Effects of Ability Grouping on Math Achievement of Third Grade Students

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Abstract

The purpose of this study was to examine the effects of heterogeneous and homogeneous grouping on the mathematical achievement of students in third grade. Participants were 16 third graders in a self-contained classroom, assigned to either small homogeneous or heterogeneous group for math instruction for 7 weeks. Pretest-posttest scores and growth of students in both groups were statistically analyzed to determine effect on student achievement. Results indicate that there was no statistically significant difference in effect on student math performance between the heterogeneous and homogeneous grouping types. Both grouping types resulted in comparable academic gains for students. There was not a significant difference between the two groups. Classroom implications are discussed.

Ability Grouping: Effects of Grouping on Math Achievement for Third Grade Students

Introduction

Small group instruction is a key component to effective math instruction. According to Doug Grouws, as quoted in the 2007 article *What Does Good Math Instruction Look Like* by Nancy Pletheroe, "[S]mall-group instruction will benefit students only if the teacher knows when and how to use this teaching practice." Thusly, there is a long term debate as to the effectiveness of homogeneous versus heterogeneous grouping within the classroom. Homogeneous grouping, also called achievement or ability grouping, is utilized by teachers to provide differentiated instruction for students based on the level at which they have mastered specific skills. In heterogeneous grouping, also called work- or mixed groups, students are interacting with and learning from each other because they are purposefully mixed because of their differing levels of academic achievement (Good, Grouws, Mulryan, & Reys, 1990). These two types of groupings pose the question: Which one is the more effective instructional tool to increase academic achievement for students?

For decades, researchers have been attempting to answer the question to give educators guidance when planning instruction. Some schools and systems have taken it to the length of grouping students in specific classes based on their abilities while others consistently mix students to provide what some consider balance in the classroom. Findings of the research are inconclusive. Some studies have taken place as action research of a teacher working to do what's best in his or her classroom while other mixed

method approaches present research that has been collected from a extremely large populations over extensive spans of times based on standardized test scores from a variety of years and surveys, questionnaires, or interviews that have been collected along the way. There is little research evidence that one type of grouping is consistently and significantly more effective than the other. So the question still stands.

Statement of Research Problem

Because of the inconclusive findings of research studies, homogeneous versus heterogeneous grouping continues to be an issue of debate within the educational field. This is a quasi-experimental action research study designed to compare the effect of homogeneous grouping and heterogeneous grouping on students' math achievement in a self-contained third grade classroom.

Definition of Terms Used in this Study

Homogeneous Grouping

Within this study, the terms homogeneous, ability, and achievement grouping will be interchangeable. This refers to a small group of students within a classroom that are placed together for the purpose of differentiated instruction. Students participate in one level of grouping until they have mastered certain skills and may move into a new group based on their academic performance and growth. Students who are struggling with certain skills or standards are given the opportunity for repeated practice to reinforce these skills. Students who have mastered previously taught skills are given extension opportunities.

Heterogeneous Grouping

Similarly, heterogeneous grouping will be interchangeable with mixed- or work-

groups. These groups represent students at all academic levels. Students are purposefully placed with others that are at different stages in the learning process for social and academic growth. In this type of grouping, students who have mastery of skills are given leadership opportunities to assist peers who are still struggling with certain concepts.

Review of Literature

Homogeneous vs. Heterogeneous Grouping

Many research studies have been conducted to evaluate the effectiveness of homogenous versus heterogeneous group types. This review of literature is important to provide analysis from other researchers as to which group is the better instructional strategy. The findings of these studies indicate that findings are generally inconclusive and that there is no statistical difference in student achievement from one grouping type to another. The following studies present both sides of the research and validate the researcher's hypothesis that the difference between the two grouping types is insignificant.

Math instruction, like other areas of education, is constantly evolving. It is no longer sufficient for students to be able to complete basic math computations. Mathematics instruction requires students to use problem solving and critical thinking. For this very reason, whole group instruction is not able to function as an exclusive teaching tool. Students must be allowed to work in small groups together in order to learn content skills from one another as well as practice social skills in an academic setting (Taylor, 1989, p. 638). Regardless of grouping type, students benefit from instruction when they have the opportunity for increased teacher and peer focus. Still, the

controversy over the most effective grouping type remains almost completely inconclusive.

James Kulik (1992) formed a meta-analysis article on the effects of student grouping. He asserted that it was not necessarily the grouping type that influenced student learning. It was, however, the level of curricular adjustment that made a difference in how much student scores increased. He states that classes grouped by ability that teach the same content have little to no effect on student learning. It is in the classes or grades where content is adjusted to meet the needs of learners that student learning increases most (Kulik, 1992).

Positive Effects of Heterogeneous Grouping

Liora Linchevsky and Bilha Kutscher (1998) discuss the academic effects of heterogeneous grouping in mathematics. They conducted three studies of quasi-experimental design. The studies indicated that low and average achieving students made great progress when working with students of a higher ability level. The higher achieving students achieved about the same in the comparison of homogeneous and heterogeneous groups (Linchevsky & Kutscher, 1998). This indicates that heterogeneous grouping has a positive effect for some students and a null effect for others. There were no negative impacts indicated during the three different studies.

Jacqueline Benero (2000) found her research problem in the boredom that accompanies traditional pencil-to-paper math reteaching. She designed a study to determine whether or not project based cooperative learning groups increased students' interest in studying math. Using a survey instrument, Benero discovered that student interested in mathematics increased when she changed her teaching strategies to use

heterogeneous groupings. Other instruments used were teacher observations and student grades. The results also indicated that student grades, when working in heterogeneous groups, increased. Work graded that was completed individually did not always increase (Benero, 2000). The researcher did not use adequate statistical analysis to indicate a level of significance in grade increases.

No Significant Difference between Homogeneous and Heterogeneous Groups

The study, *Can Ability Grouping Help Educators Meet Higher Educational Standards?,* was used to present perspectives on homogeneous vs. heterogeneous groupings from the elementary school level. The question presented asks for teacher and administrator positions on the two types of grouping. While not explicitly stated, the abstract and introduction imply that the researcher's hypothesis is that students will benefit more from heterogeneous grouping. Petrello identifies the different types of grouping as a long debated topic in education. While the survey component is good for this type of qualitative research, there could be some bias included in the responses. People who are passionate about grouping are more likely to answer the survey if it was responded to on a volunteer basis. Her conclusions stated that evidence did not support one type of grouping over another with much significance (Petrello, 2008, p. 3).

Another study by Berends and Donaldson (2011) was conducted to compare ability groups between traditional and charter schools. The conclusions of the article simply stated that neither charter school ability groups nor traditional school ability groups had significant effect on student achievement in math. To determine the types of grouping used in traditional and charter school classrooms, surveys were completed in rural, urban, and suburban areas across 24 states. According to the article, "Traditional

public schools were matched to charter schools based upon grade range, racial-ethnic and socioeconomic composition, initial achievement scores, and proximity." Teachers selected their target class, and the study included 16,501 students from 1,071 different classrooms. Although the researchers had little influence on the academic levels of students chosen, the participant group was so large that it seems to negate the opportunity of bias because such a large group is more likely to represent the general population of students. This study is one that indicates that school type does not necessarily influence how ability groups affect student learning (Bereneds & Donaldson, 2011)

Daniel Tully (n.d), a researcher at Notre Dame College Prep, also analyzed ability groups for higher levels of education. The research states the following hypothesis: "Math achievement scores would demonstrate a larger increase in students in high ability groups. Low ability groups would not see significant gains in achievement scores. Math attitudes scores would be lower in students in lower ability groups than those in higher ability groups." This hypothesis was correct based on academic achievement, but it was actually the Honors class that had the lowest self-concept. This study only indicates how ability grouping affects students at diverse achievement levels, but it does not do a thorough job of providing a comparison through heterogeneous groups to truly identify the influencing variable of student attitudes and achievement (Tully n.d.)

Another mixed-method study was conducted by Gess in 2011. During this three year study, 39 eighth grade students and 5 middle school teachers participated. Student achievement was analyzed through ITBS standardized scores. The test scores encompassed their sixth, seventh, and eighth grade years. The variance of the scores was analyzed using the ANOVA. Surveys and interviews were conducted to identify student

and teacher opinions of the various ability groups. Gess states, "A cross-sectional survey and focus group interview…" helped to identify attitudes towards grouping type. Based on the ANOVA, there was no statistical significance between student scores on the IOWA Test of Basic Skills. Because of the Liken scale used on the survey, the researcher identified quantitative data from the results. 100% of the students reported that they felt that ability grouping was important for effective learning. Gess states that there is potential for negative labeling among students when ability groups are implemented and based on statistical analysis, "Overall, findings suggest that all benefits of ability grouping may not be measurable through standardized tests or other academic measures" (Gess, 2011).

In an anonymously published capstone from the University of Maryland (n.d.), the researcher concludes that ability groups and mixed groups should be considered for instruction based on the statistical findings. From evidence in her study, she explains how she will personally implement researched findings into her heterogeneous small groups in the coming years. She recognizes the limitations of the convenience sampling used to study the achievement of her own 36 students in an action research design. Within the limitations section, she also identifies reasons for external influence on student performance. Because of this, her study has strengthened validity and consumers of the research can assess the findings with a clear description how the study could have been influenced one way or another (University, n.d.).

Andrew Kruse (2011) conducted an experimental study to determine which grouping type would be more effective for students. His directional hypothesis stated that students participants who were part of a heterogeneous group would have significantly

increased scores as opposed to students who were in a homogeneous group. In his conclusion, however, he stated that further research would have to be conducted to determine any statistical significance between grouping types (Kruse, 2011).

Alexa Lamm (2012) and fellow researchers developed a study to determine the effect of grouping type. They designed three groups and gave each group a problem to solve. The used the IDEAL Problem Solving Framework to measure how each group went through the steps and determine which of the groups was more successful (Lamm et al., 2012, p. 19). In the concluding section of the article, the researchers determined that there were advantages and drawbacks to each of the types of grouping. The indicated that there should be further research because no significant evidence was given to recommend one grouping type over the other (Lamm et al., 2012, p. 28).

In a 1995 study, Adam Gormaran along with several other researchers conducted a study on ability grouping. They identify reasons why it is utilized in the educational field, but they also recognize that there are certain aspects that hinder its effectiveness. In the abstract, Gormoran states, "Grouping students leads to segregation on nonacademic as well as academic criteria, and differentiated instruction may lead to unequal results for students assigned to different groups" (Gormoran et al., 1995, p. 687). While higher achieving students benefited from the homogeneous grouping because it allowed them to extend, lower achieving students did not have similar results. Their statistical analysis shows that putting students into ability groups consistently divides the student population into minorities and students with low socioeconomic status (Gormoran et al., 1995, p. 700). The impact goes beyond academic performance.

School and Class Organization

Stroud (2002) developed a qualitative study to analyze the decision making process that principals use in regard to the types of grouping procedures that should be used within their school in the East Tennessee region. The conclusion validated that there isn't one preferred grouping method within schools. The researcher found out that the principals tried to observe in other successful school systems and conduct research of their own prior to implementing homogeneous grouping. Many principals want to preserve a heterogeneous atmosphere. However, with pressures of standardized testing, most principals agreed that they did use homogeneous grouping for at least a portion of their day (Stroud, 2002).

Another large scale study by Henry Becker (1987) evaluates the effectiveness of "between-class grouping" and "within-class grouping" through nonexperimental quantitative data collection through a cross-sectional survey. Becker compares approximately 8,000 student test scores gathered from the Pennsylvania Education Quality Assessment (EQA). This involved over 100 different schools who represent varied methods of curricular instruction and a wide range of student backgrounds. Limitations of the study come in the cross-sectional nature because there was no data collection on student achievement prior to the instructional methods being implemented. The students' test scores were, therefore, compared to predicted scores. The study's results stated that within-class grouping was more beneficial for elementary students than between-class grouping, implying that some element of heterogeneity within the elementary classroom is beneficial (Becker, 1987).

Impact for Higher Levels of Education

A quasi-experimental study was conducted by Carol Burris (2006) to determine

the effectiveness of mixed ability groups in a high school setting. The study examines how students who are "tracked," or placed in a program schedule based on ability, excel in classes as opposed to students who are "detracked," or allowed to choose their own courses. The study included participants from varied ethnic, economic, and academic backgrounds. The study showed that detracked minority students were more likely to take advanced level classes, and students with low socioeconomic status were doubly successful in trigonometry classes when they were able to choose their own courses. There was also no evidence of increased dropout with detracking (Burris, 2006, p. 130). This indicates that students who are in mixed groups, even in higher levels of education, are more likely to be successful than those who are placed based on ability.

Davis (2012) conducted a study that analyzed quantitative and qualitative data concerning the achievement and attitudes of students based on pre- and post treatment. The researcher does a detailed job describing student scores and percentages of growth. She avoids bias by including and noting scores that decreased and went against her research hypothesis. She uses several tables to graph data and compare it to national norms to further the depth of her results. In her analysis, she acknowledges that student attitudes and motivation were an influencing factor in the results of the study. The study does lack statistical analysis because it does not include any reference to standard deviation, p values, outliers, etc. It supports ability grouping for higher levels of education although it lacks the statistical analysis needed to show any level of significance (Davis, 2012).

Social Needs of Students

From another perspective, the article *Problems Students Encounter during Math*

Instruction in Mixed-Ability Classrooms (Andrews et al., 1998) uses a qualitative study design to determine fallacies in the heterogeneous grouping strategy used in second and third grade classrooms. The study used surveys and questionnaires as instruments to determine areas of frustration for students participating in these groups. The article asserts that students who are part of an exclusively mixed ability setting do not get the individualized academic attention that they need. This article suggests a combination of whole group instruction paired with mixed cooperative learning groups as well as groups created based on skill levels of students (Andrews et al., 1998). This is intended to provide a balance to simultaneously meet academic and social needs.

Robert Slavin (1988) has many articles in which he examines grouping types and their effects on student learning as well as self-image. He asserts that it is obvious that students cannot effectively learn from the one-size-fits-all academic setting. However, he also discusses the problems that overly homogeneous groupings can cause, especially for students who are on the lower academic end. For this reason, he also concludes that balance is key to achieving differentiated instruction as well as building self-esteem for students who are struggling (Slavin, 1988).

In their book, *Cooperative Learning: The Social and Intellectual Outcomes of Learning in Groups* (2003), Adrian Ashman and Robyn Gillies base their study on cooperative learning, or mixed ability, groups on the theories by John Dewey. They state that the fundamental nature of education requires children to be invested academically and socially in order for learning to take place. Their research again supports that the social aspects of heterogeneous groupings support using them consistently in the classroom. Based on extensive reviews of literature published by other theorists such as

Piaget and Vygotsky, Ashman and Gillies clearly support the use of cooperative learning groups within the classroom for social and psychological purposes (Ashman & Gillies, 2003). There is little discussion of academic support for this claim.

Another article written based on sociological theory is presented by Robyn Zevenbergen (2003) states, "Using theoretical constructs of French sociologist Pierre Bourdieu, I argue that inserting students into particular ability groups creates learning environments that influence how students come to see themselves as learners of mathematics, i.e. the construction of a mathematics identity, which can have implications for future learning" (Zevenberger, 2003, p. 5). This article, while seemingly a bit extreme, makes the point that students from different cultures lack the schema to adequately build a foundation for mathematical learning because of the varying degrees of what is considered important during childhood. This implies that some students are initially equipped to be more successful with mathematical concepts while students who are intelligent in other areas lack the necessary vocabulary and concept for gaining "good" grades. Therefore, the researcher concludes that mixing student groups helps to avoid these stereotypes for learners (Zevenbergen, 2003).

Summary

Based on the articles presented, there is no conclusive evidence that one type of student grouping is more effective than another in terms of academic achievement. Several of these articles indicated ways in which grouping types influence the self-images of students. Confidence, interest, motivation, and self-esteem can be an important aspect of learning. However, when academic achievement is the quality being assessed, there is no significant evidence to promote one grouping type over the other.

Research Methodology

Overview of the Project

This was a quasi-experimental action research study with the teacher acting as the researcher, with the pretest/posttest group comparison design. It took place in an existing classroom of sixteen students that represent various socio-economic backgrounds, academic levels, and cultural influences. The proposed study was approved for a classroom of twenty-five students. However, four students moved, one new student joined the class, and six students or students' parents did not give consent for the study. The researcher used a convenience sampling by using the students within the already established classroom. Students were systematically assigned to either a homogeneous or heterogeneous math small group. The researcher randomly started with the fourteenth student in an alphabetized list. Every sixth student was placed into one of the groups until all students were assigned a grouping type. Because there were twenty five students, the study was intended to have three homogeneous groups and two heterogeneous groups so that each group contained five students. However, because of the change in students, there were two homogeneous and two heterogeneous groups. The researcher purposefully placed students within their category of homogeneous or heterogeneous group. The homogeneous groups were organized into below and above grade level. The heterogeneous groups were mixed to represent students at each academic level.

The study took place over the duration of one math unit spanning a four week period. The pretest was given prior to introducing the new concepts, and the posttest was given at the very end of the unit. Each group met with the teacher for twenty minutes

twice per week for the duration of the study, except for the final week. Because of inclement weather, the groups only met with the teacher once in the last week. This small group instruction was in addition to the twenty minute whole group lessons given to the students. Instructional content was specifically structured based on Common Core Performance Standards for third grade students. Homogeneous groups were given instruction based on their academic level, and heterogeneous groups were given instruction to review previously taught concepts to all students present in the group. Both of the heterogeneous groups will receive the same instruction on the same standard. At the end of the unit, a posttest was given and statistically analyzed in comparison to the pretest.

The unit was focused on the third grade standards for fractions. Students are expected to have understanding of fractions and the ability to compare and determine equivalent fractions. The pretest and posttest assessed these skills along with other review skills such as graphing. After the pretest was given, students began small group meetings. The first meeting for all groups was to review the general definition of a fraction. Students were asked to match a picture of a fraction with the written expression of that same fraction (See Appendix A). All students were successful with this task. The focus then became introducing, guiding, and practicing comparing fractions and finding equivalents. Manipulatives, both physical and online, were used for this instruction. Each group received the same instruction on the same topic and with the same resources to remove the opportunities for extraneous influence on results. However, the pacing of the lessons was differentiated based on the needs of each group. At the end of the four week period, the posttest was given.

Research Question

Is there a difference in achievement between students who receive small group math instruction in a homogeneous and those in a heterogeneous group? If there is any difference, which grouping approach is more effective?

Hypothesis

Based on the review of literature, the most evidence is in support of the null hypothesis. That is, there is no significant difference between heterogeneous grouping and homogeneous grouping in the effect on math achievement of students in third grade. The independent variable is grouping approach (heterogeneous grouping vs. homogeneous grouping), and the dependent variable is math achievement.

Description of Participants

Participants of this study were from a third grade classroom in an elementary school in the North Georgia suburbs. Students were selected through a convenience sampling as they are currently members of the researcher's classroom. The school is comprised of 1,123 students. The demographic makeup is as follows: 21.99% Hispanic, 11.58% Asian, 4.81% Black (Non-Hispanic), 2.58% Multi-Racial, 58.15% White (Non-Hispanic), 47.02% Female, and 52.98% Male. 16.53% of students are being served or monitored through the ESOL/EL program. 31.44% of students are economically disadvantaged meaning they are on the free or reduced lunch plan.12.87% of students are being served in the gifted program, and 152 students receive special education services (Forsyth, 2013).

The participants of this study included 8 females and 8 males (n=16). Two

students are served through the Early Intervention Program (EIP) for Math. One is served through the EIP for Reading. One attends a “Repeated Practice” math intervention for Response to Intervention (RTI). Two have ESOL services, and one student is diagnosed with ADHD. Demographically, two students are Asian, one is Hispanic, eleven are White, and two are Multiracial. Students were selected to homogeneous or heterogeneous groupings through a systematic, convenience sample. Starting with the fourteenth student in an alphabetical list, the researcher randomly selected every sixth student in alphabetical order until each student was placed into one of the two categories. The students were then placed into small groups for instructional purposes that used their instructional levels to group them with students at a like ability level or to mix them with students who were on a different level. In order to determine which students would be placed in the high achieving or low achieving homogeneous group, the researcher considered in class test scores and services provided to the student.

Gender	
Male	8
Female	8

Interventions	
EIP Math	2
EIP Reading	1
RTI Math	1
ESOL	2

Demographics	
Asian	2
Hispanic	1
White	11
Multiracial	2

Heterogeneous	
Male	4
Female	5
Asian	1
Hispanic	1
White	6
Multiracial	1

Homogeneous	
Male	4
Female	3
Asian	1
Hispanic	0
White	6
Multiracial	1

Data Collection

For the study, the researcher gave a pretest and posttest assessment using a math Common Formative Assessment (CFA) that was written by our county board of education. These tests must be given to assess each math unit. CFAs are designed to be used in a pre and posttest situation. Data from these tests can be compared across grade levels and school districts to measure student mastery of "power standards" in Common Core. They are used as evidence to drive further instruction (Ainsworth & Viegut, 2006). Forsyth County Schools realized a need for such assessments in 2011. These are written by teachers in the county and administered in the same way across the district. The types of questioning used (selected response, constructed response, and extended response) are purposeful in their scaffolding of student thinking and based on current standards and expectations. According to Lissa Pijanowski (2011), "Once teachers achieved consensus

on grades for report cards, the need for common assessments became evident. Teachers in the elementary schools have worked to develop common formative and summative assessments aligned to standards." Because these assessments are given county wide, they are our typical tool to determine student progress. In the case of this study, the scores also aided in identifying differences between grouping types. The reliability of the scores should be accurate because students' needs are met through IEPs. For example, the ESOL students will have the pre and posttests read to them. These tests are not timed. The researcher has been trained on how to grade these assessments using rubrics for extended response questions. The researcher also covered student names prior to grading the assessments to avoid any possible bias. The CFA had a selection of multiple choice, short answer, and extended response questions (See Appendix B). It was first administered on January 6, 2014 as a pretest. Students took the test independently. Two students who were part of the ESOL program had their test questions and answers read aloud in a small group setting. The tests are typically scored based on a 1, 2, or 3 to show limited achievement, moderate achievement, and consistent achievement, respectively. For the purpose of this study, they will be graded with a percentage. After four weeks of instruction using homogeneous and heterogeneous grouping, students were given a posttest on February 7, 2014. Although this was five weeks, there were only four instructional weeks as stated in the proposal. One week, the schools were closed for inclement weather. Again, this was graded using a percentage to accurately show student achievement. A t-test was used to determine the statistical significance of score increases based on the students' grouping type.

For the study of student grouping, a quasi-experimental research design was used.

The strength of internal validity was in the researcher's ability to control extraneous influences on student achievement. It was critical that there be consistency with small groups meetings and that a positive environment be created for all learners on the days that they are assessed to avoid things like test anxiety that can influence student scores. This assessment should have stability because of the test and retest design of the experiment. This showed student growth. The experimental variable was the type of group that the students participated in. The control variable was the instrument through which they were measured and consistent support through whole group math.

Data Analysis and Results

Quantitative data of pre and post test scores were collected from the Common Formative Assessment. To compare results of the test, a series of t-tests were used to compare pretest scores, posttest scores, and point increases of homogeneous and heterogeneous groupings. Scores were analyzed with consideration to students who received accommodations (2 ESOL students) and students who receive additional math support through the Early Intervention Program and RTI. T-tests were used to determine the results and significance of student grouping.

Raw data (Table 1) showed that student pretest scores ranged from 29% - 71%. Posttest scores ranged from 61% - 91%. The point increases ranged between 6 and 46. As shown in Graph 1, the average pretest of the heterogeneous group was 52%, and the average pretest score of the homogeneous group was 51%. Both the heterogeneous group and homogeneous group had an average posttest score of 79%. They also both had an average point increase of 27 points. All students increased somewhat from their pretest to posttest indicating that overall instruction improved student understanding of the

concepts. However, the initial data also showed that there was not much of a difference between the learning that took place in direct relation to the type of grouping.

Graph 1: Average results on pretest, posttest, and point increase

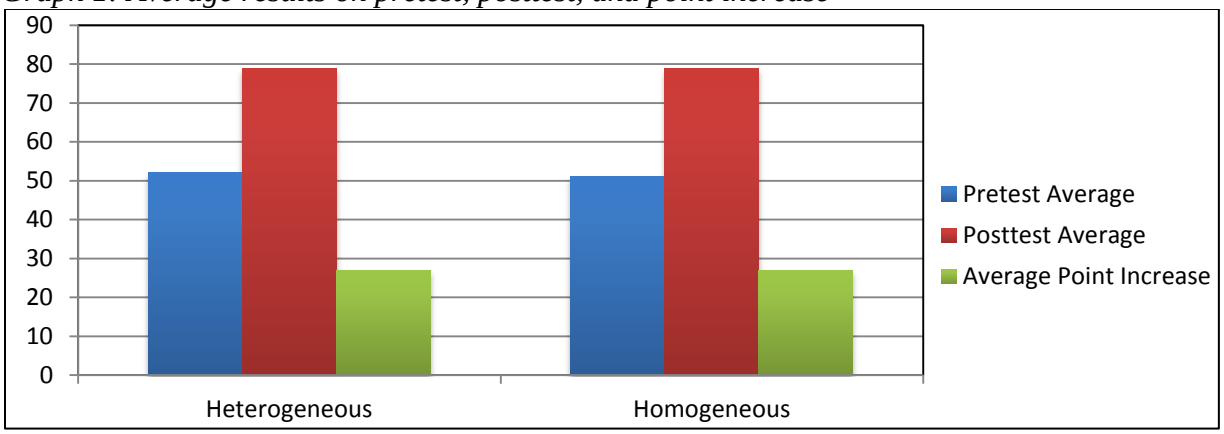

Table 1: Results of pretest, posttest, point increase

Student ID Number	Pretest Score	Posttest Score	Point Increase
Heterogeneous			
23	29%	61%	32
18	43%	79%	36
19	46%	71%	25
2	50%	79%	29
4	50%	96%	46
12	54%	86%	32
22	61%	71%	10
28	64%	89%	25
10	71%	82%	11
Overall Homogeneous Average	**52%**	**79%**	**27**
Homogeneous – Lower Achieving			
15	29%	61%	32
9	46%	52%	6
21	50%	84%	34
Average	42%	66%	24
Homogeneous – Higher Achieving			
3	54%	86%	32

7	54%	88%	34
6	57%	91%	34
14	70%	89%	19
Average	59%	89%	30
Overall Heterogeneous Average	**51%**	**79%**	**27**

Because the two homogeneous groups were divided into a higher achieving group and lower achieving group, a t-test was conducted to see if there was a significant difference between the point gain from pretest to posttest between the two homogeneous groups (Table 2). The point gain was analyzed rather than the posttest scores because, as is typical for these students, the lower group had lower overall posttest scores and the higher group had higher overall posttest scores. It was important to analyze how much the students increased over time to provide a fair comparison of the groups. The t-test indicated that there was not a statistically significant difference between the higher achieving and lower achieving groups. Although the raw data shows that the higher group did increase six points more on average, the statistical analysis still considers them to similar in their amount of increase. For this reason, the homogeneous groups were combined for the remainder of the t-tests performed to compare the homogeneous groups with the heterogeneous groups.

Table 2: Results of t-test comparing high achieving and low achieving homogeneous group

Homogeneous Groups	Lower Achieving	Higher Achieving
Number of Participants	3	4
Mean	24	30
Standard Deviation	15.62	7.23
T-Test Results: 0.66, df = 5, P(0.54) > .05		
Effect Size: 0.28		

A t-test was completed on pretest scores (Table 3). The heterogeneous group (N=9) and the homogeneous group (N=7) had comparable means and standard deviations. According to the t-test and effect size, there was not a statistically significant difference between the heterogeneous group and homogeneous group prior to the small group instruction. This indicates that the groups were reasonably balanced between high achieving students and those who typically struggle with mathematical concepts. Since the groups were so similar, this should have clearly shown any impact that the grouping types had on student learning.

Table 3: Results of t-test comparing pretest scores

	Heterogeneous	Homogeneous
Number of Participants	9	7
Mean	52.1%	51.4%
Standard Deviation	12.45	12.41
T-Test Results: 0.11, df = 14, P(0.91) > .05		
Effect Size: 0.03		

A second t-test was completed to determine the significance of posttest scores. Again, the heterogeneous group (N=9) and the homogeneous group (N=7) had similar means. Although there was a larger difference in the standard deviation found on this t-

test, the results showed that there was no statistical significance between the posttests of the two grouping types. These results were supported by the small effect size. These results point to a lack of significant impact between the heterogeneous and homogeneous groups.

Table 4: Results of t-test comparing postest scores

	Heterogeneous	**Homogeneous**
Number of Participants	9	7
Mean	79.3%	78.7%
Standard Deviation	10.59	15.55
T-Test Results: 0.09, df = 14, P(0.93) > .05		
Effect Size: 0.03		

The fourth t-test compared the point increases from pretest to posttest in the heterogeneous group (N=9) and homogeneous group (N=7). The average point increase was exactly the same in this case, and the difference in standard deviation was minimal. The results of the t-test again showed that there was no statistical difference in the point increase between the two groups. This was also supported by a very low effect size. This indicated that students who participated in either group increased at approximately the same rate of understanding the tested mathematical content.

Table 5: Results of t-test comparing point increases

	Heterogeneous	**Homogeneous**
Number of Participants	9	7
Mean	27.3	27.3
Standard Deviation	11.45	10.81
T-Test Results: 0.01, df = 14, P(0.99) > .05		
Effect Size: 0.01		

Based on the results of the performed t-tests and supporting effect sizes, the null hypothesis can be accepted. There was no statistical difference in gain between the homogeneous group and heterogeneous group. Data showed that both groups started with similar average scores which enabled comparisons to be made more accurately. Because there was not a significant difference in point gain between groups, it can be concluded that grouping type does not positively or negatively impact student learning.

Discussion and Conclusion

This research study took place over a span of four weeks in a third grade classroom. The research question was: Is there a difference in achievement between students who receive small group math instruction in a homogeneous and those in a heterogeneous group? If there is any difference, which grouping approach is more effective? The purpose of this study was to accept or reject the null hypothesis that there would be no statistically significant difference between the two groups. This hypothesis was made based on extensive study of previously published literature which indicated various or inconclusive results in previous studies focused on a similar research question. The participants included 16 students (8 male, 8 female) in a self-contained third grade classroom in a Georgia public school. Student demographics represented a range of ethnic and socioeconomic diversity.

Students took a pretest at the beginning of the math unit. They then received four weeks of small group instruction based on their random assignment to a heterogeneous or homogeneous group. These groups met twice a week for twenty minutes each. At the end of the four week unit, students were given an identical posttest to assess their growth with mathematical concepts. Statistical analysis was performed to determine the significance

of the results. The analysis showed that there was no statistical difference between the two grouping types which confirmed the null hypothesis and in accordance with other published studies on the topic. The reviewed literature often concluded with similar results where neither the homogeneous nor heterogeneous group increased student scores significantly. This study also has the same results.

In looking at the raw data, it is possible to compare how different student groups (lower achieving, average achieving, and higher achieving) performed on the posttest by looking at the point gain of which students participated in the heterogeneous group versus the homogeneous group. Overall, the students had a fairly consistent point gain. However, there were some minor differences. For lower achieving students, the point gain was slightly higher for students who participated in the heterogeneous group. For higher achieving students, the point gain was slightly higher for the homogeneous group. The average achieving group had similar point gains to all other groups, although one student in particular increased his test score by 46 points. This may indicate that struggling students are more successful when they are able to learn from their peers and that students who excel with grade level standards perform even better when given extension opportunities and independence in their learning. However, further research would have to be conducted to validate such conclusions.

Implications for Educators

As a teacher, it is always important to look at data and adjust methods according to what is supported by research. Based on the results of this study, the grouping type used by educators will most likely not positively or negatively impact student scores on math assessments. However, teachers will also want to consider student attitudes towards

grouping and how that impacts learning. While this study did not analyze students' emotional responses to the grouping types, research indicates that lower achieving students are often sensitive to being constantly grouped with other struggling students. This factor must be considered when teachers determine which grouping type to use. It seems that if there is no statistical difference between the scores of the two groups, then it would be beneficial to students to be grouped heterogeneously to support student self-esteem and encourage cooperative learning with a diverse group of students. This type of grouping enables higher achieving students to take on the responsibility and challenge of understanding content well enough to explain it to a student who is struggling. This type of grouping also fosters growth in social skills of students from various backgrounds and academic levels. Allowing students to work together in this type of mixed peer setting could potentially create a more positive learning environment for some students. While there is no academic difference between the heterogeneous and homogeneous grouping type in the third grade math classroom, heterogeneous grouping may be an effective way to avoid students stereotyping one another or developing negative attitudes toward themselves as learners.

Limitations of the Study

Because of the small number of participants and the convenience sample, there were several extraneous factors that could have influenced the results of this study. The students participating in this action research study had to continue receiving interventions as needed. The researcher was as consistent as possible in providing small group instruction specific to the group type throughout the experiment. The small group instruction was planned and purposeful. Any missed meetings due to an irregularity in

schedule, in this case inclement weather, were documented and accounted for. All students met in small group an equal number of times. The researcher also removed the opportunity for bias in grading by covering student names. This helped to avoid teacher bias that could have influenced subjective grading opportunities. However, the researcher had no control over factors such as RTI Intervention instruction, EIP instruction, or home support. These factors along with the small sample size must be taken into consideration when discussing the implications of the results in the experiment. For this reason, statistical analysis was used to appropriately determine the significance of the results. The study also only took place over the duration of four weeks. If the study had a longer duration, it is possible that the results might show a more significant difference between the two grouping types. Ideally, this study would have been conducted over a longer span of time and with a much larger sample size. Increasing both of these elements would provide stronger validity for the study.

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