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Implications for Ability Grouping in Mathematics for Fifth Grade Students

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Implications for Ability Grouping in Mathematics for Fifth Grade Students

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ABSTRACT

This study examines the effects of ability grouping on fifth grade students at 47 elementary schools in a large urban school district. Using disaggregated standardized test data that statistically measures achievement growth, this study analyzes gains among students assigned to prior achievement quintiles as compared to three grouping strategies: homogeneous, heterogeneous with special classes for advanced and special education, and heterogeneous ability groups.

The findings suggest that the grouping strategies used in these schools are effective for the students at these schools. Most significant is that, on average, low achieving schools are grouping students in ways that are exhibiting positive gains among low achievers. Conversely, schools with large populations of high achievers are grouping in ways that are making gains among high achievers. Average students show similar gains among all three grouping strategies. Overall, the research and data suggest the importance of using multiple data sources, knowledge of students and school culture, as well as pedagogy to determine appropriate grouping strategies for particular schools.

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CHAPTER I
INTRODUCTION

Each year, teachers and educational leaders in elementary schools face decisions about grouping students for instruction. These decisions influence class composition, staffing, materials allocation, and student learning. The question that is most often considered when grouping for mathematics instruction is how to arrange student classes and groups for maximum student achievement and growth. In some cases, these decisions are made with great deliberation and consideration; however, they are often made in order to maintain status quo and to keep traditional practices in place.

Historically, the practice of grouping students by ability has been controversial. The practice tends to separate students by race or class and has raised many questions about equity and discrimination. According to recent NAEP data, the practice of using ability groups in the 4^{th} grade has increased dramatically in the past decade. According to the 2013 Brown Center Report on American Education, the increase can be attributed to the high stakes accountability measures put in place by the No Child Left Behind Act. Teachers are considering the need for remediation and direct support for less proficient students as justification for separating students by ability.

This paper discusses the implications of a variety of grouping practices for mathematics instruction. I discuss nearly 50 years worth of research on the topic in terms of equity, achievement effects, and pedagogy. I compare the findings to current achievement and achievement growth data from a large urban public school system in the Southeastern United States. The data compares disaggregated achievement test scores for fifth graders and their gains to the grouping strategies of 47 elementary schools. Included in the study are the results of a teacher attitudes survey that analyzes how teachers perceive their current grouping practices.

The findings of this research provide insight to educators seeking effective ways to group elementary students for mathematics instruction. It is evident here that the data reveals a need to investigate instructional practices that complement ability grouping practices. The data here does not identify the root causes of achievement growth. We may not always be able to determine if the grouping strategy is the cause of the growth; however, when patterns emerge among the schools that choose certain strategies for grouping, we can imply that the strategy plays a role in serving the academic needs of the students.

CHAPTER II
LITERATURE REVIEW

Literature Review

In reviewing the literature about ability grouping for mathematics instruction, four recurring themes emerge. First, the practice of sorting students raises questions about equity and providing *all* students with rigorous instruction and high expectations. Second, grouping practices are defined in many ways and terms are often used synonymously. Researchers conclude that grouping practices have effects on student achievement, academic growth, and self-concept. However, nearly all studies making claims about student achievement discuss the impact of classroom instruction and professional development. When educators collaborate to determine the ways in which to group, sort, and schedule students, we must also stay vigilant about gaps in achievement between all levels of students. Ultimately it is the mission of each teacher to provide all students with effective instruction in a positive environment that is most conducive to learning.

According to the National Council of Teachers of Mathematics' Principles and Standards for School Mathematics, "excellence in mathematics education requires equity-high expectations and strong support for all students" (NCTM, 2000, p.12). The Equity Principle states that students need access to a coherent, rigorous curriculum that is taught by well-supported teachers. Because students enter school with a variety of background knowledge, they are often assigned to different levels of classes. Classes can vary in demographic composition, rigor, and quality of instruction. In elementary schools, this is most common in math classes. Teachers believe that students at different ability levels need different types of instruction, therefore, teachers group. The Equity Principle encourages schools to consider instructional programs in mathematics in terms of expectations, accommodations, resources, and support for *all* classrooms and *all* students (emphasis mine).

Low achieving students (those without learning disabilities) placed in low-level math classes typically do worse than students who are not grouped. (Fuligni, Eccles, and Barber, 1995) Oakes (2000) found that ability grouped classes receive different types of instruction with different content and that the classroom environments were different. Often, in low-level classes, the expectations are lower and the environment is more focused on discipline and behavior. However, when students are placed into classes beyond their ability level, achievement increases significantly (Fuligni, Eccles, and Barber, 1995). Students respond to high teacher expectations and to the challenges that more demanding lessons provide. In high-level classes, students receive more encouragement and are less focused on discipline. Oakes (2000) also concludes that the practice of grouping students by ability reinforces the attitude that low-achieving students cannot learn as much and are expected to do less. This type of expectation keeps the students with the greatest academic need from getting the highest levels of instruction in their classrooms. It seems likely that students gain from the instruction that is typically received in higher-level classes. Therefore, placement in an ability-grouped class at a young age can "act as a sorting event that sets youths on different developmental trajectories" (Fuligni, Eccles, and Barber, 1995, p. 87).

Burris and Welner (2005) support the positive effects of heterogeneous grouping in their case study of a Long Island school district's de-tracking program. The Rockville Centre School district was concerned that their current practices of student tracking were increasing the achievement gap. Limiting the high-quality curriculum to the high classes was leading to a disproportionately high representation of minorities and students with low socioeconomic status in the lower level classes. The district implemented a consistent, rigorous curriculum and set high expectations for all students. The "tone, activities, and discussions in the heterogeneously grouped classes were academic, focused, and enriched," creating what the authors call a close in the curriculum gap (Burris and Welner, 2005, p. 597-8).

With nearly a century of research on ability grouping, there are several discrepancies in the way grouping practices are defined (See Table 1). The literature reviewed often defines tracking and ability grouping synonymously (Oakes, 1986, Slavin, 1987, Fuligni, 1995, Betts & Shkolnik, 2000, Hanushek, 2003, Hill, 2004, Burris, 2005, Delmore, 2005, Archbald, 2009, Vogel, 2012, Collins & Gan, 2013). Tracking places students in homogeneous achievement level classes for the entire school day. Tracking most often refers to a fixed course of study where students are in self-contained classes labeled as average, above average, or below average. Tracking leads to a violation in equity for students and increases gaps in student achievement among subgroups (Archbald, et. al., 2009). In 1964, Title IV of the Civil Rights Act required schools to provide opportunities for students to move between classes based on academic progress and the practice of tracking nearly ceased (Chiu, et. al., 2008). In modern, post-Civil Rights Act schools, tracking is loosely used to define homogeneous ability grouped

Table 1. Definitions of Grouping

Term	Definition	Reference
Tracking	Students are grouped between classes by subject with differing curriculum based on intelligence or prior achievement. Historically, students are set on curricular paths such as vocational, academic, and general (honors, on-level, advanced).	Chiu, et. al. (2008), Loveless (2013)
Tracking/Ability Grouping	Sorting students and assigning classes based on achievement. Classes may be sorted by specific academic subjects, usually math and reading. Students' abilities match the difficulty of the curriculum. Instruction is tailored to the needs of the group.	Oakes (1986), Slavin (1987), Fuligni (1995), Betts & Shkolnik (2000), Hanushek (2003), Hill (2004), Burris (2005), Delmore (2005), Archbald (2009), Vogel (2012), Collins & Gan (2013)
Ability Grouping	Ability grouping can be within class or across one or more academic subjects.	Slavin (1987), Gamoran (1987), Burns & Mason (1998), Loveless (2013)
	This includes special classes for high or low achievers while other students are heterogeneously grouped.	Slavin (1987), Delmore (2005)
Within Class Grouping	Teachers assign students to small groups within heterogeneously grouped classes based on performance level.	Slavin (1987)
Other	Non-graded plans where students are placed based on performance level, not age or grade.	Slavin (1987), Lou, et. al. (1996)
	Standards-based groups that are flexible and differentiated based on mastery of specific skills.	Slavin (1987) Vogel (2012)

courses (Archbald, et. al., 2009, Chiu, et. al., 2008, Delmore, 2005). Sometimes, because of class scheduling in schools, students that are ability grouped for one or two academic subjects end up grouped together for all academic classes because of logistics in scheduling.

In ability grouping, students are also grouped by achievement levels but may be grouped only for math or reading or only within their heterogeneously grouped classroom. The practice of changing classes for only one or two subjects is most often referred to as ability grouping, but also sorting (Collins and Gan, 2013, Gamoran, 1987). In this situation, student groups are not static throughout the day; however, due to scheduling, students that are ability grouped across heterogeneously grouped classes for more than one subject can end up being tracked. These practices of "merit-based selection" use academic criteria to place students in a prescribed course that does not always play out consistently in terms of race and socio-economic status (Archbald, Glutting, & Qian, 2009). Ability grouping is also used when describing special classes for gifted and special education students while the other students are grouped heterogeneously (Slavin,1987, Delmore, 2005). Burns and Mason (1998) suggest that ability grouping may inadvertently create unequal learning opportunities for students. Even at the elementary level, this practice may give some students opportunities for more effective teachers, class composition, and instruction; thus giving a better chance at higher achievement.

According to Robert Slavin (1987) tracking has few advantages for students. His study found that students who are ability grouped within their heterogeneously grouped class perform best. When students are flexibly grouped based on specific skills, the lowest achievers experience the greatest gains (Slavin, 1987). Small group instruction combined with extra time for struggling students is an effective way to increase student achievement (Battelle for Kids, 2013). These effects are even greater when combined with differentiated instruction and materials in groups of 3-4 students. These effects were greatest in math and science (Lou, Abrami, et. al., 1996). Collins and Gan (2013) argue the merits of ability grouping claiming that teachers are better able to tailor instruction to the specific academic needs of the students in their homogeneously grouped class. However, even students in homogeneously grouped classes need adaptations (Lou, Abrami, et. al., 1996). Because of the discrepancies in the way tracking is defined, it is difficult for researchers to compare strategies across schools (Betts and Shkolnik, 2000). Collins and Gan (2013) developed a unique formula that used students' previous achievement score and correlated it with their current class and it's grouping practice. In their study of 9,325 students in 135 Texas schools, they found that homogenous ability groups benefitted all students, including special education and gifted students (Collins and Gan, 2013).

Hanushek, Kain, et.al (2003) followed a cohort of Texas elementary students from grades 3-6. Their data included characteristics such as race, gender, and free or reduced price lunch status in order to find peer effects on achievement growth. Typically, achievement is affected by socioeconomic status and the average achievement of peers; however, in this study, there was no evidence that variations in peer achievement groups (changing the heterogeneity of students) affected achievement growth (Hanushek, Kain, et.al, 2003). They found that in classes where students were grouped heterogeneously, socioeconomic status and achievement levels did not affect achievement growth. They found that there are benefits to achievement when special programs, like tutoring and enrichment are provided, but that the academic growth of an average student is rarely affected by class composition.

In addition to the effects of grouping on achievement, grouping also affects students socially and emotionally. Chiu, Beru, et. al. (2008) found that students compared themselves more often to other students within their track than across tracks. This comparison affected the students' self-concept, but not always their overall self-esteem. More influential are teacher attitudes and expectations as well as interactions with peers, and positive or negative labels assigned to groups (Lou, Abrami, et. al., 1996, Chiu, et. al., 2008). Grading practices also have an impact on students' self-concept (Chiu, et. al., 2008). If students' do not feel adequate in their ability to achieve, then their grades will be affected. Conversely, when students consistently receive poor grades, their self-concept is diminished (Chiu, et. al., 2008). Therefore, when examining the grading practices of teachers across multiple tracks, it is important that teachers consider the types of feedback they give students. When expectations are high and feedback is specific and academic, students have a better chance of making academic progress (Battelle for Kids, 2013).

Given the implications of ability grouping on student achievement and student attitudes, we must consider what happens in the classroom when making conclusions about grouping (Gamoran, 1987). The role of the teacher and the classroom environment is rarely controlled in the research about grouping practices (Betts and Shkolnik, 2000). To gain a full understanding of the effects of grouping practices, we must address how grouping is used to provide quality instruction and how the grouping structures result in changes in instructional behaviors that lead to greater student achievement (Slavin, 1987, Gamoran, 1987). Slavin's recommendations in 1987 were consistent with the literature reviewed in that teachers must have clear, educational benefits for their grouping practice and that all grouping decisions need reliable evidence. Nearly 30 years later, Battelle for Kids (2013) and the Ohio SOAR collaborative make five recommendations for promoting student growth that are similarly consistent with the literature reviewed. Their recommendations for a narrow focus and collaborative commitment to effective instructional practices are comparable to the suggestions for flexible small groups that are differentiated for struggling and advanced students. Also, using a variety of data as evidence for learning and to guide instruction is found in Slavin's 1987 research. In order to bring effective practices into schools, there needs to be a consistent emphasis on teacher buy-in and empowerment (Battelle for Kids, 2013, Hill, 2004, Slavin, 1987).

Ensuring students are getting consistent, rigorous instruction is crucial to increasing student achievement. Providing students with rich opportunities for learning often requires no additional funding (Hill, 2004, Battelle for Kids, 2013). What is necessary is that all stakeholders share a clear vision and mission (Battelle for Kids, 2013, Delmore, 2005, Vogel, 2012). It is important to consider teacher beliefs and behaviors when analyzing grouping strategies that will maximize student achievement (Battelle for Kids, 2013, Vogel, 2012). In order to affect change, teachers need to feel empowered and valued.

In addition to strategic student supports, teachers need purposeful professional development to support students at all levels when de-tracking. Specifically, teacher professional development should address differentiation, creating common, standards-based assessments and rubrics, using formative instructional practices, and using multiple data measures to assess student learning (Delmore, 2005, Battelle for Kids, 2013, Vogel, 2012). Professional development also plays a key role in making sure all students have access to rigorous instruction (Battelle for Kids, 2013, Delmore, 2005). Making sure teachers are able to teach the standards through problem solving and hands-on, integrated, activities, with real-world problems takes a focused and collaborative effort (Battelle for Kids, 2013). Teachers must also use a variety of assessments to guide instruction, and work under the guiding assumption that each student learns differently and has potential (Hill, 2004). It is the responsibility of the teacher to select meaningful tasks that are relevant and accessible to the students. Finally, and most importantly, teachers must hold high expectations (Meuller and Maher, 2010).

Patrick Delmore (2005) describes a "math makeover" that took place at Georgia O'Keefe Middle School in Madison, WI. This was a de-tracking effort that incorporated a common, challenging curriculum for all students that included differentiation and co-teaching for special education students. Professional development was the cornerstone of this initiative and the curriculum was a constructivist, student-centered approach. This systematic method along with a strong commitment from parents, teachers, and support staff resulted in greater achievement at Georgia O'Keefe Middle School than those of schools with similar demographics.

Using cooperative groups is an alternative to ability groups that has proven effective (Lou, Abrami, et. al., 1996, Mueller and Maher, 2010, Slavin, 1987). It is important that students in cooperative groups have opportunities to solve open-ended problems independently while also being encouraged to work together (Hill, 2004, Lou, Abrami, et. al., 1996, Mueller and Maher, 2010). Teachers need to differentiate and allow students opportunities to present multiple perspectives and solutions. Students must develop an appreciation for the ideas presented by their peers and be comfortable evaluating the reasonableness of their arguments. Teachers must believe that every student has, “the desire to socialize, and to be with friends, the desire to communicate, the desire to move and be involved, and the desire to investigate” (Hill, 2004, p. 132). Teachers are to facilitate the learning process and must refrain from judging in order to create an environment free from the anxiety of being wrong. Teachers and students must value multiple opinions and solutions. Developing a culture of confidence and of equity is the responsibility of each teacher, no matter the academic abilities of the students.

The idea of using high stakes testing to sort students by ability level is one of the most talked about subjects in math education. Unfortunately, students tracked into the lowest level classes are often the minority students or less affluent students. These are also the students that enter school at a disadvantage. They have not always received the same kinds of life skills from their families as children from more affluent communities. They come to school as young children already behind their affluent peers academically. This creates a gap that is sometimes perpetuated by poor instructional practices and stereotypes. Ability groups are helpful in theory; however, because of scheduling, these students are typically tracked into low-level classes across all disciplines. These are sometimes the students with the greatest needs academically and behaviorally. As a group, the dynamics are often difficult for teachers to manage. This results in a lot of time and attention given to discipline and classroom management. It makes it very hard for teachers to create positive learning environments when remedial, often rote, procedures are valued. In some cases the “low class” is passed each year from teacher to teacher as if it is something to endure and the instruction can be vastly different from the advanced class. These students deserve the same experiences and expectations of those in higher-level classes. It is important that teachers identify and address academic deficits while ensuring the students are receiving high-quality and rigorous instruction. Students deserve opportunities that foster positive learning environments. Despite family background, prior knowledge, IQ, or achievement level, all students are curious. All students crave engaging learning experiences. Teachers need to give all students equal opportunities with the curriculum and instruction, believe in the potential of every student, and make few assumptions about their ability. Effective classroom practices that are designed to provide all students the opportunity to achieve the goals of a coherent and rigorous curriculum have the greatest impact on students. When making decisions about student grouping, educators must consider whether the students will have equal opportunities for this type of instruction. School leaders must ensure that the teachers are prepared and eager to provide it.

CHAPTER III
METHODS

For this study, I chose to examine the results of the 2012 Tennessee Comprehensive Assessment Program (TCAP) data for 47 elementary schools in one urban school district with regards to ability grouping. Each school was placed into one of three categories to define the specific grouping strategy of their 5th grade classes: heterogeneous, heterogeneous with special classes for advanced and special education, and homogeneous. In addition to the quantitative achievement test data, I also collected data about 31 (representing 17 of the elementary schools) 5th grade teachers' attitudes towards grouping.

In 2012, the district served 87 schools representing 55,160 students and 3,373 teachers in grades pre-K through 12. The students in the district are 77.7% White, 14.6% African American, 5.4% Hispanic, 2.2% Asian, and 0.2% Native American/Alaskan. Of the students in the district, 3.5% are limited English proficient, 12.9% are students with disabilities, 47.3% are economically disadvantaged, and 26.5% are served by Title I schools.

The TCAP test is given in late April to all students in grades 3-8. The data is reported in terms of achievement and growth. Achievement data is a one-time indicator of how well students mastered objectives on a criterion-referenced test. Achievement is reported by percent of students who score proficient or advanced on the TCAP test. These cut scores are determined at the state level. Growth, or value-added, data uses change in NCE scores to tell us how much progress a student made from year to year. Value-added is reported by the Tennessee Value-Added Assessment System (TVAAS) using a statistical analysis of achievement data. The TVAAS methodology follows individual students over time using individual student longitudinal data (tn.gov/education/assessment/doc/TVAAS_Fact_Sheet.pdf, 2013). It is important to analyze both achievement and growth in order to get a complete picture of student learning.

For this study, I examined the percentage of students scoring proficient and advanced in the 5th grade at each elementary school. I looked for patterns in the percent of proficient and advanced students as they relate to the three grouping strategies. Since ability grouping in this district is more common in 5th grade than in other grades, I also compared the percent of students proficient and advanced in 5th grade to the percentage of students in the school overall (grades 3-5). This gives a rough estimate of the impact grouping has on achievement levels. I also looked at the average size of each school to look for patterns in grouping as compared to the size and achievement levels of the school. I defined high-achieving schools as those with percents of 5th grade students scoring proficient or advanced above 50%.

Because the TCAP test is highly correlated to curricular objectives, has enough stretch to measure growth in both high and low achieving students, and meets appropriate standards of test reliability, Tennessee's value-added metric can appropriately disaggregate data for all students (battelleforkids.org/tennessee, 2013). The TVAAS reports include a school diagnostic report that assigns students to one of five prior achievement quintiles. This assignment is determined by averaging each student's current and previous years' score then placing them, based on their average, along the state distribution. The gain is then expressed in normal curve equivalents (NCE). For example, students in the lowest quintile (1) have average scores that fell in the bottom 20% of students across the state. Conversely, students placed in the highest quintile (5) have average scores that fell in the highest 20% of students across the state.

Once the quintiles are determined, a progress measure is calculated by determining the difference in average NCE scores from one year to the next (4^{th} to 5^{th} grade). These gains are depicted on a bar graph that compares the students' growth to the growth standard (the amount of progress needed to maintain their prior achievement). Included on the graph is a measure of standard error that is determined by the size and consistency of the group. These reports provide progress measures that are designed for educators to find patterns in growth among students at different achievement levels.

For this study, I looked at each school's TVAAS school diagnostic report. If the average NCE gains of students in a prior achievement quintile were above the growth standard (including the standard error), I counted it as a gain for that school. When the lower extreme of the standard error is positive, I considered that a more significant gain than if the standard error fell below the growth standard. I also looked at the average percent of students per school for each quintile to determine the magnitude of growth in each quintile. I was also looking for patterns in the distribution of students at each quintile. For example, the higher percentage of students with positive growth represents a more significant gain. In addition, I looked for quintiles where positive growth represented the majority of the students at that school. The larger the population represented by the group, the greater the magnitude of the gain. Again, these scores were sorted by the three grouping strategies.

In order to collect data about 5th grade teachers' attitudes towards grouping, I administered an electronic survey. After obtaining written informed consent from the principal, I emailed the survey to 5th grade teachers at that school. By completing the survey, teachers gave consent to participate in the study. The survey consisted of four questions including the name of their school, their years of experience at that school, their grouping strategy across the grade level, and in their classroom. In addition, 18 statements about grouping were rated using a Likert scale, ranging from strongly agree to strongly disagree, including a neutral choice (See Appendix 1).

CHAPTER IV
RESULTS AND DISCUSSION

School Characteristics

Out of 47 elementary schools examined in this study, 20 schools grouped heterogeneously, 8 schools grouped heterogeneously with special classes for advanced and special education students, and 19 schools grouped homogeneously. On average, the schools that grouped students heterogeneously were smaller schools, with average numbers of 5th grade students at 68, whereas homogeneously grouped schools and those with special classes for advanced and special education were larger, with averages near 113 students per school (see Table 2).

When comparing 5th grade achievement scores to those of the school overall, all three grouping strategies had percentages of students scoring proficient or advanced in 5th grade significantly higher (70% or greater) than those of the school overall (See Table 2). When comparing average NCE gains of the 5th grade classes to the school overall, the gains among 5th graders are significantly below those of the school overall. Thirty-eight percent of schools that heterogeneously grouped students with special classes for advanced and special education had gains in 5th grade greater than those of the school overall. Eleven percent of schools that grouped homogeneously had greater gains in 5th grade and 20% of schools that grouped heterogeneously had greater gains in 5th grade. The percent of students scoring proficient and advanced in the 5th grade was greater than the school overall in 89% of the schools that grouped homogeneously, in 88% of the schools that grouped heterogeneously except for advanced and special education, and in 70% of schools that grouped heterogeneously.

Table 2. 2012 TCAP Data

	Heterogeneous (20 schools)	Heterogeneous with special classes for Advanced and Special Education (8 schools)	Homogeneous (19 schools)
Percent of schools where the average NCE Gain in 5th grade is greater than the average NCE gain for the school	20%	38%	11%
Percent of schools where the percent of students scoring proficient or advanced is greater than that of the school	70%	88%	89%
Average number of 5th grade students per school	68	114	112

In schools considered high achieving (Greater than 50% of the 5th graders scored Proficient or Advanced), 52% of those schools grouped homogeneously while 22% grouped heterogeneously with special classes for advanced and special education, and 26% grouped heterogeneously (See Table 3). In contrast, 58% of the low achieving schools (less than 50% of the 5th grade students scored proficient or advanced) grouped heterogeneously. Twenty-nine percent of those schools grouped homogeneously and 13% grouped heterogeneously with special classes for advanced and special education (See Table 4).

Table 3. Percent of High Achieving Schools by Grouping Strategy

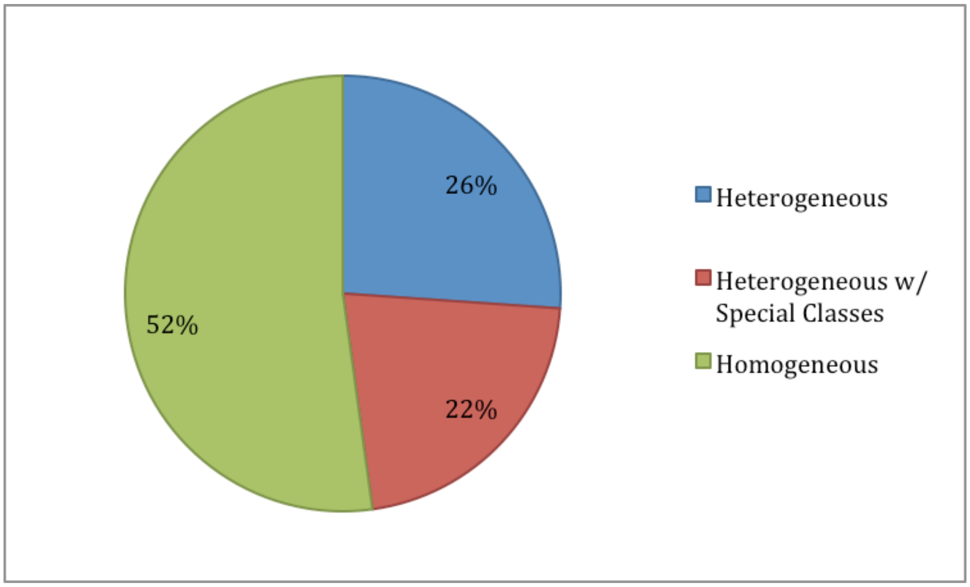
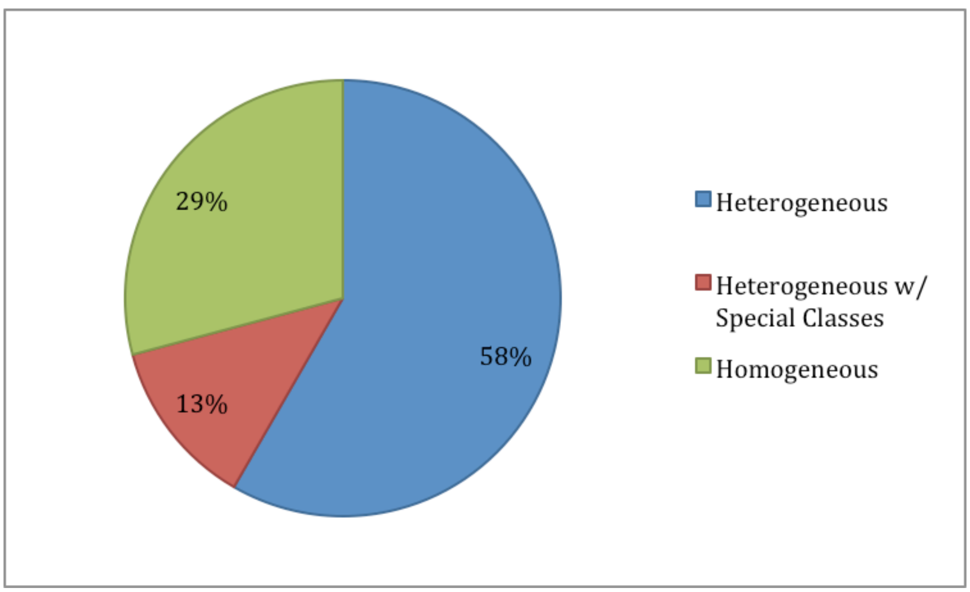


Table 4. Percent of Low Achieving Schools by Grouping Strategy



Student Growth by Achievement Quintile

Student gains in prior achievement are separated into 5 quintiles, with 1 representing the lowest achievers and 5 representing the highest achievers. Schools analyze patterns in quintile gains to determine areas of strength and weaknesses among certain populations of students. Gains among heterogeneously grouped students were greatest among students in the lowest two quintiles. Forty percent of these 20 schools had gains greater than the growth standard, including the standard error in both quintiles 1 and 2. The average distribution of students in each quintile at each school was relatively consistent with the highest average (22.6%) in the 5th quintile (See Table 5). Twenty-five percent of schools that grouped heterogeneously had the highest percent of their students with positive gains placed in quintile 1. Those five schools had positive growth with the greatest majority of their students. Keep in mind that these schools that group heterogeneously, on average, have smaller student populations.

Gains in schools where students are grouped heterogeneously except for advanced and special education students are highest among students in quintiles 2-4. Half of the schools had positive gains with these students. The highest concentration of students within these schools is in the 5th quintile with an average of 31.8% of the students in each school represented by this subgroup. When gains represent the majority of the students in a school, the distribution of those gains was consistent at 13% of the schools in every quintile except for quintile 3. None of the gains in quintile 3 represented the majority of any school's students.

When students were grouped homogeneously, positive gains were evident among 42% of the schools in the first, third and fourth quintiles. For homogeneously grouped

Table 5. 2012 Average NCE Gains per Prior Achievement Group

Prior Achievement Group		Quintile 1 (Lowest)	Quintile 2	Quintile 3 (Middle)	Quintile 4	Quintile 5 (Highest)
	Grouping Strategy	Percent of Schools				
Positive Gains (Gains, including standard error are greater than growth standard.)	Heterogeneous (20 Schools)	40	40	30	15	5
	Heterogeneous Except for Advanced and Special Education (8 schools)	25	50	50	50	38
	Homogeneous (19 schools)	42	16	42	42	21
Average percent of students at each school	Heterogeneous (20 Schools)	20.4	20.0	18.0	19.0	22.6
	Heterogeneous Except for Advanced and Special Education (8 schools)	15.2	15.2	17.0	20.7	31.8
	Homogeneous (19 schools)	11.4	15.6	17.1	24.6	31.2
Schools where quintile represents the majority of students at that school and those gains were positive	Heterogeneous (20 Schools)	25	15	0	10	5
	Heterogeneous Except for Advanced and Special Education (8 schools)	13	13	0	13	13
	Homogeneous (19 schools)	5	0	5	5	11

schools, the 5^{th} quintile had the highest average number of student per school representing approximately 31.2% of the students at each school. This means that, on average, the larger schools here grouped homogeneously. In 11% of these schools, the 5^{th} quintile was the largest quintile with positive gains at those schools. Therefore, the majority of students at the school are making positive gains.

Table 5 shows that the percentage of schools with positive gains among students in the middle quintile (quintile 3) is relatively high (30%, 50%, and 42%), the highest percentage being with schools that have heterogeneously grouped students except for advanced and special education. Students at the higher end of average (quintile 4) had a higher percentage of positive gains in homogeneously grouped schools (42%). Whereas there is an inverse relationship for heterogeneously grouped schools. Forty percent of the schools that grouped heterogeneously had positive gains in quintile 2.

When analyzing achievement gains, it appears that, for these schools, heterogeneous grouping strategies are effective with the lowest two quintiles of students. If the majority of these schools are not high-achieving schools, then the grouping strategy of these schools is serving their population in terms of achievement gains. Homogeneously grouped schools also had positive gains among students in quintile 1 even though those gains represented fewer students. The gains were more significant in the top three quintiles when students were grouped homogeneously. Since the majority of the students in the homogeneously grouped schools are in the top two quintiles and are making positive gains, the grouping strategy of these schools is serving their populations.

Overall, the disaggregated growth data is most consistent among quintiles in schools where students were grouped heterogeneously except for gifted and special education. Four out of five quintiles had positive gains among the majority of the students. Quintiles 2 through 5 had relatively high percentages of the schools with positive gains. In addition, these quintiles represent a significant number of students at these schools. When looking at growth patterns for students in quintile 5, it appears as though homogeneous groups, as well as schools that provide special classes for advanced students are effective for high achieving students.

Teacher Attitudes Survey

Consent was obtained from 21 principals to administer an electronic attitudes survey to 5th grade teachers. The survey was emailed to 86 teachers. Thirty-one teachers responded to the survey, representing approximately 15% of the 5th grade teachers in the district. Ten percent of those teachers have more than 10 years of experience at their school, 42% have been at their school 4-10 years, and 48% have been at their current school 3 years or less. Of the 31 teachers surveyed, 45% group students homogeneously across the grade level, 32% group heterogeneously, and 23% group heterogeneously except for advanced and special education. None of the teachers who have been teaching at their school more than ten years indicated that they are still searching for the best way to group students.

Ninety percent of the teachers surveyed use within class small groups during math instruction. Of those teachers, half of them group homogeneously across the grade level. All but one of the teachers that do not group students within the classroom agreed or strongly agreed that small group instruction enhances student achievement. Eighty-four percent of the teachers agreed that groups should be flexible and skill-based.

Table 6. Number of Teacher Responses by Grouping Strategy

Group	Statement	SA	A	N	D	SD
Heterogeneous	Student achievement is enhanced for all students when students are ability grouped across the grade level for math instruction.	2	3	2	2	1
	Student achievement for gifted students is enhanced when schools homogeneously group by ability.	5	2	2	0	1
	Student achievement for students with disabilities is enhanced when schools homogeneously group by ability.	4	3	1	0	2
	Heterogeneous (mixed ability) groups are an effective way to improve student achievement for *all* students.	2	4	3	1	0
	Heterogeneous (mixed ability) groups are an effective way to improve student achievement for students with disabilities.	1	4	3	2	0
	Heterogeneous (mixed ability) are an effective way to improve student achievement for gifted students.	1	3	3	3	0
	There is no need to group students across the grade level for math instruction.	1	0	2	3	4
	Statement	**SA**	**A**	**N**	**D**	**SD**
Heterogeneous w/ classes for Advanced and Special Ed	Student achievement is enhanced for all students when students are ability grouped across the grade level for math instruction.	2	3	0	1	1
	Student achievement for gifted students is enhanced when schools homogeneously group by ability.	3	4	0	0	0
	Student achievement for students with disabilities is enhanced when schools homogeneously group by ability.	3	3	1	0	0
	Heterogeneous (mixed ability) groups are an effective way to improve student achievement for *all* students.	2	1	2	2	0
	Heterogeneous (mixed ability) groups are an effective way to improve student achievement for students with disabilities.	1	2	3	1	0
	Heterogeneous (mixed ability) are an effective way to improve student achievement for gifted students.	0	1	2	4	0
	There is no need to group students across the grade level for math instruction.	0	0	1	4	2
	Statement	**SA**	**A**	**N**	**D**	**SD**
Homogeneous	Student achievement is enhanced for all students when students are ability grouped across the grade level for math instruction.	8	2	1	3	0
	Student achievement for gifted students is enhanced when schools homogeneously group by ability.	5	7	1	1	0
	Student achievement for students with disabilities is enhanced when schools homogeneously group by ability.	6	2	0	6	0
	Heterogeneous (mixed ability) groups are an effective way to improve student achievement for *all* students.	1	4	1	6	2
	Heterogeneous (mixed ability) groups are an effective way to improve student achievement for students with disabilities.	1	4	0	5	4
	Heterogeneous (mixed ability) are an effective way to improve student achievement for gifted students.	2	2	1	4	5
	There is no need to group students across the grade level for math instruction.	1	0	0	3	10

When asked if teachers agree that student achievement is enhanced for all students when students are ability grouped across the grade level for math instruction, the majority of the teachers surveyed agreed or strongly agreed that ability grouping enhances achievement for all students, regardless of their current grouping practice (See Table 6). Similarly, most teachers agreed or strongly agreed that achievement is enhanced for gifted students and students with disabilities when homogeneous groups are used. This was true of teachers using all three grouping strategies. More teachers that currently group heterogeneously agreed or strongly agreed that heterogeneous groups enhance achievement for all students, students with disabilities, and gifted students, while teachers that currently group homogeneously agreed or strongly agreed that achievement is enhanced for students when homogeneous groups are used. When the teachers surveyed group students heterogeneously with special classes, most teachers did not agree that missed ability groups enhance achievement for gifted students. While nearly half were neutral regarding special education classes. There were mixed responses for these teachers regarding achievement for all students. All but three teachers disagreed or strongly disagreed that there is no need to group students, and only three were neutral.

Discussion

Since elementary schools in this district typically group in 5th grade only, I chose to compare scores of the 5th graders to the school overall. When comparing overall school data to 5th grade data, there are some interesting patterns (see Table 2). The percentage of schools where achievement (percent of students scoring proficient or advanced) among 5th graders is significantly higher than the school overall is high for all three grouping strategies. In contrast, average NCE gains among 5th graders are generally lower than those of the school. Since gains are calculated based on the difference between the previous grade and current grade, value added scores are calculated only for 4th and 5th graders in elementary schools (prior to this study, standardized testing occurred among 3-5th graders only). The patterns seen in this study, whether they be in student achievement or in achievement gains, could be related to instruction, content knowledge of the teachers, or to the difficulty of the test. Therefore, it is difficult to say, with certainty, that grouping students has greater impact on achievement than on achievement growth.

Fuligni, Eccles, and Barber (1995) found that low achieving students in low ability-grouped classes did worse than students who were not grouped. According to the TVAAS data examined in this study, schools where low achieving students who were grouped had a similar percentage of gains than those at schools who were not grouped, 42% and 40% respectively (See Table 3). This implies that low achieving students are capable of making achievement gains with either grouping strategy. In addition, Hanushek, Kain, et. al. (2003) found that in classes where students were grouped heterogeneously, socioeconomic status and achievement levels did not affect achievement growth. The majority of the schools in this study that grouped students heterogeneously, were low achieving schools (less than 50% of 5th grade students scoring proficient/advanced). These schools were generally smaller schools (with an average of 68 students per school). Smaller schools may not group as often because it is difficult to ability group students with only two teachers in a grade. Two of the schools in this study had only one 5th grade teacher, leaving a heterogeneous math class as the only option. Forty percent of the heterogeneously grouped schools experienced gains with the lowest achievers, supporting the claim that low achieving students can make achievement gains in heterogeneously grouped classes. In 25% of the heterogeneously grouped schools, the achievement gain in quintile 1 was positive among the majority of the students at that school. This is compelling evidence that the grouping strategy is working for the students at those schools.

When teachers were surveyed, most of them agreed with the statements that pertained to the grouping strategy they were currently using at their grade level. This supports the research that discusses the value of teacher behaviors, beliefs, and buy-in (Battelle for Kids, 2013, Vogel, 2012). The fact that nearly half of the teachers surveyed in this study are still searching for the best way to group students for math instruction implies that these decisions are challenging. It is difficult to say, with certainty, that there is one strategy that works all the time for every student.

In studies of schools where students were de-tracked, Burris and Welner (2005) found that the curriculum gap is narrowed in classrooms where students are exposed to consistent, rigorous curriculum. In this study, 40% of the schools that grouped heterogeneously had positive gains among both quintiles 1 and 2. When these two quintiles are combined, they represent an average of 40% of the students in these schools. Perhaps teachers in these schools hold high expectations for all students or perhaps these teachers are tailoring their instruction to meet the needs of their school's population. However, we cannot determine the root cause of this gain without examining classroom practices and teacher behaviors at each of these schools.

Hanushek, Kain, et. al. (2003) also claimed that the average student is rarely affected by class composition. When analyzing average NCE gains for students in quintile 3, a relatively high percentage of schools exhibited significant positive gains with these students (see Table 3). This supports the claim that class composition has little effect on the average student. It may also imply that most teachers tend to teach to the average student.

Collins and Gan (2013) argue the merits of ability grouping claiming that teachers are better able to tailor instruction to the specific academic needs of the students in their homogeneously grouped class. This may be true of the schools in this study, but the data here reveals that instruction is tailored to meet the needs of students at that school. Since these homogeneously grouped schools have greater populations of high achieving students, and there are more schools using homogeneous grouping strategies with significant positive gains in the higher quintiles of students, perhaps the instruction supports the student population. In some cases, homogeneous grouping in high-achieving schools is an effort to maintain the status quo or to appease parents of advanced students. This represents the claim that it may not be the strategy that contributes to a gain, but the instruction or school culture.

Collins and Gan (2013) also found that homogenous ability groups benefitted all students, including special education and gifted students. The schools with highest populations of high achievers also had the highest percentages of students placed in the 5th quintile. It is possible that these schools had large populations of gifted students. In addition, the teacher survey revealed that most teachers believe that gifted students need special classes. The data does not reveal whether the large population of high achievers is the result of the grouping strategy; however, homogeneous groups are effective in high achieving schools. There were more gains in quintile 5 among these schools than in schools where students were heterogeneously grouped. Gains among the lowest quintile were least among heterogeneously grouped students with classes for advanced and special education students. Since special education students are not included in TVAAS school diagnostic reports, we cannot speculate here on the impact grouping has on special education students. This data does point out that, when low achieving students are separated from their average and above average peers, there is less achievement growth for them. While 42% of homogeneously grouped schools had significant positive gains in quintile 1, this quintile represents a small percentage of these schools. We could assume that these gains are the result of a school culture that is tailored to instruction at high levels. These students could be benefitting from those teacher attitudes. In contrast, a low percentage of schools with gains in quintile 1 in schools that group heterogeneously except for advanced and special education in quintile 1 could represent low expectations of the teachers of those lower ability students. It could also indicate poor attitudes of teachers who are assigned to teach those classes. Often, teachers take turns teaching the lower class, as if that class is something to be endured. This could also support the claim that students in low ability grouped classes lack the academic role models that higher achievers tend to be, or that the dynamics of behavior problems in a low ability class hinder learning. It is interesting that, when surveyed, nearly half of the teachers who group heterogeneously with special classes for advanced and special education were neutral regarding special education classes. This could be because special education students are taught by special education teachers in other settings. Therefore, the regular classroom teacher may not always know how these students are learning.

I have learned that it is difficult to make assumptions about the effects of instruction on students when analyzing data on only one summative assessment. In trying to gain insight about the effects of teacher attitudes relative to grouping strategies, the survey results revealed that teachers believe in small group instruction, even when students are grouped homogeneously across the grade level. Small group instruction, as well as flexible, skill-based groups are effective strategies for students (Slavin, 1987, Vogel, 2012). The positive responses of teachers that completed the survey reveal that this is valued among those teachers. More teachers that were surveyed agreed that homogeneous ability groups enhanced achievement for all students, including advanced and special education students. However, most teachers' responses aligned with their school's current grouping practice. This could confirm that the grouping strategy used best meets the needs of students at that school.

In this study, there were several issues that made survey collection problematic. It was difficult to obtain written consent from principals during the time of year the survey was administered. The survey was given in the weeks leading up to standardized testing which is a very challenging time for all school personnel. I think teachers may have had the same issue during the rush to prepare students for testing. Some teachers had problems with the survey not working in outdated web browsers. Technical issues may have lead to some not taking the survey. Because of the limited number of teacher responses to the survey it is difficult to connect these responses to the quantitative data. To get a complete picture of teacher attitudes toward grouping, a more comprehensive survey would need to be administered.

To fully understand the implications of the data, one must spend time in the classroom and immersing oneself in the culture of each school. This data should be used as a starting point to begin critically examining the grouping practices for specific students. As Slavin (1987), Gamoran (1987), Battelle for Kids (2013), and Betts and Shkolnik (2000) suggest, it is the impact of the classroom instruction and the efficacy of the teacher that has the greatest effect on student achievement.

CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

The findings here are generalizations that support claims made by other researchers. This study was an effort to find out what works best for students in 5^{th} grade mathematics classes. First, it is difficult to consistently define grouping practices. Even among researchers, the definitions vary, often overlapping. The research emphasizes equity for students as well as the need for teachers to hold high expectations. In order for positive effects to occur in student achievement, the classroom must be an environment that nurtures curiosity, community, and high cognitive demand, regardless of the prior achievement level of the students. We can no longer deny students placed in low-ability classrooms the opportunities for problem solving and exploration that are usually reserved for the academic elite.

The schools in this study are diverse in size and achievement level. The achievement growth of students in each prior achievement quintile is related to the grouping strategy used in each school. The data tells us that, in heterogeneously grouped schools, low achieving students are making achievement gains. Gains among these students are necessary for closing the achievement gap. According to the disaggregated data here, gains in quintiles 1 and 2 are possible no matter the grouping strategy. Even in homogeneously grouped schools, the low achievers are making gains. It is also evident that students in the average range (quintile 3) are making gains no matter the grouping strategy.

The data highlights the percentage of schools experiencing achievement gains among certain populations of students. When we consider the number of students experiencing gains, heterogeneous groups are effective more often with low achieving students, while homogeneous groups are effective more often with high achieving students. This implies that these schools have chosen to group students in ways that are best meeting the needs of the majority of their students. In some cases it may be that the culture of high achieving schools benefit students at all achievement quintiles.

Although the data shows what is working, it may not always reveal why students are growing. The data here does not tell us about the teachers, their content knowledge, pedagogy, or professional development. The data also fails to reveal the values of the educators at each school. The climate in which students learn and grow can be affected by the dynamics of the students in the group; however, the teacher and the overall school culture can also set the tone for learning. We can only make assumptions that it is the grouping strategy that is affecting achievement.

In addition, standardized test data is merely a summative view of student learning. What remains critical is that educators use multiple assessment data to provide students with a consistent, rigorous curriculum in an environment of high expectations for *all* students. Whatever grouping strategy is used, it must be one that will support effective instruction for all students at a particular school.

For future research, it would be beneficial to compare, not only student achievement and growth within each grouping strategy, but also the pedagogy and practices of the teachers. I would recommend constructing and administering a survey after the test data had been collected. I feel I could have created more purposeful questions once the data had been analyzed.

There are so many ways in which grouping strategies are defined and so many variables to student learning that it is not possible to say, with absolute certainty, that there is one grouping strategy that works all the time for all students. As we strive to find an answer to the question of how to effectively group students for instruction, there is not one definitive answer. We have to analyze multiple data sources (summative and formative), consider the content knowledge and pedagogy of the classroom teacher, and appraise the culture of the school along with the beliefs of the teachers before making decisions about how to best group students for instruction. Finding the most efficient way to implement effective instructional practices that are best for our students is the goal of grouping students for mathematics instruction.

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APPENDIX

Survey of Grouping Practices for 5th Grade Mathematics Teachers

1. In what school are you currently teaching?

2. How many years have you been teaching 5th grade math at your current school?

3. Does your school group students for math at your grade level? Select your grade level's practice for ability grouping your students:

Homogenous groups (groups of similar abilities)

Heterogeneous groups (mixed ability groups)

Skill groups (flexible skill based groups)

4. Do you meet with small groups of students during your math class?

If you group your students within your class, select your method of grouping students:

Homogenous groups (groups of similar abilities)

Heterogeneous groups (mixed ability groups)

Skill groups (flexible skill-based groups)

The following questions address your beliefs about ability grouping students for math. Please indicate your agreement with the following statements by choosing: strongly disagree, disagree, neutral, agree, strongly agree.

1. Student achievement is enhanced for all students when students are ability grouped across the grade level for math instruction.

2. Small group instruction within the math class enhances student achievement in the mathematics classroom.

3. Students need small group instruction within the math class when students are homogeneously (similar ability) grouped across the grade level.

4. Student achievement for gifted students is enhanced when schools homogeneously group by ability.

5. Student achievement for students with disabilities is enhanced when schools homogeneously group by ability.

6. Students need small group instruction within the math class when students are heterogeneously (mixed ability) grouped across the grade level.

7. Heterogeneous (mixed ability) groups are an effective way to improve student achievement for *all* students.

8. Heterogeneous (mixed ability) groups are an effective way to improve student achievement for students with disabilities.

9. Heterogeneous (mixed ability) are an effective way to improve student achievement for gifted students.

10. Small group instruction within the math class does not enhance student achievement.

11. Flexible skill-based groups are an effective way to improve student achievement for *all* students.

12. Flexible skill-based groups are an effective way to improve student achievement for students with disabilities.

13. Flexible skill-based groups are an effective way to improve student achievement for gifted students.

14. Small group instruction within the math class is an effective way to provide students with flexible skill-based instruction.

15. Homogeneous ability groups are an ineffective way to improve student achievement for *all* students.

16. Heterogeneous (mixed ability) groups are an ineffective way to group students for maximum student achievement.

17. There is no need to group students across the grade level for math instruction.

18. I am still searching for the best way to group my students for instruction.

VITA

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