneous class placement – after homogeneous grouping Increased mathematic achievement in the years following the intervention
Chang (2011)	Teacher perceptions Pygmalion Effect	47 –first year learners	Case study majoring in thermodynamics	Self-fulfilling prophecy. Teacher perceptions influence end results. Get what was expected.
Marsh and Parker (1984)	Big-Fish-Little-Pond Effect (BFLPE) Self-concept			Self-concept – based on individual's social comparison to other students. Heterogeneous grouping allowed all ability levels to interact in the same "pond" *The high ability student was the "big fish" in a "little pond". Homogeneous *Put all the high ability kids in one room and the high ability individual was now the low ability kid in this room.

Marsh & Hau (2003)	BFLPE Academic self-concept (ASC)	Academically selective high schools. 26 countries	Empirical research project	Academic self-concept • Individual student's evaluation of academic ability and • Individual student's comparison to peers in the same school Findings: higher achievement schools had individual students with lower academic self-concepts.

CHAPTER III:

METHODOLOGY

In this chapter, the researcher presented the methodology of this study. The first section of the chapter included a statement of the problem, two research questions with correlating hypotheses, and study assumptions. Next, a description of the setting, population, and the instrument was included in the research design portion of the chapter. Additionally, the study rational and ethical considerations were noted within the data collection portion. The final section, data analysis and a summary, was located at the end of the chapter.

Introduction

New federal accountability initiatives included measures for students, teachers, administrators, and schools (Hemelt & Marcotte, 2013). The accountability component included the results of students' state-mandated Georgia Milestone (GM) End-of-Course (EOC) assessment score. As a result of these student-based accountability standards and assessments, along with an increase in graduation requirements, student schedules have been impacted by local policy decisions surrounding student support and grouping practices (Cortes & Goodman, 2014). Consequently, researchers have, in an attempt to determine best practices, explored the effect of grouping practices based on academic ability (Slavin, 1988).

The researcher set out to understand the impact of an additional mathematics support course on the student's mean scale scores when completing the GM Analytic Geometry EOC assessment. Specifically, the researcher set out to determine the impact of this additional course when support students were grouped heterogeneously or homogeneously in the regular GSE Analytic Geometry course. The researcher also set out to determine the impact of grouping practices for the bottom 30% of students and determined the statistical implications for student groups enrolled in the additional mathematics support course versus the student groups not enrolled in this additional support course.

Statement of the Problem

Throughout the literature, researchers indicated mixed findings associated with additional instructional interventions and grouping practices. Researchers noted that terminology and definitions surrounding grouping policies often conflicted (Gentry & MacDougall, 2008), and the vague results based on various achievement factors added to the limitations surrounding application for future studies (Loveless, 2013). Previous research conducted by Cortes and Goodman (2014) examined homogeneous grouping of ninth grade students enrolled in Algebra support in the Chicago School System. The researchers referenced the additional hour as "double dose" mathematics and examined outcomes of students enrolled in this homogeneous program of support. The researchers noted positive outcomes for students enrolled in the curricular addition of support for the single academic year. The researchers argued that increased teacher pedagogy and academic rigor were included as benefits of the “double-dose” of instruction for this specific study (Cortes & Goodman).

A closer examination of student gains noted individuals ranked within the higher and middle level of the homogeneous group had higher gains than students within the lowest level (Cortes & Goodman, 2014). The researcher’s conclusions aligned with the findings of Duflo, Dupas and Kremer (2011) which noted the lower group illustrated less improvement than higher skilled classmates. The researchers (Cortes & Goodman, 2014; Duflo, Dupas & Kremer, 2011) theorized that the homogenous grouping of students benefitted from the impact of target instructional strategies.

In this study, the researcher investigated the statistical relationship for two different research questions. The first question revolved around the student population identified in the bottom 30% on a previously completed mathematics EOC. These students were scheduled with or without the support course during the 2014-15 school year. The researcher analyzed data and determined the statistical relationship of the mean scores for these students on the GM Analytic Geometry EOC assessment. The researcher also investigated the statistical relationship between the assessment scores and all students who were grouped and received no support or received support and were grouped heterogeneously or homogeneously in the regular mathematics course.

Research Questions/Hypothesis

Research Question 1 (RQ1): Did the mean of the scores on the GM Analytic Geometry EOC assessment for the lowest 30% of nonsupport students have a statistically significant difference when compared to the mean of the lowest 30% of students receiving the additional support course and grouped homogeneously or heterogeneously in the geometry classroom?

Null hypothesis 1 ($h_0 1$): The mean scores will have no significant difference between the lowest nonsupport and lowest support groups. $h_0 1$: ($\mu_{lownonsupport} = \mu_{lowscho} = \mu_{lowscht}$)

Alternate hypothesis 1 (H_1): The mean scores will have a significant difference between the lowest nonsupport and lowest support groups. $H_{1:}$ ($\mu_{lownonsupport} \neq \mu_{lowscho} \neq \mu_{lowscht}$)

Research Question 2 (RQ2): For the 2014-15 school year, did the mean of the scores on the GM Analytic Geometry EOC assessment for the nonsupport students have a statistically significant difference compared to the support students grouped heterogeneously and homogeneously?

Null hypothesis 2 ($H_0 2$): The mean scores will have no significant difference between the means of the three groups. $H_0 2$: ($\mu_{nonsupport} = \mu_{schomo} = \mu_{schetero}$)

Alternate hypothesis 2 (H_2): The mean scores will have a statistically significant difference between the means of the three groups. H_2: ($\mu_{nonsupport} \neq \mu_{schomo} \neq \mu_{schetero}$)

Assumption

Based on the review of literature, it was the researcher's assumption the students grouped heterogeneously without support would have the highest mean scale score on the GM Analytic Geometry EOC assessment. However, for the lowest 30% it was assumed students involved in the extra hour of support would have a higher mean scale score than the lowest 30% not scheduled for support. Additionally, the heterogeneous support group would exceed the homogeneous support group when the mean scores were analyzed

Research Design

The quantitative study took place in a single high school in a rural county in South Georgia and involved predominantly 10th grade students enrolled in the GSE Analytic Geometry course during the 2014-15 school year. The independent variable for the study included a nonsupport group, a support group scheduled homogeneously into geometry and a support group scheduled heterogeneously into geometry. For students with weak mathematical abilities, the state provided an additional course labeled "mathematics support" (Ga DOE, 2014b). This course provided an additional hour of class time, in which students were given more in-depth attention and had the time to relearn and reapply the standards presented in the required GSE Analytic Geometry course (Ga DOE, 2014f). While the Ga DOE outline suggested criteria for placement into the mathematics support program, the local districts ultimately determined the criteria governing support course placement in their area. These criteria included guidelines such as the student's previous test results and course aptitude (Ga DOE, 2014f).

High school registration for course selection started during the spring of the preceding year. Current Algebra teachers and school administrators utilized a rubric which included previous student test scores, current mathematic deficits, and teacher recommendations and developed the support course recommendation list. Next, the high school administrators determined support courses based on the number of recommended students and teacher availability during a seven period schedule. Due to limited funding, space allotments, and scheduling conflicts, not all of the predetermined mathematical deficient students were able to enroll in the geometry support course.

Within the Infinite Campus scheduling software, support courses were placed during various periods of the day based on the best fit for all student request. The support courses did not take place during a period with high conflicts. For example, the support course was not placed during the period of 10th grade band, athletic weight training, or other high interest singleton courses that would have caused conflicts and removal of the student from the support section. The support courses were hooked to the correlating geometry course and included a mixture of homogenous and heterogeneous scheduling connections. Of the population placed into a support section, individual students were randomly divided homogeneously or heterogeneously into the regular mathematics classroom. For the purpose of this study, homogeneous grouping placed students with similar academic abilities together into one classroom while heterogeneous grouping involved mixed ability students within the same classroom to form one equitable group (Becker, Neumann, Tetzner, Bose, Knoppick, et al, 2014). The scheduler software within Infinite Campus randomly and evenly placed recommended students into a support section based on the following parameters: gender, race, socio-economic, special education, and discipline. The researcher obtained permission from the Institutional Review Board (IRB) and the school system before student schedules and demographics were analyzed to determine student population and grouping practices (see Appendix A: IRB Approval).

The design of this quantitative study was quasi-experimental with convenience clustering because the applicable student population in this study lacked random assignment (Shadish, Cook, & Campbell, 2002). Student schedules were manipulated during the year prior to registration based on a noted mathematical deficit and section availability. Additionally, the intact support section was homogeneous and the students were randomly grouped homogeneously or heterogeneously based on scheduling factors implemented prior to the arrival of the researcher (Lomax & Hahs-Vaughn, 2012).

In accordance with State requirements, students enrolled in the course GSE Analytic Geometry completed the State's criterion-referenced exam, Georgia Milestone (GM) Analytic Geometry End-of-Course (EOC) assessment. As the dependent variable in this study, this exam took place in May 2015, served as the student's final exam, and accounted for 20% of the student's final average in the course. The student's GM Analytic Geometry EOC score served as a dependent variable for this study for both research questions. For research question 1, the preceding GM Coordinate Algebra EOC assessment scores completed during May 2014 served as a baseline and determined the bottom 30% of the student population.

The quasi-experimental study utilized descriptive statistics based on the dependent and independent variables and determined whether there is a statistically significant difference for either of the research questions. Within SPSS, a computer program, the researcher completed a one-way analysis of variance (ANOVA) of the differences of the mean scores of the same sample of students. The independent variable for this study was the student's scheduling group which included either nonsupport or support with homogeneous geometry or support with heterogeneous geometry. The dependent variable will be the student's mean score on the GM Analytic Geometry EOC. Because the students previously completed the assessment and participated in the support or nonsupport environment, the researcher used cluster sample. Additionally, convenience sampling was used to compile data for this study. The researcher chose the quasi-experimental, quantitative approach based on the impact of the scores on the researcher, students, teachers, administrators, and school. Researchers (Lomax & Hahs-Vaughn, 2012; Shadish, Cook, & Campbell, 2002) provided relevance to the type of quantitative research noted above.

Setting and Population

The study took place in a single high school in a rural community in southwest Georgia. The population for this study was predominantly 10th grade students enrolled in GSE Analytic Geometry. For research question 1, the bottom 30% of the student population was identified based on scores from the previously completed 2014 GM Coordinate Algebra EOC assessment. At the end of the 2014-15 school year, the students completed the GM Analytic Geometry EOC assessment, which served as the dependent variable in this study. This assessment also served as the dependent variable for research question 2. As the principal in the school building, the researcher had access to all of the documentation needed for this study once permission was granted from IRB and the system superintendent (see Appendix A: IRB Approval & Appendix B: System Superintendent Approval).

Sampling

The specific demographics, students, and sampling method was determined once proper permission was obtained. The school system utilized the Student Information System, Infinite Campus, which compiled all student information including demographics and schedules. Student assessment scores were available in an existing database on the Ga DOE administrator portal. Only students with both GM Analytic Geometry EOC and GM Coordinate Algebra EOC scores were included in the study. Partial data sets were removed from the study (e.g. students without both scores in the data base) Students were grouped based on schedule parameters. As an administrator in the school building, the researcher had access to the existing database and all of the documentation needed for this study once proper permission was obtained.

Groups within the population**.**

The different groups represented in this analysis included:

- Group 1: A control group of GSE Analytic Geometry students who were not enrolled in an additional mathematics support class.
- Group 2: A test group of GSE Analytic Geometry students who were homogeneously grouped for both the regular and support course. Within these regular mathematics sections, all of the students were support students with no nonsupport students included.
- Group 3: A test group of GSE Analytic Geometry students who were homogeneously grouped within the support course, but were heterogeneously grouped with nonsupport students during the mathematics class. Within these regular heterogeneously grouped mathematics sections, half of the students were in the additional support course, while half were not enrolled in math support.

Instrument, validity, and reliability

According to the Ga DOE (2014c & 2014d) the GM EOC assessments primarily utilized criterion-referenced questions, which were aligned with the domains found in the course curriculum. Only these specific questions would be used to determine student proficiency on the final composite scale score. Nationally norm-referenced questions were also included in the assessment but did not impact scoring; rather, the norm-referenced questions were supplemental and only informed on national comparisons (Ga DOE, 2014c & 2014d). The scale scores from both the GM Coordinate Algebra and GM Analytic Geometry EOC assessments were available on the Ga DOE administrator's platform. As the principal in the school building, the researcher had access to the existing database and all of the documentation needed for this study once proper permission was obtained.

The mean scale score from the GM Analytic Geometry EOC assessment served as the dependent variable for both research questions during this quantitative study. According to the Ga DOE (2014d), the main purpose of the GM Coordinate Algebra EOC score was to provide information on the student's readiness for the next educational mathematical level and identify students that did not master the content. For research question 1, this assessment served as the baseline and determined students located in the bottom 30% of the respondents during this assessment in this location. Similarly, the Ga DOE (2014c) noted one purpose of the GM Analytic Geometry EOC score was measured student achievement. The mean scale score on this assessment for applicable students served as the dependent variable for both research questions.

Students participated in EOC assessments during the month of May correlating to the specific year of the course of study. State guidelines, protocols, and procedures were enforced during the student's assessment session. Specific time restrictions were also applicable for all students while completing each assessment. The State created the criterion-referenced assessment, and the students' scale scores was calculated by the State Department (Ga DOE, 2014c & 2014d).

Assessment overview.

The GM Coordinate Algebra EOC (Ga DOE, 2014d) and the GM Analytic Geometry EOC (Ga DOE, 2014c) assessments both included two sections comprised of multiple-choice, constructed-response, and extended constructed-response items. The multiple-choice items each had four selection possibilities with detractors included. The constructed-response item allowed the student response without choices available for selection. The final portion, extended-response, was longer and involved more detail on the part of the student. The GM Coordinate Algebra EOC focused on the following curriculum domains: 1) Algebra and Functions, Algebra Connections to Geometry, and Algebra Connections to Statistics and Probability (Ga DOE, 2014d). The GM Analytic Geometry EOC focused on the following curriculum domains: 1) Geometry; 2) Expressions, Equations, and Functions; 3) Number and Quantity; 4) Statistics and Probability (Ga DOE, 2014c).

Assessment setting and security.

Each assessment took place in a computer lab under the supervision of a trained school official. Each student logged into the student assessment platform and used the predetermined individual identification ticket number with the unique username and password provided by the State Department. Calculators were only allowed during the allotted section and time. The assessments both involved a two-day period and included one section per day as approved in the testing guidelines from the Ga DOE assessment guidelines. All other testing guideline requirements and security measures were established and performed during each assessment.

Data Collection

The collection of data for the quantitative analysis involved examination of student schedules and assessment information. For the independent variable, grouping method, student schedules were examined for nonsupport or support and the homogeneous or heterogeneous grouping of the corresponding geometry course. Also, documentation included records from the school which included the release of final assessment scores from the Ga DOE. The test result data for the study was stored in preexisting databases found within the Ga DOE Administrator's Portal. Each student's schedule and demographic information was collected in the school system databased, Infinite Campus. The researcher had access to the existing database and all of the documentation needed for this study once proper permission was obtained. The researcher completed the following steps using an excel document during data collection:

1. Scheduling and demographic information was collected from the school's Student Information System, Infinite Campus, for all individuals enrolled in the GSE Analytic Geometry course during the 2014-15 school year. This information was placed into an excel spreadsheet.
2. Student schedules were analyzed to determine grouping placement on the excel sheet (independent variable).
3. Utilized the Ga DOE administrator's portal to collect assessment scores from the GM Coordinate Algebra EOC, 2013-14, and GM Analytic Geometry

EOC, 2014-15 assessments. Scores were placed on the excel sheet next to the corresponding student.

4. Utilized the school's Infinite Campus to identify students enrolled in the GSE Analytic Geometry course during the 2014-15 school year.
5. Utilized an excel document to match students to the corresponding assessment scores.
6. Removed all partial data fields (e.g. students without both exam scores)
7. All information – demographics, assessment scores and grouping application was double checked.
8. Students were assigned random ID codes and names were removed.
9. Ranked all GM Coordinate Algebra EOC scores to determine lowest 30% group.
10. Uploaded all information into the SPSS software for data analysis.

As an administrator in the building, the researcher selected this year and student population to control for bias. The rationale for the convenience, sample selection was based on pre-existing scheduling and grouping practices. The researcher had no context with the teachers or students in this data collection to lower bias variables. All teachers and students remained anonymous. Once all documentation was collected and correlated, the names were deleted and an identification number was assigned to ensure confidentiality. For the quantitative portion, students were not aware or involved.

Data was collected from the existing databases once IRB approval was granted (see Appendix A: IRB Approval & Appendix B: System Superintendent Approval). The goals for this study aligned with educational improvement. Additionally, as the researcher and principal, the baseline data obtained from this study influenced policy regarding scheduling decisions based on grouping methods.

Data Analysis

Data was collected from the Ga DOE portal and the school's Infinite Campus system. The researcher included student demographic data outlining the student's gender, race and socioeconomic level. The assessment information was entered into SPSS Statistics software and analyzed by the researcher. Utilizing SPSS, the researcher analyzed the descriptive statistics for each group. Next, the researcher examined all 6 assumptions required prior to running a one-way ANOVA. Upon validation of the assumptions, the researcher completed a one-way ANOVA and Tukey post hoc test. The results were analyzed for possible differences in the geometry mean between the groups, and whether those differences were statistically significant (Lomax & Hahs-Vaughn, 2012).

Summary

The rural high school in Southwest Georgia manipulated student schedules and provided a support course for individuals demonstrating documented mathematical deficiencies. The researcher set out to understand the impact of scheduling and grouping practices on the student's GM Analytic Geometry EOC assessment. The purpose of the study was to analyze and compare the mean scale scores of three different groups of students in order to determine which impact of two different scheduling treatments was most effective for students enrolled in the math support course. In particular, the researcher wanted to determine if grouping practices indicated a statistically significant difference for the population identified as the lowest 30% on the previous criterion-referenced assessment.

The researcher used a quasi-experimental design with convenience clustering for the quantitative study because the study population lacked random assignment and was pre-established into groups. Applicable student GM assessment scale scores served as the baseline and posttest dependent variable for research question 1. For research question 2, the mean scores from the GM Geometry EOC served as the dependent variable. The independent variable was based on the grouping categories available: nonsupport, support with homogeneous geometry or support with heterogeneous geometry. The researcher used SPSS to analyze descriptive statistics for each group. The researcher also analyzed for statistically significant differences in mean scale scores for the different groups using an ANOVA model and Tukey post hoc test. Data was collected from the existing databases once the Institutional Review Board IRB approval was granted.

CHAPTER IV:

RESULTS

This chapter provided an overview of the research questions investigated, methodology utilized, data analyzed, findings outlined, and discussion completed. First, the introduction included a brief summary of the research study. Second, the research design section included a description of the methodology and research questions. It also included the demographics of the respondents, the assumptions of the one-way ANOVA, the Tukey post hoc test, and the findings of the data and discussions of each research question. The two research questions were explored independently. Third, the summary, included an overview of the entire chapter.

Introduction

This quantitative research study was designed to gain an understanding of the impact of scheduling practices on state mathematics assessment scores in a small high school in rural South Georgia. All of the students involved in this study were enrolled in the Georgia Standards of Excellence (GSE) Analytic Geometry course during the 2014-15 school years. The researcher analyzed data to determine if a statistical difference existed between three different groups of students and the mean scores on the Georgia Milestone (GM) Analytic Geometry End-of-Course (EOC) assessment. The test scores functioned as the dependent variable and the groups served as the independent variable during the one-way ANOVA and the Tukey post hoc test. The groups were based on each individual student's schedule which included either no support or an additional support course with the corresponding geometry class grouped homogeneously or heterogeneously. Due to limited funding, space allotments, and scheduling conflicts, not all students identified as mathematically deficient were enrolled in the additional support course. As a result, the researcher also examined data from the lowest 30% of the participates to determine if grouping practices indicated a statistically significant difference for this specific population.

Research Questions/Hypothesis

Research Question 1 (RQ1): Identified as the lowest 30% on a previous state mathematics assessment, did the mean scale scores of GM Analytic Geometry EOC of nonsupport students have a statistically significant difference compared to support students grouped homogeneously or heterogeneously within the Geometry classroom? Null hypothesis 1 ($h_0 1$): The mean scores will have no significant difference between the lowest nonsupport and lowest support course (sc) grouped homogeneously (ho) or heterogeneously (ht) within the mathematics classroom. $h_0 1$: ($\mu_{lownonsupport} = \mu_{lowscho} = \mu_{lowscht}$). Alternate hypothesis 1 (H_1): The mean scores will have a significant difference between the lowest nonsupport and lowest support course grouped homogeneously (ho) or heterogeneously (ht) within the mathematics classroom. H_1: ($\mu_{lownonsupport} \neq \mu_{lowscho} \neq \mu_{lowscht}$)

Research Question 2 (RQ2): For the 2014-15 GM Analytic Geometry EOC, did the scale scores for the nonsupport students have a statistically significant difference when compared to support students grouped homogeneously or heterogeneously within the geometry course? Null hypothesis 2 ($H_0 2$): The mean scores will have no significant difference between the means of the three groups. $H_0 2$: ($\mu_{nonsupport} = \mu_{schomo} = \mu_{schetero}$) Alternate hypothesis 2 (H_2): The mean scores will have a statistically significant difference between the means of the three groups. H_2: ($\mu_{nonsupport} \neq \mu_{schomo} \neq \mu_{schetero}$)

Research Design

The quantitative study design was quasi-experimental with convenience clustering because the applicable student population lacked random assignment (Shadish, Cook, & Campbell, 2002). The study utilized descriptive statistics based on the dependent and independent variables and investigated whether there was a statistically significant difference for either of the research questions. Within SPSS, a computer program, the researcher completed a one-way ANOVA variance and Tukey post hoc tests (Laerd

Statistics, 2015) and compared the mean scores of the GM Analytic Geometry EOC assessment (dependent continuous variable) of three different groups (independent variable) of students. Student names were replaced with random coded ID numbers and remaining, raw data which included race, gender, economic disadvantage indicator and grouping type was provided (see Appendix C: Raw Data Collected from All Participants).

Dependent Variable

In accordance with State requirements, students enrolled in the course GSE Analytic Geometry completed the State's criterion-referenced exam, GM Analytic Geometry EOC assessment. As the dependent variable in this study, this exam took place in May 2015, served as the student's final exam score, and was stored in the Georgia Department of Education archived database. The student's GM Analytic Geometry EOC score served as a dependent variable for this study for both research questions.

RQ1, the inclusion in this portion of the study involved students whose scores on the GM Coordinate Algebra, completed during May 2014, ranked them numerically in the bottom 30% of the tested population. Only students with both the GM Analytic Geometry EOC and GM Coordinate Algebra EOC scores were included in this study. The researcher removed all other partial data (e.g., students who did not have both scores) from all data sets analyzed. For RQ1, the lowest 30% included 111 students (N = 111). For RQ2, all students with GM Analytic Geometry EOC and GM Coordinate Algebra EOC scores were included (N = 324). The study did not have an equal sample size for any of the groups for either research question.

Independent Variable

The independent variable for this study was the student's random placement into the support or nonsupport course. Class schedules from 2014-15 were examined and students were placed into groups based on the following criteria: Group 1) The student was enrolled in one hour of geometry with no additional support course on the schedule; Group 2) The student population was grouped homogeneously for both the geometry class and the correlating support class. All of the students in this group were together for both geometry and support. No students in this group had geometry with nonsupport students; and Group 3) The student was enrolled heterogeneously in the geometry course. Some of the students in the geometry classroom were enrolled in support and some were not. While students in this support group were together during the support class, they were scheduled for geometry with many nonsupport students.

Examination of the participant's schedules revealed the same teacher for geometry if scheduled for support. For group 2, two homogeneous groups were developed and two teachers had one group each. For group 3, four support sections were noted and four teachers each had one section. The geometry class size ranged from 21-31 and the support class size ranged from 24-31.

Research Question 1

Research Question 1 (RQ1): For the lowest 30% of the student population, did the mean of the scores on the GM Analytic Geometry EOC assessment of nonsupport students have a statistically significant difference when compared to the mean of the lowest 30% of students receiving the additional support course and grouped homogeneously or heterogeneously within the mathematics classroom?

Null hypothesis 1 ($h_0 1$): The mean scores will have no significant difference between the lowest nonsupport and lowest support course (sc) grouped homogeneously (ho) or heterogeneously (ht) within the mathematics classroom. $h_0 1$: ($\mu_{lownonsupport} = \mu_{lowscho} = \mu_{lowscht}$). Alternate hypothesis 1 (H_1): The mean scores will have a significant difference between the lowest nonsupport and lowest support course grouped homogeneously (ho) or heterogeneously (ht) within the mathematics classroom. $H_{1:}$ ($\mu_{lownonsupport} \neq \mu_{lowscho} \neq \mu_{lowscht}$)

Demographic Profile of the Applicable Population

Based on the GM Coordinate Algebra EOC scores from the previous year, 111 (N = 111) students accounted for the bottom 30% and were included in this study. This number included all students and was not a sample size. The following outlined the demographic makeup for each group:

- Group 1 (lownonsupport$_{)}$: Females = 27; Males = 20; Economically disadvantaged = 17; African-American = 5, Asian = 1, Hispanic = 0, Multi-Racial = 1, White = 40
- Group 2 (lowscho): Support course homogeneous mathematics: Females = 15; Males = 13; Economically disadvantaged = 15; African-American = 6, Asian = 0, Hispanic = 0, Multi-Racial = 2, White = 20
- Group 3 (lowscht): Support course heterogeneous mathematics: Females = 19; Males = 17; Economically disadvantaged = 21; African-American =11, Asian = 0, Hispanic = 0, Multi-Racial = 0, White = 25

6 Assumptions and a One-way ANOVA

Before running the one-way ANOVA, the researcher determined the six required assumptions were met. Assumption 1 noted the importance of one dependent variable that is continuous (Laerd Statistics, 2015). This study revolved around only one dependent variable, GM Analytic Geometry EOC scores, that were continuous. Assumption 2 required the application of multiple independent variables to compare. Throughout the study, the independent variable was based on the three groups outlined above. Next, assumption 3 dealt with the independence of observations which required students to only contribute to one of the groups analyzed. Students did not represent or have any relationship with any of the other groups (Laerd Statistics). Within this study, all of the students were grouped based on the individual class schedule and no cross-over between the groups existed. All three of the assumptions were confirmed based on the parameters of the research study.

Assumption 4 focused on the inclusion or exclusion of outliers within the population investigated. Outliers were identified as single data points (geometry scores) falling outside the normal range of the established groups data set. The GM Analytic Geometry EOC scores were tested for outliers in each of the three scheduling groups. Outliers were not evident in either of the support groups. However, the nonsupport group noted two low scores falling below the acceptable level. Within a one-way ANOVA, the validity of the results was altered with the inclusion of any outliers (Laerd Statistics, 2015). To fix an outlier and proceed with a one-way ANOVA, researchers allowed the use of a replacement score to any outlier. As a positive, this replacement validated assumption 4 and allowed the remaining statistical information to be included in the study. While the replacement score option utilized the closest next score in the string, this method unfortunately forced a more normal, less dispersed, appearance than really existed (Laerd). For this research study, both outlier scores,415 and 448, were replaced with the next lowest score of 470. The replacement of the scores removed the outliers, demonstrated in Figure 2, and allowed the study to meet the guidelines established for assumption 4.

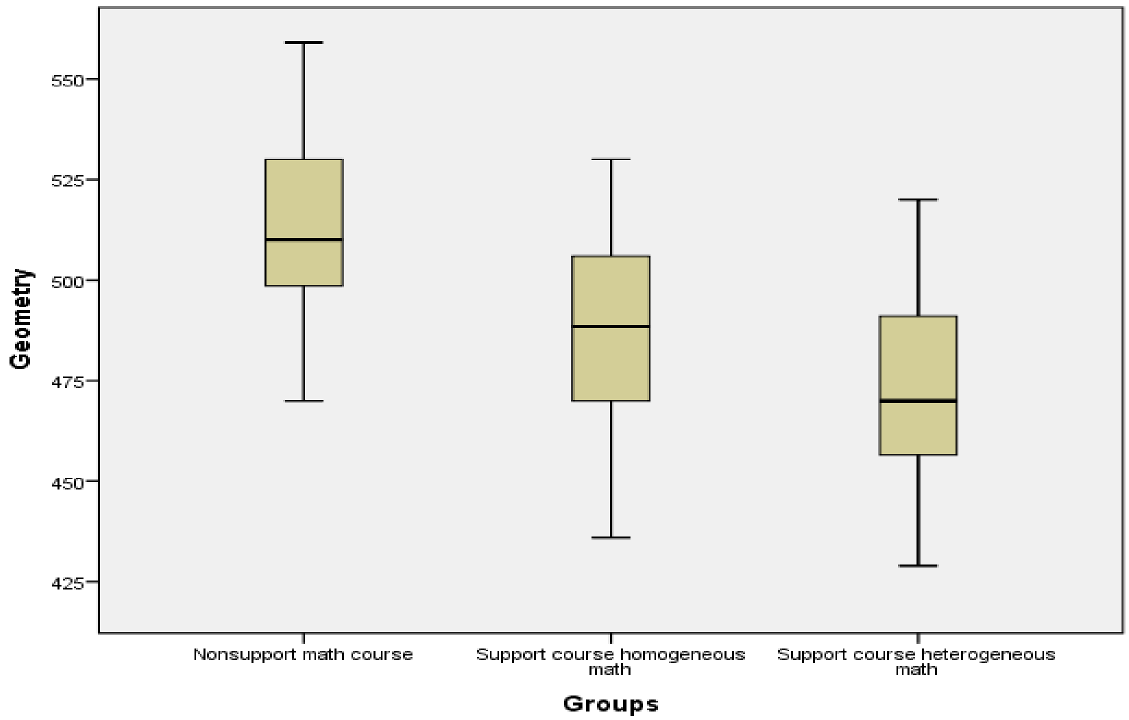

Figure 2. **Boxplot of outliers RQ1- GM Analytic Geometry EOC scores, May 2015**

Assumption 5 examined the geometry scores for an approximate normal distribution within each of the three independent variable groups (Laerd Statistics, 2015), The three groups were examined to determine if skewness, kurtosis, histograms, normal Q-Q plots and box plots indicated an acceptable normalcy. The nonsupport group had a skewness of 0.173 (SE = 0.347) and a kurtosis of -0.669 (SE =0.681). The support course homogeneous mathematics group had a skewness of -0.109 (SE = 0.441) and a kurtosis of -0.450 (SE.858). The support course heterogeneous mathematics group had a skewness of 0.173 (SE = 0.393) and a kurtosis of -0.347 (SE = 0.768). All three groups fall within the acceptable normalcy range +/- 1.96 for z-scores.

According to the Shapiro-Wilk test ($p>.05$) results (Laerd Statistics, 2015), the nonsupport group was not normally distributed. The *p*-value for this group was ($p = .008$) below the acceptable $p > .05$. However, 47 students were included in this data set and researchers (Laerd Statistics) indicated samples sizes greater than 50 students should not utilize the Shapiro-Wilk test (Shapiro & Wilk, 1965). Rather, the normal Q-Q plots and boxplots were recommended for verifying normal distribution (Laerd Statistics). The Shapiro-Wilk test did reveal p-scores normally distributed for the support groups ($p = 0.773$, $p = 0.790$). Based on the Shapiro-Wilk test, illustrated in Table 2, the researcher determined that the data for the two support groups were approximately normally distributed. The visual examination of the histograms, normal Q-Q plots and box plots further indicated that all three groups noted an approximate shape of a normal curve. Additionally, the observation noted the Normal Q-Q plot for all three groups illustrated most of the dots falling on the continues line. Finally, the observed outcomes of the boxplots noted the groups were symmetrical and the nonsupport box was the highest while the support heterogeneous group was the lowest on the chart. For assumption 5, the researcher determined the data for the lowest identified scores was approximately normally distributed for each of the groups.

Table 2

Assumption 5 the Shapiro-Wilk Test of Normality for RQ1

	Groups	Kolmogorov-Smirnov[a]	Shapiro-Wilk

		Statistic	Df	Sig.	Statistic	df	Sig.
Geometry	Nonsupport math course	.158	47	.005	.930	47	.008
	Support course homogeneous math	.107	28	.200*	.977	28	.773
	Support course heterogeneous math	.098	36	.200*	.981	36	.790

*. This is a lower bound of the true significance.

The Shapiro-Wilk test noted p-scores normally distributed for the support groups (p = 0.773, p = 0.790). However, the nonsupport group did not fall within the acceptable range (p = .008).

For assumption 6, based on Levene's test (p = 0.641), the homogeneity of variances of the geometry scores for the lowest 30% of the population was evident, Table 3. Having validated each of the 6 assumptions, the researcher moved forward and conducted a one-way ANOVA.

Table 3

Assumption 6 - Levene's Homogeneity of Variances for RQ1

Levene Statistic	df1	df2	Sig.
.446	2	108	.641

The Sig (p = 0.641) fell within the acceptable range for homogeneity of variances.

Findings

The researcher utilized a one-way ANOVA to determine if grouping decisions for the lowest 30% of the population impacted assessment results. Students were placed into three different groups: Nonsupport (N = 47), support course with homogeneous math (N = 28), and support course with heterogeneous math (N = 36). A close examination of the data revealed no outliers, as indicated by boxplot; data was normally distributed for each support group, as indicated by Shapiro-Wilk test ($p > .05$) and Normal Q-Q plots for the nonsupport group; and homogeneity of variances, as determined by Levene's test (p =

.641). The data in this study was presented as mean ± standard deviation. The mean scores for the geometry assessment, Table 4, increased from the support group with heterogeneous mathematics (N = 36, $\mu_{lowscht}$ = 472.39, *SD* = 3.77), to the support group with homogeneous mathematics (N = 28, $\mu_{lowscho}$ = 486.46, SD = 4.61), to the nonsupport mathematics group (N = 47, $\mu_{lownonsupport}$ = 515.11, *SD* = 3.82) as the highest mean. The score level ranges from 429 to 559. The large value of the standard deviation did not negate the mean variance as insignificant. Rather, the large value of the standard deviation is aligned with the large and scattered individual participant scores. Additionally, the geometry scores were statistically significantly different, Table 5, for the different groups, $F(2, 108) = 32.397$, $p < .001$, $\omega^2 = .375$.

Table 4

Descriptive Statistics of Three Groups for RQ1

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Nonsupport math course	47	515.11	26.189	3.820	507.42	522.80	470	559
Support course homogeneous math	28	486.46	24.415	4.614	477.00	495.93	436	530
Support course heterogeneous math	36	472.39	22.633	3.772	464.73	480.05	429	520
Total	111	494.03	30.883	2.931	488.22	499.84	429	559

Table 5

One-way ANOVA for RQ1

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	39340.931	2	19670.466	32.397	.000
Within Groups	65573.988	108	607.167		
Total	104914.919	110			

Discussion

There was a noted increase in the mean geometry score, Figure 3, of the support homogeneous mathematics group ($\mu_{lowscho}$ = 486.46, *SD* = 4.61) from the support course heterogeneous mathematics group ($\mu_{lowscht}$ = 472.39, *SD* = 3.77). The Tukey post hoc analysis, Table 6, revealed the mean between the two groups increased by 14.075, 95% CI [-.68, 28.83], which was not statistically significant (*p* = .065). However, the increase in the geometry scores from the nonsupport group to the support groups were significantly different. The increase in the mean score from the support course homogeneous mathematics group ($\mu_{lowscho}$ = 486.46, *SD* = 4.61) to the nonsupport group ($\mu_{lownonsupport}$ = 515.11, *SD* = 3.82) was a mean increase of 28.642, 95% CI [14.66, 42.62], which was statistically significant (*p* = .000). Additionally, the increase in the mean score from the support course heterogeneous mathematics group ($\mu_{lowscht}$ = 472.39, *SD* = 3.77) to the nonsupport group ($\mu_{lownonsupport}$ = 515.11, *SD* = 3.82) was the largest increase of 42.717, 95% CI [29.75, 55.69], which was also statistically significant (*p* = .000). Figure 4 provided a simple graph with confidence intervals to illustrate the results of the one-way ANOVA performed for the RQ1.

The mean scores between the two support groups were not statistically significant. While the mean score for the students grouped homogeneously was larger than the heterogeneous groups mean, the two groups did not have a statistically significant difference. However, the comparison between the nonsupport and both of the support groups were statistically significantly different (p < .000). Therefore, the researcher rejected the null hypothesis and accepted the alternative hypothesis: Alternate hypothesis 1 (H_1): The mean scores will have a significant difference between the lowest nonsupport and lowest support groups. $H_{1:}$ ($\mu_{lownonsupport} \neq \mu_{lowscho} \neq \mu_{lowscht}$)

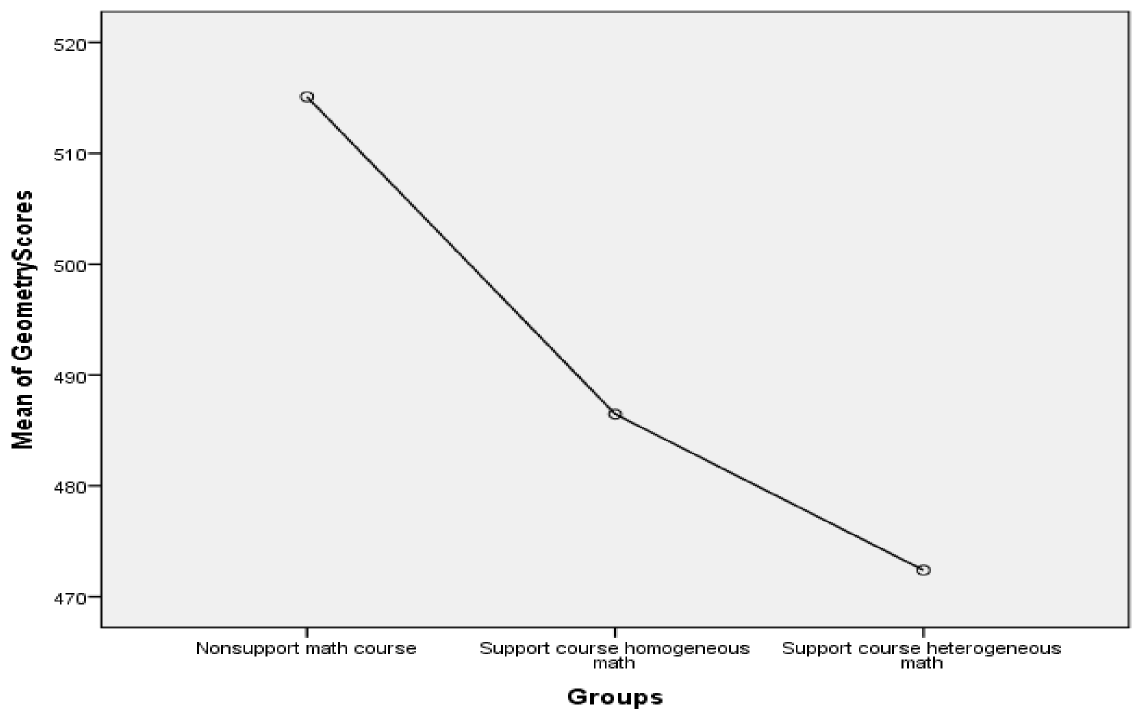

Figure 3. **Mean Plots of the Geometry Scores for RQ1**

Table 6

Tukey Post Hoc Test for Multiple Comparisons of the Three Groups for RQ1

	(I) Groups	(J) Groups	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Tukey HSD	Nonsupport math course	Support course homogeneous math	28.642*	5.882	.000	14.66	42.62
		Support course heterogeneous math	42.717*	5.457	.000	29.75	55.69
	Support course homogeneous math	Nonsupport math course	-28.642*	5.882	.000	-42.62	-14.66
		Support course heterogeneous math	14.075	6.209	.065	-.68	28.83
	Support course heterogeneous math	Nonsupport math course	-42.717*	5.457	.000	-55.69	-29.75
		Support course homogeneous math	-14.075	6.209	.065	-28.83	.68

*. The mean difference is significant at the 0.05 level

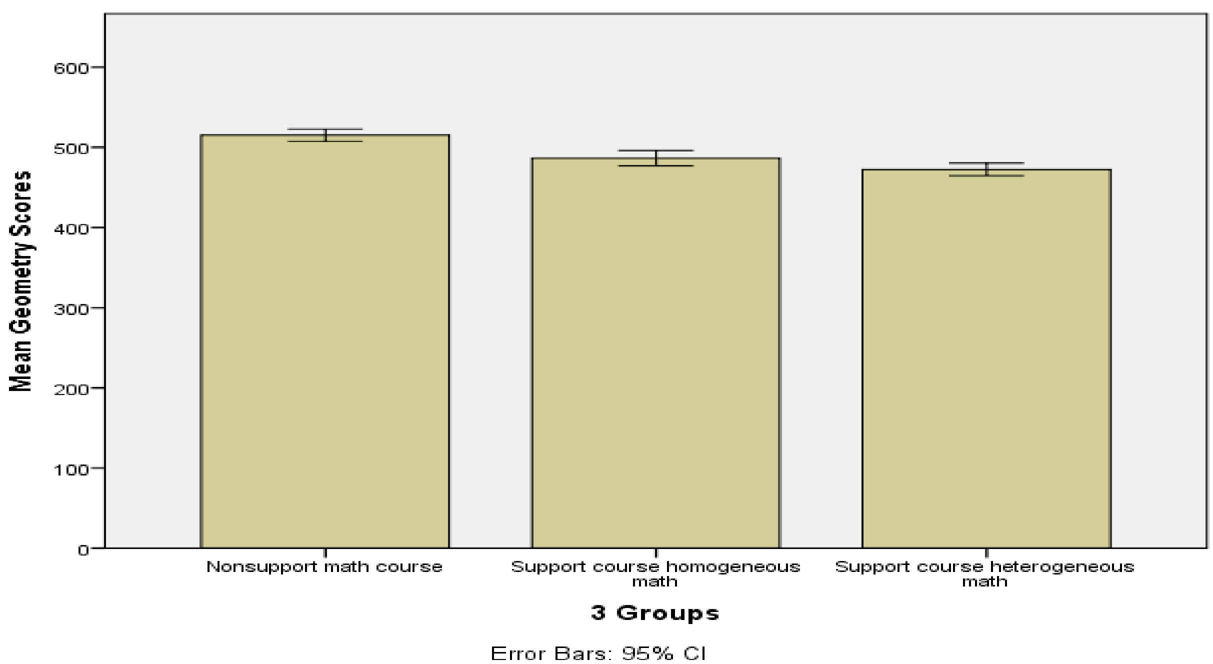

Figure 4. Bar Graph of the one-way ANOVA for RQ1

Research Question 2

Research Question 2 (RQ2): Did the mean of the scores on the 2014-15 GM Analytic Geometry EOC assessment for students not enrolled in support have a statistically significant difference when compared to the support students grouped heterogeneously and homogeneously in geometry?

Null hypothesis 2 ($H_0 2$): The mean scores will have no significant difference between the means of the three groups. $H_0 2$: ($\mu_{nonsupport} = \mu_{schomo} = \mu_{schetero}$).

Alternate hypothesis 2 (H_2): The mean scores will have a statistically significant difference between the means of the three groups. H_2: ($\mu_{nonsupport} \neq \mu_{schomo} \neq \mu_{schetero}$)

Demographic Profile of the Applicable Population

RQ2 included all students completing the GM Analytic Geometry and GM Coordinate Algebra assessments (N = 324). The population included all students and was not a sample of the population. The following outlined the demographic makeup for each group:

- Group 1 (nonsupport): Females = 119; Males = 87; Economically disadvantaged = 119; African-American = 38, Asian = 3, Hispanic = 1, Multi-Racial = 3, White = 161
- Group 2 (schomo): Support course homogeneous mathematics: Females = 23; Males = 26; Economically disadvantaged = 27; African-American = 8, Asian = 0, Hispanic = 0, Multi-Racial = 3, White = 38
- Group 3 (schetero) Support course heterogeneous mathematics: Females = 37; Males = 32; Economically disadvantaged = 27; African-American =21, Asian = 0, Hispanic = 1, Multi-Racial = 2, White = 45

6 Assumptions Required prior to running a One-way ANOVA

As previously discussed, the research study parameters met the requirements for assumptions 1-3. Assumption 4 revolved around the inclusion or exclusion of outliers within the population investigated (Laerd Statistics, 2015). Previously altered outlier scores, RQ1, were returned to the original number prior to running the new boxplot outlier analysis. Three outliers were detected when the researcher utilize boxplots and examined the dependent variable, geometry scores, and the independent variable, groups. The nonsupport group included one low score of 415, which was outside of the acceptable range, and was replaced with the next highest score 510. The support homogeneous group had one score of 592 and the support heterogeneous group had one score of 580. Both outliers were altered to 570 which was the next highest score of both groups. The practice of outlier replacement values allowed the remaining statistical data to be included in the research study (Laerd Statistics). The replacement of the scores removed the outliers, demonstrated in Figure 5, and allowed the study to meet the guidelines established for assumption 4.

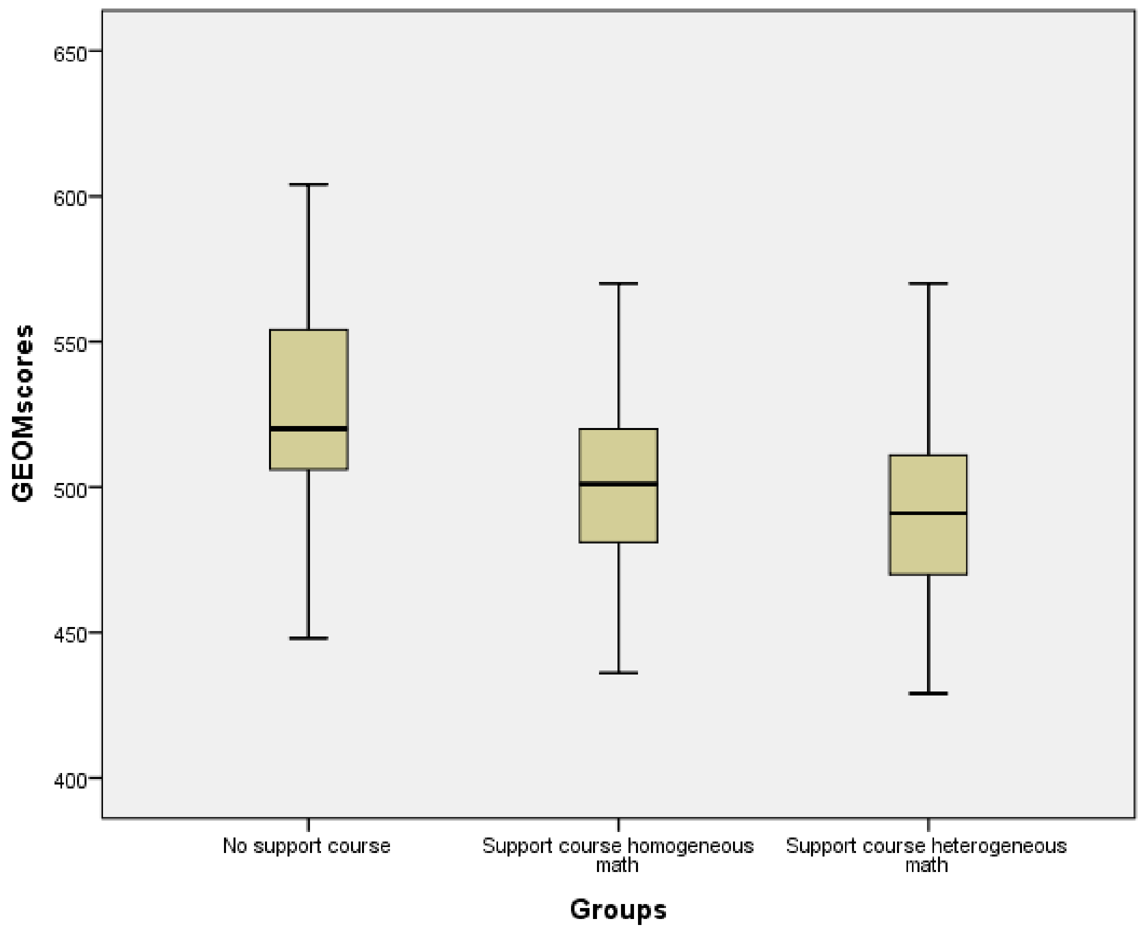

Figure 5. **Boxplot of outliers RQ2- GM Analytic Geometry EOC scores, May 2015**

For assumption 5, the data was analyzed and normal distribution was determined. First, all three groups were analyzed for kurtosis and skewness. The nonsupport group had a skewness of 0.146 (SE = .169) and a kurtosis of -0.323 (SE =0.337). The support course homogeneous mathematics group had a skewness of 0.302 (SE = 0.340) and a kurtosis of -0.315 (SE.668). The support course heterogeneous mathematics group had a skewness of 0.4954 (SE = 0.289) and a kurtosis of -0.048 (SE = 0.570). Second, all three groups were analyzed for normality. All groups included z-values within +/- 1.96 and were, therefore, within the acceptable range. In conclusion, the data was skewed and kurtotic for all three groups, but it did not differ from normality outside of the acceptable range.

As assessed by the Shapiro-Wilk test within the SPSS program, geometry scores for both of the support groups had *p*-values above .05. Based on the Shapiro-Wilk test, Table 7, the researcher determined the data for the two support groups were approximately normally distributed (p >.05). The Shapiro-Wilk test was not recommended for the nonsupport group because it included 206 students and the data would not accurately reflect normalcy (Laerd Statistics, 2015). However, a normal Q-Q plot, Figure 5, noted most of the dots falling on the continuous line and confirmed the normalcy of the nonsupport groups geometry scores. The visual examination of the histograms, normal Q-Q plots and boxplots further indicated that all three groups followed an approximate shape of a normal curve. This indicated that the test scores were approximately distributed. Finally, the box plots for the support groups were very symmetrical while the nonsupport group was slightly higher than the other two boxes. For assumption 5, it was assumed that the data was approximately normally distributed for each of the groups in regards to skewness and kurtosis (Laerd Statistics).

Table 7

Assumption 5 the Shapiro-Wilk Test of Normality for RQ2

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Groups	Statistic	Df	Sig.	Statistic	Df	Sig.
Geometry scores	No support course	.130	206	.000	.967	206	.000
	Support course homogeneous math	.118	49	.084	.976	49	.424
	Support course heterogeneous math	.082	69	.200*	.972	69	.125

*. This is a lower bound of the true significance.

The Shapiro-Wilk test noted p-scores normally distributed for the support groups (*p* = 0.424, *p* = 0.125). However, the nonsupport participation population was outside of the suggested range.

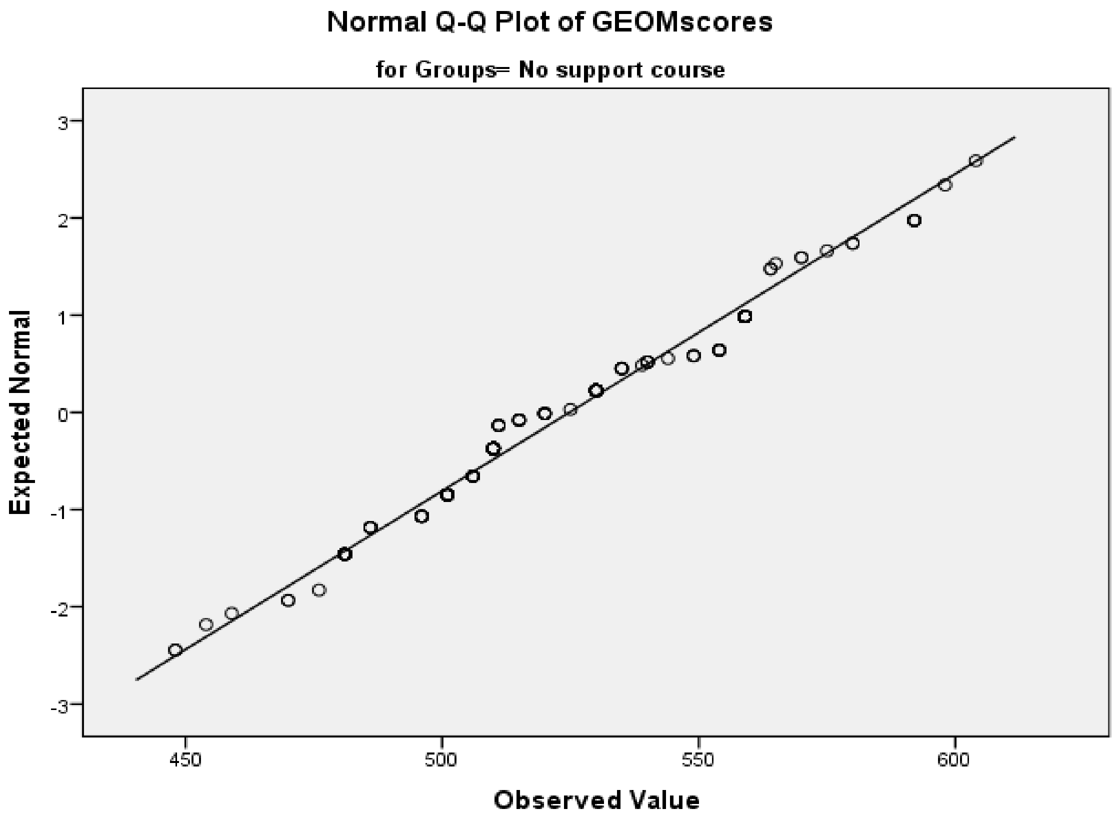

Figure 6. **Normal Q-Q Plots visually confirmed normalcy for the nonsupport group.**

For assumption 6, homogeneity of variances of the geometry scores was confirmed based on Levene's test (*p* = 0.971), Table 8. Having validated each of the six assumptions, the researcher conducted a one-way ANOVA and a Tukey post hoc test.

Table 8

Assumption 6 – Levene's Homogeneity of Variances for RQ2

Geometry scores

Levene Statistic	df1	df2	Sig.

.030	2	321	.971

The Sig (p = 0.971) fell within the acceptable range for homogeneity of variances.

Findings

To determine if grouping decisions affected the geometry scores for this population, a one-way ANOVA was conducted. Students for RQ2 were placed into the following three groups: Nonsupport (N = 206), support course with homogeneous math (N = 49), and support course with heterogeneous math (N = 69). A close examination of the data revealed no outliers, as indicated by boxplot; that data was normally distributed for each support group, as indicated by Shapiro-Wilk test ($p > .05$) and Normal Q-Q Plots for the nonsupport group; and the homogeneity of variances, as determined by Levene's test ($p = .971$). The data in this study was presented as mean ± standard deviation.

The mean scores for the geometry assessment, Table 9, increased from the support group with heterogeneous mathematics (N = 69, μ_{hetero} = 491.16, *SD* = 3.96), to the support group with homogeneous mathematics (N = 49, μ_{homo} = 501.49, *SD* = 4.63), to the nonsupport mathematics group (N = 206, $\mu_{nonsupport}$ = 524.79, *SD* = 2.14). The score level ranged from 429 to 604. The large value of the standard deviation did not negate the mean variance as insignificant. Rather, the large value of the standard deviation was aligned with the large and scattered individual participant scores. Additionally, the geometry scores were statistically significantly different, Table 10, for the different groups, $F(2, 321) = 34.270$, $p < .001$, $\omega^2 = .176$.

Table 9

Descriptive Statistics of 2015 Geometry Scores for Three Groups in RQ2

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean Lower Bound	95% Confidence Interval for Mean Upper Bound	Minimum	Maximum
No support course	206	524.79	30.660	2.136	520.58	529.00	448	604
Support course homogeneous math	49	501.49	32.436	4.634	492.17	510.81	436	570
Support course heterogeneous math	69	491.16	32.905	3.961	483.25	499.06	429	570
Total	324	514.10	34.502	1.917	510.33	517.88	429	604

Table 10

One-way ANOVA for RQ2

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	67650.917	2	33825.458	34.270	.000
Within Groups	316835.516	321	987.027		
Total	384486.432	323			

Analysis is statistically significant ($p < .05$).

Discussion

The mean of the group geometry scores increased from one group to the next, Figure 7. An increase was noted in the mean score from the support homogeneous mathematics group (μ_{schomo} = 501.49, *SD* = 4.63) to the support course heterogeneous mathematics group ($\mu_{schetero}$ = 491.16, *SD* = 3.96). The Tukey post hoc analysis illustrated in Table 11 revealed a mean increase between the two groups of 10.33, 95% CI [-3.49, 24.15], which was not statistically significant (p = .185). However, the increase in the geometry scores from the nonsupport group to the support groups was significantly different. In fact, the mean score increased from the support course homogeneous mathematics group (μ_{schomo}= 501.49, *SD* = 4.63) to the nonsupport group ($\mu_{nonsupport}$ = 524.79, *SD* = 2.136) by 23.3, 95% CI [11.54, 35.06], which was statistically significant (p = .000). Additionally, the mean score increased from the support course heterogeneous mathematics group ($\mu_{schetero}$= 491.16, *SD* = 3.96) to the nonsupport group ($\mu_{nonsupport}$ = 524.79, *SD* = 2.136) by 33.63, 95% CI [23.34, 43.92], which was also statistically significant (p = .000). The bar graph in Figure 8 provided a visual representation of the confidence interval to illustrate the one-way ANOVA results for RQ2.

The examination of the mean scores between the two support courses revealed an increase in the means of the homogeneous group over the heterogeneous group. The two group means were not statistically different ($p > .05$), but the mean scores between the nonsupport and both of the support groups were individually statistically significantly different ($p < .000$). Therefore, the researcher rejected the null hypothesis and accepted the alternative hypothesis: Alternate hypothesis 2 (H_2): The mean scores will have a statistically significant difference between the means of the two groups. H_2: ($\mu_{nonsupport} \neq \mu_{schetero} \neq \mu_{schomo}$)

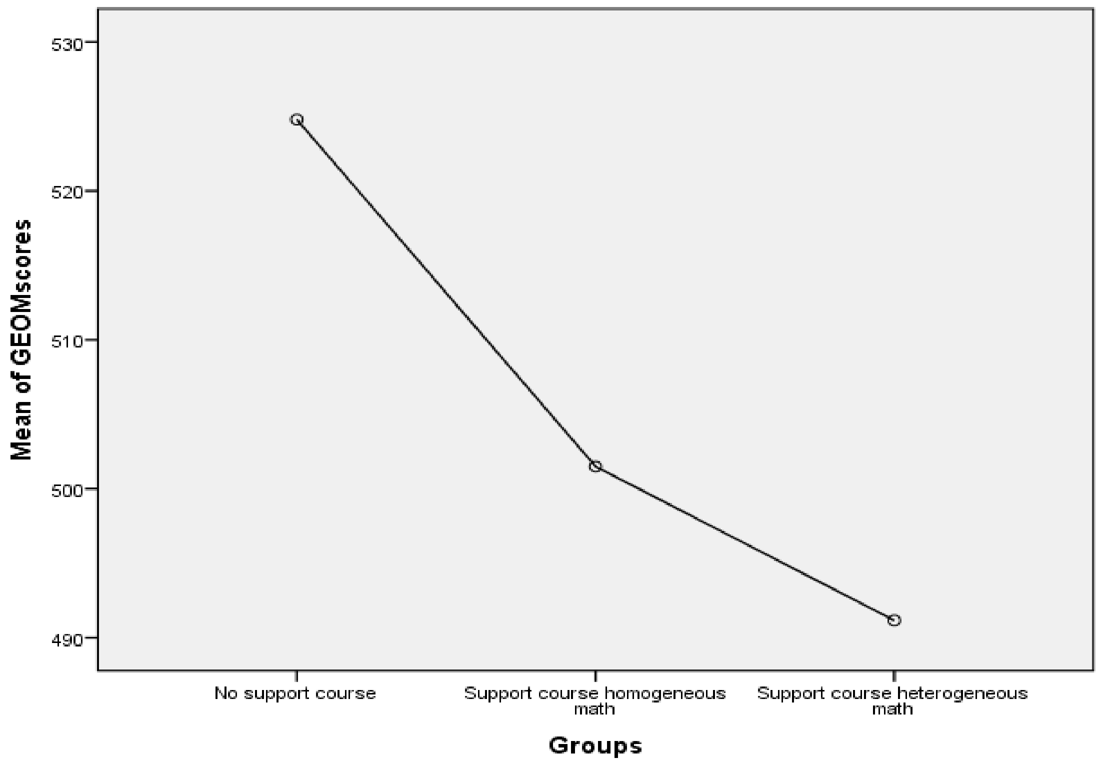

Figure 7. Mean Plots of the Geometry Scores for RQ2

Table 11

Tukey post hoc test for Multiple Comparisons RQ2

	(I) Groups	(J) Groups	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	Upper Bound
Tukey HSD	No support course	Support course homogeneous math	23.301*	4.993	.000	11.54	35.06
		Support course heterogeneous math	33.632*	4.370	.000	23.34	43.92
	Support course homogeneous math	No support course	-23.301*	4.993	.000	-35.06	-11.54
		Support course heterogeneous math	10.330	5.869	.185	-3.49	24.15
	Support course heterogeneous math	No support course	-33.632*	4.370	.000	-43.92	-23.34
		Support course homogeneous math	-10.330	5.869	.185	-24.15	3.49

*. The mean difference is significant at the 0.05 level.

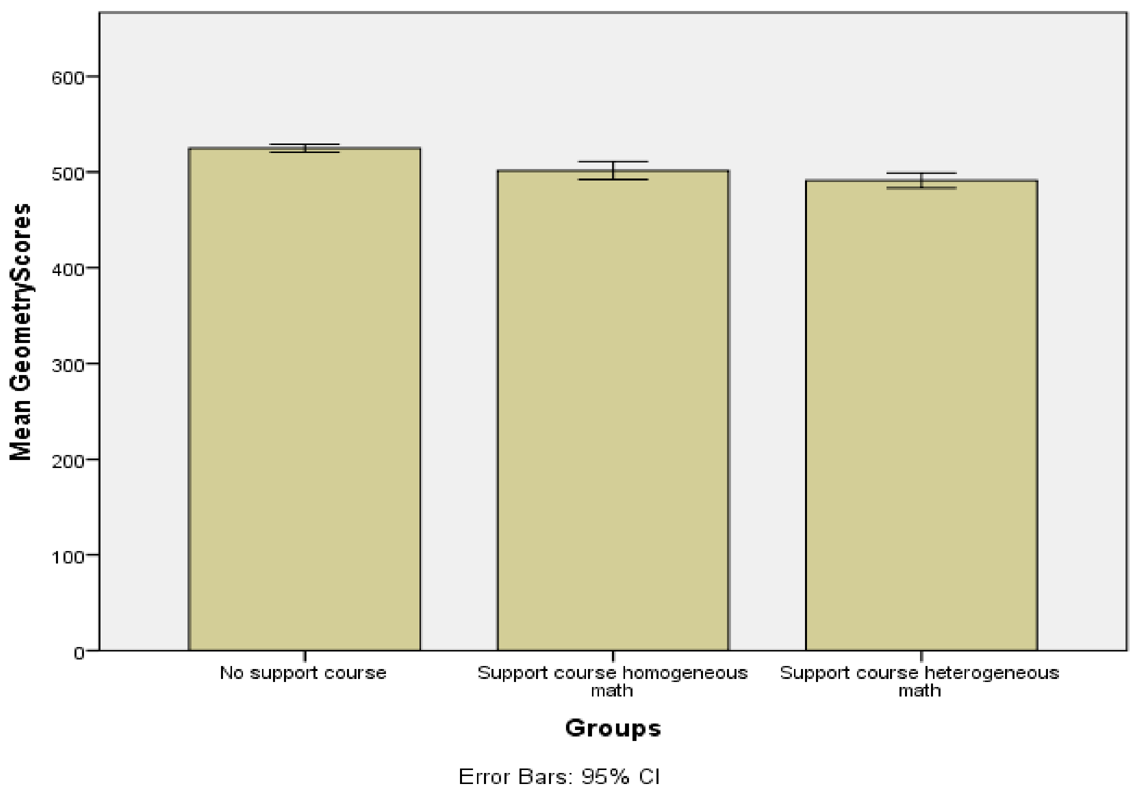

Figure 8. **Bar Graph of the one-way ANOVA for RQ2**

Summary

The researcher utilized a one-way ANOVA and a Tukey post hoc test and determined the GM Analytic Geometry EOC scores were impacted by scheduling practices in a local high school in South Georgia. For this analysis, the 2015 geometry assessment score acted as the dependent variable and the grouping practices operated as the independent variable. Each student's class schedule was analyzed and the students were placed in the appropriate group within the categories for the independent variable: 1) nonsupport; 2) support course homogeneous geometry; and 3) support course heterogeneous geometry.

RQ1 focused on the predetermined lowest 30% population of students (N = 111). The researcher examined the mean scores for each group ($\mu_{lownonsupport}$= 515.11, $\mu_{lowscho}$ = 486.46, $\mu_{lowscht}$= 472.39); and completed the one-way ANOVA and the Tukey post hoc test. The researcher's final analysis revealed no statistical difference (p = .065) between the homogeneous and heterogeneous support course. However, the nonsupport group indicated a significantly statistical difference (p = .000) when compared to both support group. The data tables illustrated the nonsupport group increased over both the homogeneous group (28.642, 95% CI [14.66, 42.62]) and heterogeneous group (42.717, 95% CI [29.75, 55.69]).

While the mean scores between the two support groups (14.075, 95% CI [-.68, 28.83]) were not statistically significantly different (p = .065), the mean scores between the nonsupport and the support groups were statistically significantly different (p < .000). The researcher rejected the null hypothesis and accepted the alternative hypothesis:

Alternate hypothesis 1 (H_1): The mean scores were statistically significant different between the lowest nonsupport and lowest support groups. $H_{1:}$ ($\mu_{lownonsupport} \neq \mu_{lowscho} \neq \mu_{lowscht}$). Data associated with the lowest 30% and students enrolled in the support course, noted a higher score when scheduled homogeneously instead of heterogeneously. Additionally, the highest performing group revolved around the group not enrolled in the support course at all. The nonsupport lowest 30% group had a higher mean without the additional course aimed at remediating and re-teaching.

While research question 2 used the same parameters as the first analysis, this study included the entire participant group (N = 324), not just the lowest 30% (N= 111). The mean score for each group ($\mu_{nonsupport}$ = 524.79, μ_{schomo} = 501.49, $\mu_{schetero}$= 491.16) revealed similar findings previously discussed in research question 1. The one-way ANOVA and the Tukey post hoc test revealed no statistical difference (p = .185) between the two support course group means 10.33, 95% CI [-3.49, 24.15]. However, the mean scores for the nonsupport group compared to the homogeneous support group increased by 23.3, 95% CI [11.54, 35.06] and the heterogeneous grouop increased by 33.63, 95% CI [23.34, 43.92].

The support course heterogeneous and homogeneous groupings were not statistically different. However, the nonsupport course mean scores were statistically significantly different (p = .000) from each of the support groups. Therefore, the researcher rejected the null hypothesis and accepted the alternative hypothesis: Alternate hypothesis 2 (H_2): The mean μcores will have a statistically significant difference between the means of the three groups. H_2: ($\mu_{nonsupport} \neq \mu_{schomo} \neq \mu_{schetero}$). For students enrolled in the GSE Analytic Geometry course during the 2014-15 school year, a higher impact was noted for students not enrolled in either of the support courses. For the population involved in support, the homogeneous group performed higher than the heterogeneous group.

CHAPTER V:

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Revolving federal initiatives enacted accountability measures for students, teachers, administrators, and schools (Hemelt & Marcotte, 2013). For public high schools in Georgia, the accountability was linked to score results collected from the applicable students' state-mandated Georgia Milestone (GM) End-of-Course (EOC) assessment. In an effort to increase assessment results, researchers explored the impact of grouping strategies based on the student's academic ability (Slavin, 1988). Additionally, local policy decisions surrounding homogeneous and heterogeneous grouping (Duflo, Dupas & Kremer, 2011) and the inclusion of an additional correlating mathematics support course (Cortes & Goodman, 2014) were analyzed for statistical differences.

The researcher utilized a one-way ANOVA and Tukey post hoc test and analyzed the statistical impact an additional support course had on the mean score of the GM Analytic Geometry EOC assessment. For this research study, the 2014-15 GM Analytic Geometry EOC scores from a local high school served as the dependent variable and the student group placement into one of three different groups served as the independent variable. Specifically, the researcher investigated the mean score of three scheduling group scenarios: 1) students not in a support course; 2) students enrolled in support, but grouped homogeneously in the geometry course; 3) students enrolled in support, but grouped heterogeneously in the geometry course. The researcher set out to understand the impact of student scheduling on the GM Analytic Geometry score for students completing Georgia Standards of Excellence (GSE) Analytic Geometry course during the 2014-15 school year in a local high school in South Georgia.

For research question 1 (RQ1), the researcher investigated the predetermined lowest 30% of the student population and determined a significant statistical difference existed between the mean GM Analytic Geometry scores for the nonsupport group compared to both support groups. Additionally, the researcher analyzed the entire tested group, research question 2 (RQ2), and determined the mean GM Analytic Geometry scores was also significantly different between the nonsupport and support groups.

Presentation of Research Findings

The researcher utilized a one-way ANOVA and Tukey post hoc test and determined the May 2015 GM Analytic Geometry EOC scores for the single high school were impacted by scheduling practices for the entire population tested (N = 324) and specifically, the lowest 30% population (N = 111). For RQ1, the mean scores for each group increased from the support heterogeneous ($\mu_{lowscht}$= 472.39), to the support homogeneous ($\mu_{lowscho}$ = 486.46), to the highest, nonsupport group ($\mu_{lownonsupport}$= 515.11). While no statistical significant difference existed between the two support groups (p = .065), the researcher indicated a significant statistical difference (p = .000) between the group mean of the nonsupport and both the homogeneous group mean (28.642, 95% CI [14.66, 42.62]) and heterogeneous group mean (42.717, 95% CI [29.75, 55.69]). For RQ1, the researcher rejected the null hypothesis and accepted the alternative hypothesis: Alternate hypothesis 1 (H_1): A significant difference existed between group mean of the lowest 30% nonsupport student population and the lowest 30% of the student population of both support groups. $H_{1:}$ ($\mu_{lownonsupport} \neq \mu_{lowscho} \neq \mu_{lowscht}$). For RQ1, the researcher determined the highest group mean score was the nonsupport group, followed by students grouped homogeneously and then heterogeneously.

Research Question 2 (RQ2) involved the same dependent and independent variables, but this question investigated the entire population of GM Analytic Geometry EOC students (N = 324), not just the lowest 30% (N= 111). Results and findings were similar to the RQ1. The mean score increased from the support heterogeneous group ($\mu_{schetero}$= 491.16), to the support homogeneous group (μ_{schomo} = 501.49), to the highest nonsupport group ($\mu_{nonsupport}$ = 524.79). The researcher utilized the one-way ANOVA and Tukey post hoc test and determined no statistical difference (p = .185) between the two support course group means 10.33, 95% CI [-3.49, 24.15], but illustrated the nonsupport data compared to the homogeneous support course increased by 23.3, 95% CI [11.54, 35.06] and the heterogeneous course increased by 33.63, 95% CI [23.34, 43.92]. Additionally, the nonsupport course was statistically significantly different (p = .000) from each of the support groups. Therefore, the researcher did not accept the null hypothesis. Instead the researcher accepted the alternative hypothesis: Alternate hypothesis 2 (H_2): The mean scores had a statistically significant difference between the means of the three groups. H_2: ($\mu_{nonsupport} \neq \mu_{schomo} \neq \mu_{schetero}$).

In conclusion, for the population involved in support, the homogeneous group performed higher than the heterogeneous group. However, the higher group mean impact on this assessment for this local high school involved students not enrolled in either of the support courses; but rather, the mean score for the nonsupport population had a statistical significant difference compared to both support groups for both the lowest 30% of the population and entire student population involved in the study.

Discussion of the Research Findings

Discussed in detail, Chapter II provided a Review of Literature of pertinent grouping practices. The major applicable research aligned to the current study was outlined in Table 1 *Concept Analysis Chart* and further compared in Table 12 *Concept analysis Chart and Current Study Correlation*. The long-term advantages of the school cluster approach were analyzed by Gentry and Owen (1999) and Matthews, Ritchotte and McBee (2013). The researchers posited the school cluster approach utilized intentional heterogeneous grouping measures and increased long-term achievement for elementary students. Gentry and Owen (1999) conducted a mixed methods research and included qualitative information within the longitudinal study. However, Mathews, Ritchotte and McBee (2013) utilized quantitative data focused on the applicable gifted and non-identified student population.

The previous researcher's findings aligned with the current researcher and noted positive gains for the lowest and the entire population when grouped heterogeneously without the additional support course. However, the current study methodology included one year of data focused on the high school population instead of longitudinal data focused on the elementary population. Additionally, the current researcher included data specific to mathematics and analyzed grouping measures that included an additional hour of support for a portion of the population.

For research question 1, the lowest 30% population, the nonsupport students, grouped heterogeneously, outperformed the support groups ($\mu_{lownonsupport} = 515.11$, $\mu_{lowscho}$

= 486.46, $\mu_{lowscht}$= 472.39). The nonsupport group also outperformed the support groups with data from the entire population was analyzed ($\mu_{nonsupport}$ = 524.79, μ_{schomo} = 501.49, $\mu_{schetero}$= 491.16) for the research question 2. Both research questions resulted in the acceptance of the alternate hypothesis because a statistical difference (p = .000) existed between the nonsupport and support groups for both questions.

Based on previous mathematical deficiencies, two of the groups within the current study were placed into an additional hour of support aligned to the curriculum of the geometry course. Within this support population, students were grouped homogeneously for the support course, but grouped either heterogeneously or homogeneously for the required geometry course. Collins and Gan (2013), Cortes and Goodman (2014), and Duflo, Dupas, and Kremer (2011) postulated positive academic gains were evident within homogeneous grouping practices. However, big-fish-little-pond theorist, Marsh and Hau (2003) and Marsh and Parker (1984) noted negative psychological effects for student's self-concept when grouped homogeneously. Additionally, Chang (2011) analyzed teacher perceptions which influenced the end result and completed a case study on the theory of self-fulfilling prophecy. While the current study focused on quantitative assessment data only, the theoretical implications of previous studies was noted for future investigation.

The previous researchers postulated homogeneous grouping allowed the teacher to focus on the student knowledge gaps and lacking basic skills and noted positive results for high and low ability students. Cortes and Goodman (2014) noted the homogeneous grouping of students within an additional hour, "double-dose," tied to targeted instructional strategies, provided positive, long-term outcomes. The researchers noted an increase for high and middle level students, but not for the lowest identified population.

Additionally, this study lacked the inclusion of students not double-dosed for comparison purposes and focused on the longitudinal advantages of the additional hour of mathematical support.

Duflo, Dupas, and Kremer (2011) also indicated positive results of homogenous grouping practices when aligned to professional development targeting the specific needs of the impacted elementary level students. Collins and Gan (2013) also analyzed elementary students and noted homogeneous grouping had a positive mathematical effect on the identified low and high level student. Examined together, researchers noted positive gains for all academic levels when students were grouped homogeneously.

Similar to the results of the previous studies, the researcher noted the population of students enrolled in the homogeneous support group outperformed support students that were mixed heterogeneously in the correlating geometry course. However, unlike the previous studies, the current researcher examined both homogeneous and heterogeneous support groups within a local high school in rural Georgia. The researcher also noted academic gains for the lowest and the entire population analyzed. For the lowest 30%, research question 1, the mean scale score for students in the homogeneous group increased by 14.075, 95% CI [-.68, 28.83] and the overall homogeneous group, research question 2, increased by 10.33, 95% CI [-3.49, 24.15] when compared to the corresponding heterogeneous group.

Relationship to Research

The researcher investigated the impact of three different grouping strategies on the data compiled from the Georgia Milestone Analytic Geometry End-of-course assessment. Gentry and Owen (1999) noted positive gains for all groups when students were heterogeneously grouped for instruction within a school cluster model. Aligned with Gentry and Owen (1999), the current researcher noted students heterogeneously grouped for a single course of geometry had a statistically significant difference when compared to students enrolled in an additional hour of support and grouped homogeneously or heterogeneously within the geometry course. The findings of the current study challenged the premise that the extra time, double-dose, provided the best assessment results for the applicable year.

Oakes (1985) concluded that low ability students did not gain academically when grouped homogeneously within the classroom environment. Consistent with this research, Gentry and Owen (1999) noted positive gains for all academic levels when students were grouped heterogeneously based on a school cluster model. This student scheduling model required the strategic placement of all ability levels within each classroom environment. The current researcher supported the previous conclusions based on the academic gains of heterogeneous grouped, nonsupport students for both the lowest 30% of the population and the entire population. Students not enrolled in the support course were grouped heterogeneous and included all ability levels within each classroom. The result of the ANOVA and Tukey post hoc analysis revealed the heterogeneous grouped, nonsupport students had a statistically significant difference when compared to students who received a double-dose of mathematics support and were grouped homogeneously or heterogeneously in the geometry classroom.

Within the current study, the remaining two groups analyzed included students scheduled for two mathematics courses, geometry and support. Previous research conducted by Cortes and Goodman (2014), labeled the additional support course a “double-dose” and noted positive gains surrounding the addition of instructional time for students with mathematical deficiencies. Within the parameters of this study, teachers implemented targeted instructional strategies during the student’s extra hour of support. For high and middle ability level students, the researchers noted positive gains during the years following this double-dose intervention.

While Cortes and Goodman (2014) noted several positive benefits to the double-dosed intervention, the current research study illuminated a few differences between the studies. First, a major component of the previous study discussed targeted instructional strategies linked to the double-dosed instruction. However, the specifics of the strategies were not noted for replication. Within the parameters of the current study, no professional development of targeted instructional strategies in the support course was provided. Next, the researchers failed to indicate if only the double-dosed students received the benefit of the targeted strategies or if the students not double-dosed also benefited. For the current study, all students received the same instruction from the same teachers with the same strategies during the normal geometry course. Finally, the researchers failed to compare the two groups, if they both existed, for a statistical difference. Within the current study, the homogeneously grouped students had a higher scale score than the heterogeneously grouped students. However, the students not enrolled in the double-dose of support outperformed both support groups. This was not investigated in the previous research scenario.

According to Cortes and Goodman (2014), students were at an advantage if grouped homogeneously because the instruction was geared towards the specific needs of the students. Within the original study, the basic skills of the lower level students increased with the inclusion of targeted professional development. The researchers stated the implementation and advantages of grouping students homogeneously for the additional instruction outweighed the negative effects of grouping discussed within the review of literature. Collins and Gan (2013) also indicated positive gains when students were homogeneously grouped. The support population of the current study were grouped homogeneously or heterogeneously within the geometry classroom. In line with the previous studies, the homogeneous grouped support students had a higher scale score mean when compared to the heterogeneously grouped support students.

Conclusion

Within research question 1, the researcher analyzed the data and determined the lowest 30% population benefited the most from being enrolled in the single heterogeneously grouped geometry course. The original prediction indicated the support group mixed heterogeneously would have the largest impact on the mean scale score. The researcher noted the combination of double-dose and BFLPE increased the likelihood of positive gains for this group. However, the researcher analyzed the results from a one-way ANOVA and Tukey post hoc test and concluded the exact opposite of the predicted outcome. The additional hour of support failed to provide a statistically significant advantage compared to students grouped heterogeneously in only the geometry course. Conversely, the researcher compared the two support groups and noted the homogeneous group outperformed the heterogeneous group of students. However, the lack of established, targeted instructional strategies within the support course may have altered the results of the current study.

Research question 2 included all of the students enrolled in the GSE Analytic Geometry course in the rural high school during the 2014-15 school year. Separated into the same three categories as research question 1, the researcher determined the heterogeneously grouped nonsupport group once again demonstrated a significantly statistical difference compared to both of the support groups. Once again, the homogeneous support group outperformed the heterogeneous support group, but both were outperformed by the nonsupport group. Previously, the researcher predicted the nonsupport group would have a statistical advantage, but expected the additional support to decrease the gap between the groups.

Within the analysis of the data and groups, the researcher determined students not in the bottom 30% were enrolled in the support course. Additionally, students in the bottom 30% were not enrolled in the support course. While the original double-dose study indicated the academic gain outweighed the negative grouping effects, this was not true for the current study. For this study, the grouping practices and support course alone did not have a statistically significant difference as a stand-alone strategy aimed at improving achievement scores on the state assessment. However, the lack of established, targeted instructional strategies within the support course may have altered the results of the current study.

Implications

The researcher noted multiple implications for district leaders, school administrators and classroom teachers. The evolution of federal and state initiatives tied to accountability measures forced local systems to explore cost effective ways to increase student assessment results. For decades, educational researchers debated grouping measures correlated to the individual student's academic, emotional and social growth. Within the current study, the research noted no statistical difference academically between the heterogeneously versus homogeneously grouped support population. In fact, both research questions found statistical evidence that supported positive results when students were not placed in the additional hour of support. While the current study examined grouping measures correlated to a state mandated mathematics assessment, an implication of the study was the discovery that additional time was not effective as a stand-alone intervention. The implication for educators centered on the realization that the organization of the students and the additional time were not the contributing factors for academic achievement. Extra time and grouping practices did not equal learning. Like a pebble tossed into the water, the ripple effect of this statement provided implications within k-12 education.

For district leaders, this study revealed implications focused on fiscally relevant decisions and classroom interventions. An implication for system leaders revolved around the premise that each community included schools within the system, not a system of schools. Common expectations for tiered interventions, research-based strategies and support course inclusion was enriched at the district level. Additionally, district leaders provided purposeful, targeted professional development and data-driven research instead of grouping practices and additional time for support. Finally, the ongoing use of support courses K-12 have utilized vast resources for staffing. If the inclusion of the extra class time and teacher resources provided limited benefit to the student population, the fiscal implication for district leaders was impactful.

A major implication for school system personnel, which included the high school principal, administrators, and teachers, was the acknowledgment that an additional hour of support as an intervention alone provided no statistical benefit during this applicable year for this assessment. As a result, school leaders and classroom teachers focused on research based, professional development and targeted instructional strategies. The implication from this study revolved around understanding that additional time did not equal learning. the use of time, not just having time.

Recommendations

The researcher recommended both policy and future research based on the limitations of the current study.

Recommendations for further research

One noted limitation of this study included the use of only one grade level assessment, in one high school, in South Georgia. While data analysis revealed all students in this study responded higher without support, this study only included students in this one setting and did not separate students by gender, race or socioeconomic group. The replication of this study with the inclusion of multiple high schools in a variety of larger districts to investigate grouping practices provided the researcher a more comprehensive analysis towards future implications. Statistical analysis which utilized multiple assessment points and longitudinal data provided additional evidence of effective grouping practices within secondary education. Additionally, a closer examination of gender, race, socioeconomic and special education sub-groups provided various additional data points for more statistical generalization to take place. It is possible the different population and additional data points provided different challenges and insights and increased the understanding of grouping practices and support course applications.

Another limitation noted by the researcher was the lack of perception data. The current study included only quantitative data and did not investigate grouping perceptions of the administrators, teachers or students directly affected. A qualitative or mixed-method study completed while students were enrolled in the various groups and support course provided missing perception information and allowed the researcher the opportunity to evaluate student and teacher impressions of each of the three grouping methods. Replication of the study to include a mixed methods approach and multiple district provided insights not examined during this study.

A final limitation involved the lack of targeted interventions and professional development for the support group instruction. Future research studies focused on the implementation of professional development and purposeful, targeted interventions within the support course provided different results. Previous researchers within the current review of literature noted professional development and targeted interventions, but the specific professional development was not investigated nor described. Future research tied to response-to-interventions (RTI) and targeted professional development was applicable in the support course but not investigated by the current researcher.

Policy Recommendations

Policy decisions which impacted district, principals, and teachers was a limitation of this study. From a district level, policies centered on support courses for grades K-12 were examined for effectiveness. One future recommendation for district and school leadership was purposeful, intentional placement of students into a remedial course during the scheduling process. A system-wide rubric focused on student deficits to guide recommendations, instead of teacher input as the main contribution, allowed for more targeted interventions.

Another policy recommendation was the implementation of comprehensive, research-based strategies and interventions implemented in the form of professional development to the school leaders and teachers. School leaders worked with teachers and implemented targeted strategies aligned with student data and targeted goals. School level teachers implemented the research based strategies within both the mathematics classroom and the support classroom. Leaders and teachers focused on common expectations of effective teaching was implemented and inspected on a consistent basis.

The steps for implementation of the above policies required district level decisions and involved school leader and classroom teacher input. A comprehensive approach centered on a review of relevant research before initiating change within the school building was recommended. From a fiscal standpoint, professional development was a requirement of the state and required limited monetary obligations. District and school improvement plans outlined the professional development organization and implementation steps. While the focus of the current study revolved around the grouping practices within the geometry classroom, the policy recommendations focused on targeted and purposeful research based decisions within all aspects of education

Dissemination

The findings from this study were discussed during a recent high school administrative meeting. Within this group, two of the seven were former mathematics teachers. This groups expected findings matched the researcher's original theory in which the support course provided an advantage for the lowest 30% of the population. Once the results were explained, a positive discussion followed surrounding the research results and future steps within this building. Next, the researcher met with geometry teachers and discussed the results. Within this department meeting, the teachers were gathered together to discuss recommendations for current students for the next year course. Again, the involved teachers originally felt that the support course offered an advantage to the lowest population and a discussion centered around an in-depth analysis of current and future targeted interventions followed the revelation of the research results. Targeted professional development and purposeful interventions were discussed, investigated and implemented for the remainder of this school term.

The result of 10-12 mathematics department conversation along with the data gathered during this research study, provided the catalyst for a 6-12 meeting to discuss supportive instruction and next steps within the system. This group included the superintendent, the system curriculum director, and instructional personnel from each building. The conclusion of the meeting included a common rubric for recommending students for a support course. Additionally, the decision was made to continue the support course, with embedded targeted professional development and strategies, until additional analysis was concluded.

Earlier this semester, the researcher presented findings to other doctoral candidates enrolled in a new cohort group at Columbus State University. The researcher applied to present findings during the Georgia Association of Educational Leaders

(GAEL) convention this summer. Finally, the researcher planned to submit this dissertation research for publication.

Concluding Thoughts

Due to the limitations of this research study, casual statements cannot be made about specific benefits of grouping practices linked to increased assessment scores. However, the continuation of grouping research influenced informed decisions within the educational realm. Throughout this dissertation process, I have grown to appreciate the application of research literature and the need to analyze quantitative and qualitative data. The statistically significant results were not expected, but allowed me to grow as an educator and principal. In conclusion, the use of grouping practices alone did not tell the entire story and extra time for a remedial, support course did not guarantee positive student academic gains.

Table 12

Concept Analysis Chart and Current Study Correlation

Study	Purpose	Participants	Design / Analysis	Supported within current study	Not supported in current study

Cortes & Goodman (2014)	Mathematics Explored double-dose Algebra support	9^{th} grade students in Chicago	Quantitative	Aligned with Cortes and Goodman (2014), the current researcher noted the homogeneous double-dose group scored higher than heterogeneous double-dose group.	The methodology of the current research included multiple groups and determined the lowest group benefited more when they were not "double dosed" However, the current study only analyzed results from one year. Longitudinal data was not analyzed.
Duflo, Dupas, & Kremer (2011)	Mathematics Homogeneous grouping	121 first graders in Kenya	Experimental evidence	Within the current study, the researcher noted similar findings which supported the homogeneous grouping of students within the support sections. The lower identified students and the entire support homogeneous group benefited outperformed the heterogeneous group.	Unlike the previous research, the current researcher analyzed three variables for both the lowest tested population and the entire population. Both populations within the high school aged students scored higher when grouped heterogeneously without the support group. Homogenous grouping did not overtake student grouped heterogeneously without support.

Collins & Gan (2013)	Homogeneous grouping	135 elementary schools 9,325 students Dallas independent school district	Quantitative correlational	Within the current study, the researcher supported the findings of Collins and Gan (2013). For the two support groups analyzed, the homogeneous group outperformed the heterogeneous group. The findings were consistent for the lowest 30% of the population and the entire population tested.	While the current study did not look specifically at special education or gifted, the low and all benefited more when heterogeneously grouped without support for geometry. The original Collins and Gan study did not analyze a pull out support heterogeneous group for comparison purposes.
Gentry & Owen (1999)	School cluster grouping	Elementary	Qualitative and quantitative Longitudinal, causal comparative	The current researcher noted similar aspects to the study completed by Gentry and Owen (1999). Both researchers noted positive gains for all student levels when heterogeneously grouped heterogeneously within the geometry course	Unlike Gentry and Owen (1999), the researcher did not complete a qualitative nor longitudinal component to the study.
Matthews, Ritchotte and McBee (2013)	School Cluster	Elementary 68 – gifted 186 – non-identified students	Quantitative Longitudinal Ex post facto	Matthews, Ritchotte, and McBee (2013) study aligned the with the current study results. Positive gains for lowest and all when grouped heterogeneously within the geometry course	The current researcher did not analyze longitudinal data.

Chang (2011)	Teacher perceptions Pygmalion Effect	47 first-year learners majoring in thermodynamics	Case study	While the current researcher did not investigate teacher perceptions, Chang (2011) findings provided a possible rational for the results of this study. The identification of students into the support course labeled the individual students as mathematically deficient. Based on RQ1, the lowest 30%, teachers perceptions might have influenced results and should be studied more in-depth in a future study..	
Marsh and Parker (1984)	Big-Fish-Little-Pond Effect (BFLPE) Self-concept			In line with Marsh and Parker (1984), the current researcher noted a statistically significant difference in favor of the heterogeneous group not identified as needing support.	
Marsh & Hau (2003)	BFLPE Academic self-concept (ASC)	Academically selective high schools. 26 countries	Empirical research project	Student academic self-concepts were not analyzed by the current researcher. However, the study completed by Marsh and Hau (2003) had student implication comparisons applicable to the current study.	For the current study, the researcher noted the lowest performing group on the Tukey post hoc test involved heterogeneous support students. However, the students in this group were placed into a common support class with other mathematically deficit students.

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APPENDICES

APPENDIX A:

IRB APPROVAL

Institutional Review Board

Columbus State University

Date: 12/9/16

Protocol Number: 17-042

Protocol Title: Effects of Grouping on Support Student's Assessment

Principal Investigator: Karen Hancock

Co-Principal Investigator: Michael Richardson

Dear Karen Hancock:

The Columbus State University Institutional Review Board or representative(s) has reviewed your research proposal identified above. It has been determined that the project is classified as exempt under 45 CFR 46.101(b) of the federal regulations and has been approved. You may begin your research project immediately.

Please note any changes to the protocol must be submitted in writing to the IRB before implementing the change(s). Any adverse events, unexpected problems, and/or incidents that involve risks to participants and/or others must be reported to the Institutional Review Board at irb@columbusstate.edu or (706) 507-8634.

If you have further questions, please feel free to contact the IRB.

Sincerely,

Amber Dees, IRB Coordinator

Institutional Review Board

Columbus State University

APPENDIX B:

SUPERINTENDENT
Jason Miller, Ed. D.

126 Starksville Ave., N.
P. O. Box 399
Leesburg, GA 31763-0399
Phone (229) 903-2100
Fax (229) 903-2130

Lee County
Board of Education

November 9, 2016

Dear Mrs. Hancock,

As Superintendent of Lee County Schools, I approve your request to conduct doctoral research using data gleaned from LCHS student test scores with the understanding that you will maintain confidentiality of both students and staff of Lee County High School. As well as conforming to all requirements of your Institutional Review Board. I wish you the best as you enter a new phase of your doctoral studies.

Respectfully,

Jason B. Miller

Jason Miller, Ed. D.
Superintendent

APPENDIX C:

RAW DATA COLLECTED FROM ALL PARTICIPANTS

students	1= lowest 30 % & 2 = not lowest	Race: 1 = African-American; 2=Asian; 3=Hispanic; 4=Asian; 5=African-American	Gender: 1 = female & 2 = male	Economically Disadvantage: 1= free/reduced & 2 = not free reduced	Geometry scale scores 2014-15	Algebra scale scores 2013-14	1= no support course; 3 = support course homogeneous math; 4 = support course heterogeneous math
1	2	5	2	2	559	402	1
2	2	5	2	2	559	402	1
3	1	5	1	1	491	368	4
4	2	5	1	1	559	384	3
5	2	5	1	1	510	434	1
6	2	5	2	2	559	396	4
7	1	5	1	1	530	407	1
8	1	5	2	1	470	351	4
9	2	5	1	2	454	390	1
10	2	1	1	2	520	393	1
11	2	5	2	1	544	390	3
12	1	5	1	1	501	362	3
13	2	5	1	1	506	390	4
14	2	1	1	2	501	393	1
15	2	5	2	2	559	402	1
16	2	1	1	1	540	407	1
17	2	1	1	2	501	393	1
18	2	5	1	1	501	400	1
19	1	5	2	1	520	381	1
20	1	5	1	2	435	381	4
21	2	5	1	1	530	407	1
22	2	5	1	1	486	396	1
23	2	4	1	2	540	387	3
24	2	5	2	2	559	402	1
25	1	5	1	1	520	365	4
26	1	5	1	1	510	434	1
27	2	4	1	2	506	400	1
28	1	1	2	1	459	375	4
29	2	5	2	1	559	414	1

30	2	5	2	2	559	402	1
31	1	1	2	1	481	371	1
32	2	5	1	1	530	407	1
33	2	5	2	2	559	402	1
34	1	5	2	1	511	375	1
35	2	5	2	2	559	402	1
36	1	5	2	1	491	378	4
37	2	1	1	2	510	387	4
38	2	5	1	1	530	407	1
39	2	1	2	1	530	430	1
40	2	5	2	2	570	408	3
41	2	5	2	2	515	393	1
42	1	5	1	2	510	372	1
43	2	5	2	2	559	402	1
44	2	5	2	1	511	390	4
45	2	5	1	2	580	414	1
46	1	5	2	1	476	378	3
47	2	5	1	2	530	384	4
48	2	5	1	1	510	434	1
49	2	1	1	2	501	393	1
50	2	1	1	2	501	393	1
51	2	5	2	1	549	417	1
52	1	1	2	2	506	374	3
53	1	5	2	2	470	368	4
54	1	5	1	2	496	381	1
55	2	5	1	1	530	407	1
56	1	5	2	2	506	378	3
57	2	1	1	2	476	387	4
58	1	5	1	1	530	365	1
59	1	5	1	1	530	407	1
60	2	5	1	1	544	400	3
61	2	5	2	2	598	405	1
62	2	5	2	1	515	430	1
63	2	5	2	2	459	397	1
64	1	1	2	1	481	371	1
65	1	5	1	1	530	374	3
66	2	5	2	2	530	393	3
67	2	5	1	1	515	396	1
68	2	5	1	1	510	434	1
69	2	1	2	1	481	371	1
70	1	1	2	2	436	362	3
71	2	1	1	2	506	402	4
72	2	5	2	2	559	402	1

73	2	1	1	2	501	393	1
74	2	5	1	1	501	390	3
75	2	5	2	2	559	402	1
76	2	5	2	2	559	402	1
77	2	5	1	1	554	402	1
78	2	5	1	1	520	384	1
79	2	1	1	2	501	393	1
80	2	5	2	2	559	402	1
81	2	5	2	2	559	402	1
82	2	5	1	1	510	434	1
83	2	1	1	2	501	393	1
84	1	5	1	1	491	381	4
85	1	4	2	2	515	361	3
86	1	5	1	1	448	365	1
87	2	5	2	2	486	390	3
88	2	3	2	2	525	384	4
89	1	5	2	2	470	339	1
90	1	5	2	2	465	358	3
91	1	5	1	2	520	347	3
92	1	5	1	1	530	407	1
93	1	5	2	2	481	374	3
94	1	5	1	1	530	378	3
95	1	5	1	1	460	367	3
96	1	5	2	1	501	378	4
97	1	5	1	1	510	434	1
98	2	5	1	1	510	434	1
99	2	5	2	2	554	396	1
100	2	5	2	1	592	437	1
101	2	5	2	2	559	402	1
102	2	5	1	1	481	400	1
103	2	5	1	1	530	407	1
104	2	5	2	1	481	384	1
105	2	5	2	2	559	402	1
106	2	5	2	1	535	404	1
107	1	1	2	1	470	381	3
108	1	5	1	1	510	434	1
109	2	3	2	2	511	390	1
110	2	5	1	1	496	384	4
111	2	5	2	2	486	390	3
112	2	1	2	2	501	384	4
113	1	1	1	1	506	378	3
114	1	1	2	2	496	374	4
115	2	5	1	2	592	424	1

116	2	5	2	2	564	387	4
117	1	5	1	2	459	377	4
118	1	5	2	2	496	381	1
119	2	5	2	2	559	402	1
120	2	5	1	1	486	407	4
121	2	5	1	1	570	431	1
122	2	5	1	2	491	387	4
123	2	5	2	2	491	390	4
124	2	5	1	2	570	400	1
125	2	5	2	1	486	387	1
126	1	1	1	2	470	346	4
127	2	5	1	2	520	400	4
128	1	5	1	2	429	378	4
129	2	1	1	2	520	384	1
130	1	5	2	2	520	378	4
131	2	5	2	2	559	402	1
132	2	5	1	1	530	384	1
133	2	5	1	1	510	434	1
134	1	5	1	1	510	434	1
135	2	5	1	1	575	407	1
136	1	5	2	2	559	402	1
137	1	5	1	1	530	407	1
138	2	5	2	1	540	420	1
139	2	1	1	2	535	400	1
140	1	5	1	2	530	378	1
141	1	5	2	1	486	378	1
142	2	5	1	1	510	434	1
143	2	5	2	1	539	400	4
144	2	5	1	1	510	434	1
145	2	1	1	2	592	439	1
146	2	5	1	1	510	434	1
147	1	1	1	2	501	393	1
148	2	1	1	2	496	387	1
149	2	1	2	1	554	414	4
150	2	4	2	2	454	396	4
151	2	5	1	2	501	393	4
152	2	5	2	2	486	400	1
153	2	5	1	1	564	414	1
154	1	1	2	1	481	371	1
155	2	5	1	1	530	407	1
156	2	5	2	1	515	417	3
157	1	5	1	1	530	407	1
158	2	5	2	1	554	417	1

159	1	5	2	1	448	351	4
160	2	5	1	1	530	407	1
161	2	5	2	2	525	404	1
162	2	5	1	1	510	434	1
163	1	5	1	1	481	381	3
164	1	5	1	2	470	358	3
165	2	5	1	1	592	402	1
166	1	5	1	1	530	407	1
167	2	5	1	1	501	393	1
168	2	5	1	1	604	446	1
169	1	5	2	2	559	402	1
170	2	5	2	2	511	400	1
171	1	5	2	2	559	402	1
172	2	5	1	1	530	407	1
173	2	5	1	1	510	434	1
174	2	5	2	1	544	384	1
175	2	5	1	1	530	412	3
176	2	5	2	1	476	423	4
177	1	5	1	2	501	371	1
178	2	5	2	1	565	424	1
179	1	5	1	1	442	370	3
180	2	1	2	1	481	371	1
181	1	1	2	2	465	358	4
182	2	5	2	2	559	402	1
183	2	5	2	2	559	402	1
184	2	5	1	1	530	407	1
185	1	5	1	1	510	434	1
186	2	5	1	1	506	417	1
187	1	5	2	1	506	371	1
188	1	1	2	1	454	354	4
189	2	5	1	2	570	400	4
190	1	5	1	2	506	378	3
191	1	5	1	2	481	381	4
192	2	5	1	1	520	387	1
193	2	5	2	2	559	402	1
194	2	1	2	2	511	404	4
195	1	5	1	1	510	434	1
196	1	5	1	1	460	329	4
197	2	5	1	1	549	400	1
198	1	5	2	2	501	368	3
199	1	5	1	1	470	375	3
200	2	1	1	2	501	393	1
201	2	5	2	2	491	390	3

202	2	5	1	1	535	420	1
203	2	5	2	1	564	402	3
204	1	1	1	2	491	374	3
205	2	5	1	1	506	417	1
206	2	5	2	1	559	396	1
207	2	1	2	1	481	371	1
208	2	1	1	1	510	390	1
209	2	2	2	2	540	414	1
210	2	5	1	1	520	400	1
211	1	5	1	1	530	407	1
212	2	1	2	1	481	371	1
213	1	5	1	1	454	365	3
214	1	1	2	2	470	378	3
215	2	5	2	2	559	402	1
216	2	1	1	2	501	393	1
217	1	5	1	1	454	372	4
218	1	5	2	1	470	381	3
219	1	2	2	2	549	381	1
220	2	5	1	1	530	407	1
221	2	2	2	1	554	407	1
222	2	1	1	2	481	393	1
223	2	1	1	1	459	387	3
224	2	5	1	1	510	434	1
225	2	5	2	2	559	402	1
226	1	5	1	1	476	378	4
227	2	5	2	2	564	402	1
228	1	5	1	1	510	434	1
229	2	5	2	1	501	400	3
230	2	5	2	2	470	396	1
231	2	5	1	1	510	434	1
232	2	5	2	1	496	387	3
233	1	5	2	2	559	402	1
234	2	5	1	1	510	434	1
235	2	5	1	1	530	407	1
236	1	5	1	2	436	354	4
237	2	1	1	2	515	390	4
238	1	5	1	1	510	434	1
239	1	1	1	2	442	368	4
240	2	1	1	2	501	384	3
241	2	5	2	1	520	407	4
242	2	4	1	1	506	407	1
243	2	1	2	1	530	411	1
244	1	5	2	1	506	371	4

245	2	5	1	2	525	387	4
246	2	5	2	1	496	387	1
247	2	5	1	2	515	390	1
248	1	5	2	1	510	365	1
249	1	5	2	2	496	371	3
250	1	5	2	2	559	402	1
251	2	5	1	1	530	407	1
252	2	5	2	1	481	402	1
253	2	1	2	2	506	400	1
254	1	5	1	1	481	381	4
255	1	5	1	2	476	374	4
256	1	5	1	1	510	434	1
257	2	5	2	1	530	441	1
258	1	5	1	2	470	368	4
259	2	5	1	1	580	430	1
260	2	5	1	1	510	434	1
261	1	1	2	1	481	371	1
262	2	1	1	2	501	393	1
263	2	4	1	1	486	390	4
264	2	5	1	1	592	441	1
265	2	5	2	1	540	431	1
266	2	5	1	2	470	402	4
267	1	5	2	1	470	378	4
268	2	5	1	1	544	396	4
269	2	1	1	1	515	404	4
270	2	5	1	1	501	400	3
271	2	1	1	2	515	400	1
272	2	5	2	2	559	402	1
273	2	5	2	1	570	393	4
274	1	5	1	1	530	407	1
275	2	1	2	1	481	371	1
276	1	4	2	2	486	378	3
277	1	1	1	2	454	372	4
278	1	5	1	1	510	434	1
279	2	5	2	2	559	402	1
280	1	5	2	2	559	402	1
281	2	5	2	1	520	430	3
282	2	5	1	1	530	407	1
283	2	5	1	1	535	417	1
284	2	1	2	2	465	387	4
285	2	1	1	2	511	417	1
286	2	5	2	2	559	402	1
287	2	5	1	1	530	407	1

288	2	5	2	2	506	422	4
289	1	5	2	2	559	402	1
290	2	5	2	1	544	387	3
291	1	5	1	1	496	381	1
292	2	5	1	1	530	407	1
293	2	1	1	2	501	393	1
294	1	5	2	2	510	362	1
295	1	1	1	2	470	374	4
296	2	5	1	1	530	407	1
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299	1	1	1	2	491	365	4
300	2	5	2	2	481	417	1
301	2	5	2	2	559	402	1
302	2	5	1	1	510	434	1
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304	1	5	1	1	491	372	3
305	2	1	1	2	554	436	1
306	1	1	2	2	486	372	4
307	1	1	2	2	459	381	4
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310	1	5	2	2	448	375	4
311	2	5	1	1	539	417	1
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313	2	1	1	2	491	384	4
314	1	4	1	2	481	358	1
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319	2	1	2	1	506	393	1
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321	2	5	2	1	496	408	1
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323	2	5	2	2	559	402	1
324	2	1	1	2	501	393	1