Fall 2012

The Influence of Ability Grouping on Math Achievement in a Rural Middle School

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THE INFLUENCE OF ÁBILITY GROUPING ON MATH ACHIEVEMENT IN A RURAL MIDDLE SCHOOL

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Submitted in Partial Fulfillment
of the Requirements for the Degree of
Doctor of Education

Seton Hall University

2012

SETON HALL UNIVERSITY
COLLEGE OF EDUCATION AND HUMAN SERVICES
OFFICE OF GRADUATE STUDIES

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ABSTRACT

The researcher examined the academic performance of low-tracked students (n=156) using standardized math test scores to determine whether there is a statistically significant difference in achievement depending on academic environment, tracked or nontracked. An analysis of variance (ANOVA) was calculated, using a paired samples t-test for a single cohort as both low- and high-tracked students were reorganized from heterogeneous course assignments in Grades 6 and 7 to an ability-grouped assignment in Grade 8. The researcher conducted a non-experimental study to analyze the influence of tracking on the academic achievement of non-accelerated students as measured by Grade 8 standardized math scores. The researcher analyzed the data using a longitudinal explanatory design. The data used were the NYSTP Math scores for a single cohort over a three-year period in Grades 6 through 8.

An analysis of the data revealed that sorting the students into two groups for the purposes of math instruction – accelerated and standard curriculum – did not have a positive influence on math achievement for either group. The lower-tracked students demonstrated statistically significant decreases ($p<.05$) in performance on standardized math testing when assigned to a non-accelerated course of instruction.

Furthermore, the pattern of declining math achievement for economically disadvantaged students enrolled in a tracked environment is significantly greater than the pattern of decline when compared to the group as a whole. In this instance, low SES students do not have the same access to a high quality curriculum as their wealthier peers. This puts students who are already in crisis at an even greater disadvantage. At a time when offering greater resources to low SES students would benefit them the most, these

students are assigned to a lower-tracked instructional grouping. The findings of this study support the elimination of a tracked academic environment for middle schools endeavoring to improve the achievement of academically at-risk students.

ACKNOWLEDGMENTS

This research has renewed my sense of service to those who are disenfranchised and lack the capacity to be truly successful – however that may be defined – in our U.S. education system. Perhaps one of the most influential scholars in research related to this field is my mentor, Dr. Charles Achilles, who has helped me, and many others, to sort through the noise and confusion of what is relevant, and what is not, when designing a system that promotes excellence and equity – two variables that should not be exclusive from each other. Dr. Achilles has provided the constructive feedback that has guided me toward educational milestones; and for this, I am grateful.

I am also indebted to Dr. Barbara Strobert for her positive attitude, calm spirit, and for inspiring in me a love for the profession. She provided a space for me in which I was able to create my best intellectual arguments while being ever-mindful of the emotional elements that shape public school administration.

Lastly, I am grateful to Drs. James Douglass and Patrick Darfler-Sweeney, two school administrators whom I have known over the years who have helped me to reconcile theoretical perspectives presented in the research with best-practices and intuition. These stars are not always aligned; but when they are, great things happen for students.

DEDICATION

I dedicate this dissertation to Sharon, my loving wife, as well as to our son and daughter, Robert and Jane, who too often had to sacrifice their own needs during this process. Throughout this endeavor, and many other challenging life-events for that matter, my wife and our children have maintained their own personal commitments to excellence while supporting me in mine. They are the reason for all that I do and a reflection of all that I am.

I would also like to dedicate this to my mother and father, Jacqueline and Robert, who enabled in me an understanding of human creativity as a function of a disciplined mind and an open heart.

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CHAPTER 1

INTRODUCTION AND BACKGROUND

Introduction

In response to the increasing pressure for public schools to produce mastery levels of student achievement, school administrators have considered changing instructional groupings. The federal government provides funding to schools with lower than average financial resources, which often requires that instructional groupings include academic intervention programs and other remedial offerings for students. As such, many of these schools receiving federal funding tend to channel students into less rigorous academic programs. Many policymakers, educators, and researchers consider this practice of ability grouping to be a form of tracking. Tracking is the process of sorting students by academic ability, a process that many researchers consider to be detrimental to the learning needs of students. This process has also been determined to be illegal when, as determined in the case of Hobsen v. Hansen (1971), Judge J. Skelly Wright concluded that "racially and socially homogeneous schools damage the minds and spirits of all children in lower tracks for reduced education based on (inappropriate) tests, thus implementing the self fulfilling prophecy inherent in such misjudgments. The scholastic achievement of the disadvantaged child, Negro and White, is strongly related to the racial and socio-economic composition of the student body" (Cuban, 1975).

In the 2008-2009 school year, the Mexico Middle School, a middle school with approximately 600 students, Grades 5 through 8, accepted funding under the No Child Left Behind (NCLB) legislation for an adequate yearly progress (AYP) deficiency to be used to improve the achievement of students with disabilities. Specifically, the New York

State Education Department (NYSED) identified this deficiency as lower than expected achievement by classified students on statewide high-stakes testing in the area of English Language Arts (ELA) in Grades 7 and 8. In order to remedy this situation mandated by NCLB legislation, the school's administration used Title I funding to provide remediation or Academic Intervention Services (AIS) for underperforming students in an effort to meet AYP goals in ELA instruction. The application of these funds typically resulted in an emphasis on ability grouping, since underachieving students were sometimes "pulled out" of regular academic programming for the purpose of remediation. School administrators assigned students to ability-grouped classes for ELA instruction which, in turn, dictated the students' schedules for the rest of the school day. Also, the top-performing students in Grade 8 math were "pulled" into a section of Integrated Algebra instruction, the top track for all eighth-grade students.

While student class assignments remain largely heterogeneous, the school's administrators assigned the top performing eighth-grade students to more rigorous, accelerated programs. Having removed a selected group for more rigorous math instruction, the administrators then assigned the remaining students to instructional groups that reflected the students' performance on ELA testing from the previous year, another symptom of the administrators' response to the NCLB mandate for intervention. While school administrators made some attempt to place students into heterogeneous class assignments in math, factors such as placement for ELA academic services and tracking for the highest performing math students were dictated by purely random assignment. As such, the students' scores from the statewide ELA examination from the prior year became the primary factor that a guidance counselor employed to determine each student's

schedule for math.

In the fall of 2011, NYSED again listed the Mexico Middle School "in need of improvement," as the school had again failed to meet its AYP requirements on ELA assessment for students with disabilities as well as those students considered to be economically disadvantaged. By randomly assigning students into more challenging coursework, the school's administrators sought to improve math instruction while eliminating the harmful influence of tracking. NYSED classified the Mexico Middle School as "in satisfactory standing" since the aggregate populations exceeded AYP in math and ELA on New York State Intermediate level assessments. However, performance indices for students considered disabled and/or economically disadvantaged were in the lowest performing subgroups in the 2010-2011 school year. Students in these subgroups received NCLB prescribed academic interventions that were more remedial than rigorous in nature.

This emphasis on remediation over acceleration calls into question the worthiness of Public Law 110-107 (NCLB). Further, the legal picture became complicated, as the Sixth Federal Circuit Court had ruled that parts of NCLB were unconstitutional. This was because the federal government had not provided clear notice to the states of the cost implications when states accepted NCLB funding. The situation was further confused, as the Secretary of Education's interpretation of the NCLB unfunded mandates provision was not correct (Walsh & Mark, 2008).

Statement of the Problem

At-risk student groups have minimal access to accelerated math classes at Mexico Middle School in Grade 8. Most of the economically disadvantaged and learning-disabled

students are unlikely to meet the standards of performance on NYS middle-level assessments as determined by the NYSED, whereas wealthier, general education students are far more likely to exceed NYSED performance standards. The table below illustrates the percentages of students by category who scored less than a "Level 3" performance index on the 2009 New York State Middle Level Math Assessment for Grades7 and 8. NYSED classifies a "Level 3" performance index as "meeting the standard" (NYSED, 2011).

Table 1

Two-Year Cohort Trend by Risk-Category on NYS Math Assessment

Sub-group	Grade 7 not meeting the standards	Grade 8 not meeting the standards
Not Disadvantaged	21%	39%
Economically Disadvantaged	44%	60%
General Education Students	21%	41%
Student with Disabilities	85%	86%

Source: (NYSED, 2011)

The practice of sorting students according to ability continues in spite of the research illustrating the manner in which low-track classes fail to serve students. Further, school administrators who sort students in this manner create an even more damaging learning environment for disabled and economically disadvantaged students (Rubin, 2008). Rubin and others have posited that the practice of tracking persists due to inherent institutional politics, beliefs, values, and culture as much as to "technical, structural, or organizational needs" (Burris, Heubert, & Levin, 2004). Intuitively, many educators and parents firmly believe that segregating high achievers according to their abilities will

provide learning benefits not found in a less-challenging curriculum. Findings on the influence of heterogeneous grouping upon student achievement have provided mixed results. Results from some studies have suggested improved achievement for low-tracked students in mixed-ability instructional groups (Burris, Welner, Wiley, & Murphy, 2007; Marzano, Pickering, & Pollock, 2004; Oakes, 1985; Oakes, Wells, Jones, & Datnow, 1997; Slavin, Lake, & Groff, 2009), while others have suggested that high-achieving students may well suffer in heterogeneous groups (Kulik, 1992; Loveless, 1999). Several researchers have even suggested that there is no statistically significant influence on high-achieving students assigned to mixed-ability instructional groups (Oakes, Wells, Jones, & Datnow, 1997; Slavin, Lake, & Groff, 2009). However, there is now emerging research to strongly indicate that detracking can and does improve achievement results for marginalized students in wealthier, suburban communities (Welner & Burris, 2006).

Tracking or "ability grouping" continues to be employed in schools to group students with the same skill levels or ability for the purpose of achieving specific goals which are believed to be attainable by each student in the group. Tracking takes on many different forms, depending on the particular school's or individual teacher's policies. Ability grouping can begin or take the form of students being grouped within a classroom where they break into small groups within the class to receive specific instruction. Often, this type of differentiated instruction occurs in the earliest grades. However, as students progress into higher grades they may be grouped into entirely separate classrooms where students of different ability groups take classes with different teachers, instructional materials, or at a different pace. Eventually, these students may be separated into different courses or "tracks" of instruction. When tracked students reach high school, some have

already been "tracked" into courses that will lead to a college preparatory course of study and exposure to the materials that will be tested on high school graduation tests or college entrance exams, whereas other students may be directed to vocational opportunities.

The effect of tracking often has the unintended consequence of negative attitudes and perceptions, which may influence student learning and subsequent scores on New York State standardized testing in the area of middle level mathematics (Boaler, 2007). In Mexico Central School District, administrators have attempted to address the negative attitudes that were evident in "tracked" classes in the middle school by scheduling nearly all students with disabilities into heterogeneous classes. The majority of students were placed into heterogeneous math classes in September 2008 when the middle school was initially deemed in a state of "corrective action" by NYSED. However, concerns continued to exist over the performance of at-risk students when these students were assigned to math classes that did not include the top performing math students. Before situations such as this can be addressed in the future, it is imperative to have a better, fuller understanding of why students continue to be sorted by ability and what challenges persist that prevent random assignment of students. Therefore, the researcher's questions were centered on differences in student achievement on NYS standardized testing as a function of students having greater access to more challenging coursework in mathematics.

The question that warranted attention and was reviewed in this study is as follows: How does the absence of higher-achieving students and lack of access to accelerated coursework influence the achievement of the general population of students in eighth-grade math in a rural, high-poverty middle school? As the highest performing seventh-

grade math students had been "skimmed" off the top for the purposes of accelerated math placement in eighth grade, this researcher's questions were centered on the impact of math instruction for "non-accelerated" eighth-grade students. Simply stated, does the achievement gap widen from Grade 7 to 8 for at-risk students who were "non-accelerated?" How did students' scores differ in classes where students were grouped heterogeneously as compared to classes where the top-performing students had been removed? Previous research compared academic achievement as it related to grouping practices, but none of the studies provided data to compare pre- and post-grouping scores on NYS middle-level math tests where the highest achieving students had been removed from what would have otherwise been a mixed-ability class.

Purpose

The researcher's purpose for this study was to determine if and how the achievement of the general population of students may be influenced when the top-performing students are removed from the regular course of study into accelerated math programming.

Conceptual Framework

One of the conceptual models used to frame this study is John Carroll's (1963) Model of School Learning. This model describes learning as a function of four variables: time, capacity, effort, and quality of resources (Figure 1). The researcher's purpose for this study is to determine if and how the achievement of the general population of students may be influenced when the top-performing students are removed from the regular course of study into accelerated math programming. This researcher considers all four variables as presented by Carroll's Model of School Learning: (1) restricted access of tracked

students to high-quality resources, (2) lack of capacity due to limited preparation or prior knowledge concerning math content, (3) reduced effort stemming from low expectations, (4) and reduced time spent on development of content knowledge, especially during after-school hours, which creates a situation where at-risk students are likely to be unsuccessful. This being the case, this researcher would suggest that students who are inherently disadvantaged should have greater access to a high-track math curriculum, not less, if ideals of equal opportunity to learn are to be achieved within a diversity of educational objectives.

Carroll considered the time needed for effective learning to be a function of ability to learn academic material, ability to understand instruction, and the quality of instruction itself. One measure of ability to learn academic material, according to Carroll, would be IQ. The preparedness of a student to understand instruction describes the student's ability to understand what he or she is taught. If a student is persistently assigned to low-track classes, it is reasonable to suggest that he or she may have limited ability to understand instruction if assigned to a high-track course. Carroll did not specifically address heterogeneous instructional grouping as a component of learning; however, a low-tracked instructional grouping, in math or any other course of study, restricts all four components of Carroll's' model for school-based learning (1963).

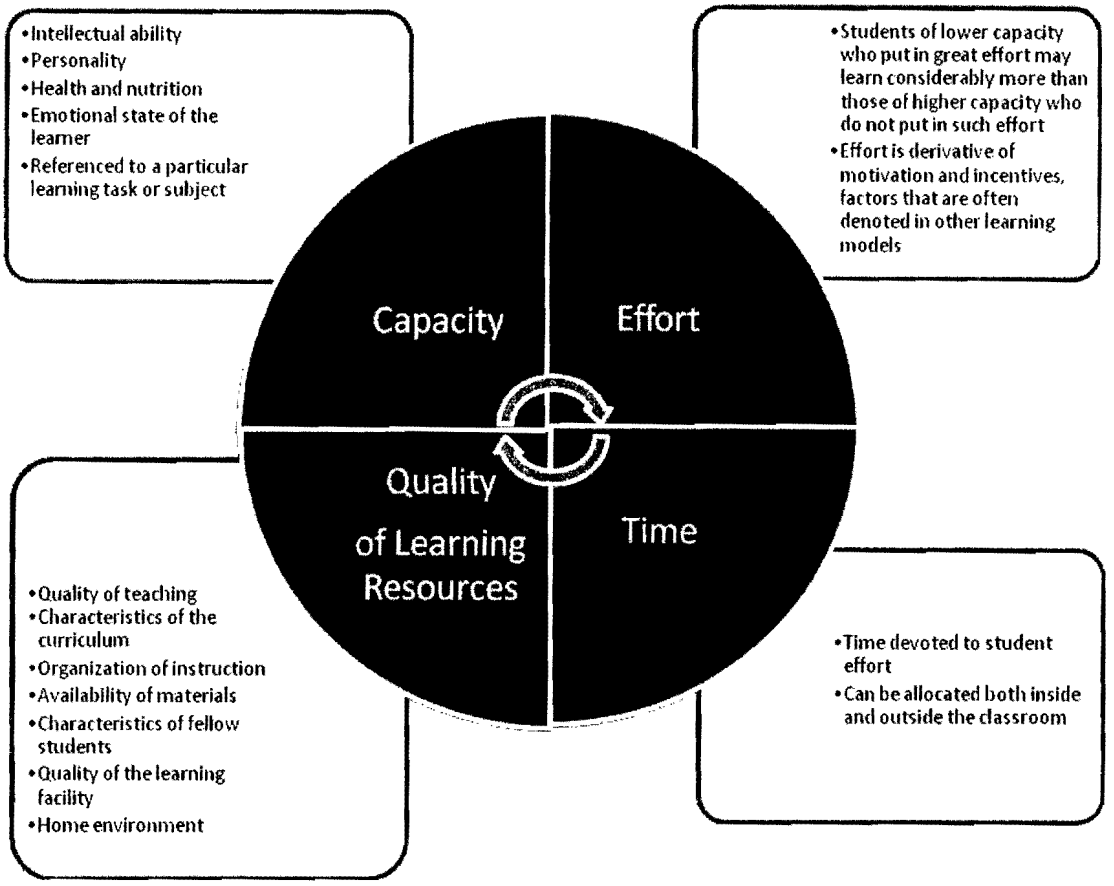

Figure 1
Carroll's Model for School-Based Learning (1963)

Carroll's model has become the groundwork for a number of other research efforts designed to classify the primary variables that are determinants of school learning. To this end, the work of Henry M. Levin on the characteristics of accelerated education and the applicability of accelerated education to at-risk students (1988) has served as the second conceptual model for this study. Levin's report on disadvantaged students' access to accelerated courses (1988) in combination with Carol Burris' research (2003) concerning how students' math course-taking patterns and math achievement are affected when students study math in heterogeneously grouped classes serve as a framework for this researcher's study. While many researchers have examined the influence of heterogeneous

instructional grouping in schools, this study is unique in that the research effort is centered upon the effects associated with low SES students sorted into a non-accelerated middle school math course. Burris (2006) showed that the probability of completion of advanced math courses increased significantly in all groups, including minority students, students of low socioeconomic status, and students at all initial achievement levels when placed in heterogeneous instructional groupings in high school math.

Research Questions

1. What is the difference, if any, between the NYS Middle Level Math Assessment performance for lower-achieving students in Grade 6 (heterogeneous instructional grouping) and the performance for the same students in Grade 7 (also grouped heterogeneously)?
2. What is the difference, if any, between the NYS Middle Level Math Assessment performance for lower-achieving students in Grade 7 (heterogeneous instructional grouping) and the performance for the same students in Grade 8 (homogeneous instructional grouping)?
3. What is the difference, if any, between the NYS Middle Level Math Assessment performance for economically disadvantaged students in Grade 7 (heterogeneous instructional grouping) and the performance for the same students in Grade 8 (homogeneous instructional grouping)?

Design and Methodology

The researcher examined the academic performance of low-tracked students (n=156) using standardized math test scores to determine whether there was a statistically significant difference in achievement depending on academic environment: tracked or

non-tracked. The researcher analyzed the data using a non-experimental, longitudinal explanatory design. The data used were the NYSTP Math scores for a single cohort over a three-year period in Grades 6 through 8.

Using quantitative methods, an analysis of variance (ANOVA) was calculated, using a paired samples t-test for a single cohort that was reorganized from heterogeneous course assignments in Grades 6 and 7 to an ability-grouped assignment in Grade 8. The researcher conducted a non-experimental study to analyze the influence of tracking on the academic achievement of non-accelerated students as measured by Grade 8 standardized math scores. The researcher employed a quantitative method using data taken from NYS Assessment scores for middle-school mathematics examinations. Scores were taken from a cohort of approximately 150 students from their sixth (2008-09), seventh (2009-10) and eighth (2010-11) grade NYS Math Assessments and analyzed to better understand the process of ability grouping as students were promoted from grade to grade to include the manner in which students qualified for AIS and accelerated placement in the final year of middle school, Grade 8. Archival student records (Math 6, 7, and 8 test scores by groupings) provided the basis for the collection of quantitative data and provided insight into the subjects of the study, general education students attending a Grades 5 through 8 middle school.

Significance of the Study

The significance of this research is centered on how school administrators might influence the achievement gap for high-poverty, marginalized students by examining how, if at all, instructional grouping influences student achievement in math. In many high need-to-resource capacity school districts in New York State, much of the funding

resulting from the NCLB continues to be allocated toward enhancing academic intervention programs for targeted students, staff development programs, equipment purchases, and salaries for academic intervention specialists. However, many of these initiatives may serve to exacerbate conditions of inequity in underperforming schools, as none promote access to more challenging coursework (Bracey, 2008).

Federal funding often means more dollars spent on remediation for students who are already marginalized. A possible alternative to this emphasis on remediation would be to redirect funding toward the restructuring of ability groups to ensure that all students may have access to high-level coursework, specifically math in the middle school. Several school districts in New York State have addressed the need to restructure by implementing programs such as the International Baccalaureate. Further, Levin's (1988) "accelerated schools" research has provided a framework for understanding equitable student access to more rigorous coursework.

Delimitations of the Study

The scope of this study is confined to a cohort of approximately 150 students and their experience with math in three grade levels – Grades 6, 7 and 8 – within a New York State rural school district during the 2008-2009, 2009-2010 and 2010-2011 school years. The researcher used quantitative methods to compare math scores on NYS standardized testing results from a single cohort of students that were heterogeneously placed in sixth and seventh grades to their subsequent results in Grade 8 when some students were grouped by ability and others received AIS in accordance with NCLB and NYSED statutes. All student results were drawn from a middle school in Oswego County, New York.

While the curriculum standards for New York State middle school math are consistent, the method of instruction varies from class to class. The researcher did not consider variations in instructional practices. For this study, standardized test scores stored in the New York State Student Information System (NYSSIS) were collected from math classes in which students were randomly placed regardless of previously demonstrated ability or level of AIS or related services prescribed in accordance with student disabilities. Students' identities were coded by a third party from the Oswego County Board of Cooperative Educational Services and included student classification information of family wealth and disabilities, if applicable.

The researcher conducted this study in a rural middle school ranked as a School in Need of Improvement Year One (SINI 1) by NYSED, and the findings may not be applicable to other schools and school districts. Further, the school was classified as having a "focused" improvement status by NYSED in September 2011, since student scores in two at-risk categories – SWD and economically disadvantaged – failed to make AYP. There was no review of student scores in academic areas beyond math in Grades 6 through 8. Beyond this, validity issues may persist in that the researcher did not consider any other confounding variables that might have possibly influenced student achievement, most notable of which included gender and race.

The study was further delimited since the information was obtained from math classes in a single middle school. Archival data was collected from all math sections for a period of three consecutive years. The data that the researcher used to measure annual student achievement were the raw scores on the NYS Math assessments, the same scores that the school's guidance staff used to place students according to ability in Grade 8.

Limitations of the Study

The results of this study are not generalizable to other grade levels. Further, there may be other intervening variables that could influence student achievement, such as student perceptions of their own math abilities (Rubin, 2003) or less-than-random assignment to heterogeneous math classes. There are also other factors that contribute to student performance beyond instructional grouping that are discussed in Chapter 3.

The demographics of the school district were a limitation of this research. The students who were not placed in the accelerated program in Grade 8 in 2010-11 were the subjects of the study (There may be other factors that impact student achievement beyond structural considerations, but ability grouping was the only factor considered in this study). The manner in which ability grouping impacts economically disadvantaged and disabled students was a further consideration of this researcher.

Summary

There is a growing emphasis on using student achievement data to measure teacher effectiveness. In order to fairly measure teacher performance using "value-added" evaluation models, well-designed inferential statistics must be employed in order to effectively compare growth in student achievement. The researcher gathered archival data from student and course records via the New York State Student Information System (NYSSIS) for the years 2008 to 2011. The information was organized into a report of five chapters. In Chapter 1, the researcher addressed the introductory material and the background information along with the problem statement, purpose, rationale, research questions, significance, definitions, limitations, delimitations, nature, and organization of the study. In Chapter 2, the researcher provided a review of the research, theory, and

literature that pertain to detracking and the achievement gap for marginalized students, especially as it pertains to economically disadvantaged or learning-disabled students. In Chapter 3, the researcher presented a description of the design and methodology used for this quantitative study, including objectives, population, validity, and reliability. Chapter 4 includes the data and analyses. In Chapter 5, the researcher has summarized the findings, discussed outcomes, and related them to prior studies.

Based on the conclusions, the researcher has suggested recommendations to educators on ways to narrow the achievement gap for marginalized students in middle-school math programs and makes recommendations for policy practice and other research. This researcher's focus has been to investigate some of the issues that develop when school-district personnel attempt to bring rigorous math courses to all students, particularly when students in the same classroom have various degrees of computational skills. Practicing classroom teachers should be able to find meaning in these analyses in order to assist them to bring strategies to their own mixed-ability math classes. School district administrators should be able to use the results to plan job-embedded professional development and other support systems for teachers. Results of this research should allow researchers and practitioners to create new questions and expose new areas for future research.

CHAPTER 2

REVIEW OF RESEARCH, THEORY, AND PRACTICE

Introduction

Each year in the United States, school district administrators construct elaborate master schedules in order to organize students and teachers into effective teaching and learning cohorts. Many of these school leaders group students heterogeneously with the intention of addressing gaps in achievement. School guidance counselors, teachers, and administrators assign students into groups according to student results on standardized achievement tests, teacher evaluations, and past performance in school. Once an administrator or teacher assigns a student to a particular track, students will likely remain in that grouping permanently. This is evident as early as kindergarten when teachers develop a differentiated program of instruction for students based on entrance evaluations, kindergarten screening criteria, and standardized tests that will ultimately create a permanent track that will influence access to curricular opportunities. What this means for an at-risk student studying math in the context of a low-wealth, rural middle school is at the heart of this study. In this chapter the researcher has reviewed pertinent literature in order to develop a framework for analysis of student achievement when the top-performing students are removed from the regular course of study into accelerated math programming.

The researcher has justified inclusion, or exclusion, of literature based on several criteria as warranted within the context of historical significance and practical significance. Further, the researcher has considered the history of tracking and how homogeneous grouping has become commonplace in U.S. schools. The primary

determinant for inclusion in this review was based upon the data provided in the literature which, in turn, enabled the researcher to set the broad context for the study. The first section of the study presents a review of the history of research regarding equitable student access to educational resources. In this instance, literature that was considered for inclusion in the review was centered on sociological factors such as economic, societal, and political forces that influence just how students are grouped for the purposes of instruction. Literature that the researcher considered for inclusion in this section critically examined the history of the topic of instructional grouping. The researcher has chosen to focus on the shifts from heterogeneity in the one-room school house to the ability-grouped instructional setting during the industrialization of America, and the manner in which school administrators have more recently employed assigning students to mixed-ability instructional groups as a means to improve student achievement. Literature that was excluded from this historical review were those studies that did not specifically address outcomes for students. In most cases these studies focused upon economic or social prosperity as a result of students being grouped for the purposes of instruction.

In the second section of the literature review, the literature that has been included by the researcher specifically addresses the achievement concerns that are presented in a tracked or de-tracked classroom. Here the researcher has framed the argument for analyzing student achievement in a heterogeneous instructional setting and has included a review of the literature that addresses the socio-economic impact of the tracked/de-tracked classroom. In the second section, the researcher has examined the research literature that illustrates the importance of creating instructional grouping that reflects the diverse learning needs of students in a single classroom. Again, in this section, the researcher has

excluded those studies that do not specifically address student outcomes, whether directly associated with student achievement or related gains beyond the classroom.

In the third section of this study, the researcher considers the research that addresses the advantages and disadvantages of grouping students without consideration for their initial perceived academic ability. Here, the researcher has reviewed the literature associated with the issues that confront educators attempting to implement heterogeneous instructional groups. Excluded from this section of the review were case studies that would otherwise advocate for ability-grouped instructional settings that do not present a causal relationship between tracking and improved student achievement for a larger student population. This type of "advocacy literature" which only addresses achievement for students with exceptionalities (e.g., gifted and talented programming or students who are severely disabled) was not considered for review by this researcher.

The History of Homogeneous Grouping and Ability Grouping

The practice of sorting and grouping students by measured and perceived ability has long been questioned by educational researchers (Bowles & Gintis, 1976; Cicourel & Kitsuse, 1963). The issue of tracking gained momentum as a topic of research following the publication of *Keeping Track* by Oakes in 1985 (Mehan, 1996; Slavin & Kartweit, 1985; Welner & Oakes, 1996; Wheelock, 1992). These researchers posited that tracking segregates students within schools and delivers a substandard education for students in the lower tracks. Researchers of high track/low track studies argue that lower-track students, mainly the poor or those classified as disabled, receive an unchallenging, non-college-bound curriculum delivered by substandard teachers, while students in the higher tracks, predominantly higher SES, participate in a more rigorous, high-quality curriculum taught

by more skilled teachers. In this manner, according to these researchers, tracking is one of the mechanisms wherein inequalities present in our schools and in society are perpetuated.

Rural schools have a long tradition of mixing students of different ability levels for the purposes of instruction largely due to financial efficiencies gained by assigning as many students to a single teacher as could fit into a classroom. In the 1800s, most Americans lived in rural areas, and communities were served through one-room school buildings. Schools were organized differently than they are today: local school board policies were not codified, few teachers were formally trained, student attendance was not compulsory and was not intended to interfere with family farming efforts. However, by the end of the nineteenth century, America had "schooling for more people than any other nation, and... patterns of education were remarkably uniform in purpose, structure, and curriculum, despite the reality of local control in thousands of separate communities" (Tyack & Hansot, 1982, p.17). Beyond this, the research associated with instructional grouping in sparsely populated, geographically expansive, and low-wealth rural schools throughout U.S. history has been largely ignored in the literature.

Much attention in the research literature has been dedicated to the influence of industrialization and urbanization of U.S. society and the impact that each has had on the schooling of American students (Kozol, 1991). Tracking students, namely immigrants, into different groups for instruction developed as America's school system expanded to accommodate the growing numbers of ethnically and economically diverse student groups. This growth was a result of immigration, urbanization, the child labor law movement, and massive industrial growth between 1890 and 1940 (Tyack & Hansot, 1982). The one-room schoolhouse model where students of differing ability levels, ages,

and socio-economic status were all educated together (usually within walking distance from their homes) was no longer viewed as an effective means of educating large numbers of students from culturally diverse backgrounds in an urban setting. Additionally, educators promoted the practice of child rearing as the role of the school in settings where parents were increasingly unable to spend time because of work-related constraints (Tyack & Hansot, 1982). Upon reflection, we see that the role of schools has changed radically throughout American history, particularly in light of the expanded role of curriculum that was designed to produce a citizenry that was capable of democratic and socially acceptable behavior.

Education policymakers maintained a growing emphasis on assimilating immigrants into a common American culture (Tyack & Hansot). Much of the curriculum prior to the 1960s was centered on developing citizens who would embrace the democratic principles which were challenged by the events that were shaping economic and political landscapes in Europe. However, the impact that these shifts in world events had on the rural educational systems in the United States remained largely unnoticed by researchers. The research literature is largely silent regarding historical changes in rural schools that remained largely untouched by the forces of industrialization, urbanization, immigration, and the perceived threat to the development of an American culture.

More than any previous decade, the 1960s saw a growing awareness of the societal problems associated with segregated schools in the southern United States and large urban centers that yielded a number of educational reforms and court cases. Despite these reforms and judicial actions, tracking continues today to be present in many U.S. schools, even though research beginning as early as the 1980s argues against this practice (Stevens

& Wood, 1992; Berends, Lucas, Sullivan, & Briggs 2005). Most researchers who have investigated tracking in secondary schools have attempted to understand and identify the educational consequences of placing students in high-track and low-track curricula as well as the underlying rationale upon which schools rely to sort and assign students to a particular track. To this end, research suggests that the framework of attending to the individual differences of students only exacerbates the inequities between student groups (Desimone, Payne, Fedoravicius, Henrich, & Finn-Stevenson, 2004; Gamoran & Mare 1989).

Findings from several studies further suggest that the process of sorting students by perceived academic aptitude or vocational interest contributes to the achievement gap between students in vocational and academic tracks (Oakes, 2005; Gamoran & Mare, 1989; Chunn, 1989; Gamoran, 1987). These studies suggest that high-track classes like Advanced Placement and IB (International Baccalaureate) courses tend to attract students from high SES households and are taught by better-qualified teachers. Conversely, low-track courses are taught by less-qualified instructors, and coursework is largely vocational in nature (Carbonaro & Gamoran, 2002; Dreeben & Gamoran, 1986; Gamoran, 1986, 1989; Gamoran & Nystrand, 1991; Gamoran, Nystrand, Berends, & LePore, 1995; Gamoran, Porter, Smithson, & White, 1997; Hallinan, 1994; Oakes, 2005; Page, 1990). These same studies also find that low-track classes tend to be represented by at-risk students from disadvantaged socioeconomic backgrounds and that high-track courses tend to be represented by wealthier students. Generally speaking, these high-track courses place a greater emphasis on higher-order thinking skills and encourage students to pursue a college trajectory beyond high school (Oakes, 2005). Several studies also suggest that

these tracks tend to be permanent in that students stay in assigned tracks (Ayalon & Gamoran, 2000; Braddock, 1990; Yonezawa, Wells, & Serna, 2002). However, in these aforementioned studies, the researcher must question the practical significance of the research literature in that these studies did not address the disadvantages associated with rural poverty for low-tracked students.

Schiller (1999) found that most courses, including math, have a characteristically vertical sequence from eighth grade to high school. This vertical structure tends to limit movement between high- and low-tracked courses of study. Uncertainties continue to exist as to how low-SES, rural students are influenced by being assigned to low-tracked math courses, and these concerns are not specifically addressed in the research literature.

The Need for Heterogeneous Instructional Grouping

Tracking in many U.S. schools takes the form of a practice called "ability grouping." Ability grouping permits students to self-sort through the enrollment in a range of courses, from remedial to advanced, with placement determined though individual student course selection (Lucas, 1999; Yonezawa, Wells, & Serna, 2002). Much like traditional means of tracking, grouping patterns associated with class and race are reproduced despite the element of choice that is offered to students and families (Lucas; Oakes, Wells, Jones, & Datnow, 1997; Wheelock, 1992). When offered the opportunity, lower-achieving, at-risk students tend to select low-track, vocational electives, which raises concerns among educators and researchers who see a persistence of inequalities in schools. This researcher has observed a higher-than-average number of non-academic course offerings in the Mexico High School, which presents a concern, as the low-track students who have completed non-accelerated coursework in math at the Mexico Middle

School tend to avoid college prep courses when given the option in high school.

Although tracking remains a common practice in the majority of American schools, the number of detractors continues to increase (Goodlad & Oakes, 1988; Mehan, Hubbard, Villanueva, & Mehan, 1994; Oakes, 1986, 1992; Slavin, 1991, 1995). Researchers argue that tracking serves as a means of sorting students by race and class. Moreover, many researchers claim that students in different tracks do not receive the same quality of education (Oakes, 1985; Loertscher, 2008; Mulkey, Catsambis, Steelman, & Crain, 2005). These researchers contend that students in lower-tracked classrooms are subject to characteristically lower-quality instruction and curriculum. It is this experience, framed by social interactions, that perpetuates a lowered self-esteem. The outcome for students is a system that is both demoralizing and demotivating. Further, these researchers argue that it is the students who are already at-risk who end up in the lowest tracks (Alexander, Entwisle, & Olson, 2001; Oakes, Gamoran, & Page, 1992).

Further, many researchers argue that the practice of tracking is inherently unfair and that it plays a significant role in the perpetuation of social inequalities (Burris, Welner, & Murphy, 2008). In response to lingering questions and concerns associated with homogeneous and/or ability grouping, some schools have implemented heterogeneous grouping strategies. Heterogeneous grouping has been implemented in numerous schools and school districts using a variety of approaches and strategies ranging from the total elimination of ability grouping, commonly referred to as detracking, to ability-grouped programs that provide greater access to upper-track classes for students in the lower-track (Rubin, 2006).

There is growing evidence that administrators and teachers are favoring

heterogeneous grouping as a prescriptive solution to the adverse influences of tracking. This is further reinforced by more recent research that strongly suggests that heterogeneous grouping promotes improved student achievement (Alvarez & Mehan, 2006; Boaler, 2007). Yonezawa defines detracking as "the process of replacing tracked course programs or so called ability-grouped classes with mixed ability classes or the creation of heterogeneous classes" (Yonezawa, Wells, & Serna, 2002). School administrators have attempted to address the inequalities associated with homogeneously grouped students by placing them in mixed ability instructional groupings. This is often referred to as the "detracking movement" (Goodlad & Oakes, 1988; Rubin, 2008). Opponents of ability grouping argue that all students, regardless of academic ability, should have equal access to the most rigorous and highest-quality curriculum that maximizes each student's potential in school and beyond. (Burris, Heubert, & Levin, 2004).

Specific to this study, there was a limited amount of research addressing school communities that perceive excellence and equity as competing educational values (Welner & Burris). However, Faye Brady (2010) suggested that there was no statistically significant influence on achievement for regular education students when students with learning disabilities were included in heterogeneously grouped math and ELA courses. Brady's work strongly indicated that excellence and equity can be achieved in heterogeneously grouped classrooms (2010). The researcher of this study considered the appropriateness of the research methods that Brady (2010) used to warrant the claim that including lower-achieving students with higher-achieving students does not negatively impact the performance of the high-achievers. As a result of Brady's (2010) study, this

researcher has considered the converse argument: The exclusion of high-achievers from the regular eighth grade math classes might negatively influence the performance of the lower-achieving students.

Boaler (2007) conducted research on models of teaching used in mixed-ability, high school math classes where inequalities were reduced and student achievement improved. However, since many of these studies used data solely from high school classes, given the parameters of this study, uncertainties existed that questioned how inequalities and achievement might be addressed at the middle school level. Regardless of grade level or subject matter, studies by Henry M. Levin demonstrated convincingly that at-risk students must learn at a faster rate than more privileged students, not at a rate that drags them farther behind (Levin & Hopfenberg, 1991). This approach, the Accelerated Schools Project, was designed to channel all students into more rigorous academic programming regardless of initial achievement levels.

Advantages and Disadvantages of Heterogeneous Grouping

Wheelock (1994) defined heterogeneous grouping as "a method of grouping students with varying abilities, learning styles, backgrounds, and racial and ethnic origins, with an emphasis on challenging curriculum and instruction for all students" (p. 76). Lucas (1999) suggested that the presence of advanced-level courses does not mean that a school is tracked. School administrators may assign students to heterogeneous grouped classes but must emphasize curricular differentiation. In schools that provide high-tracked courses such as Advanced Placement or IB, administrators ensure that students of all ability levels receive guidance and preparation for those courses. According to Watanbe (2006), school administrators in de-tracked schools do not provide separate advanced-

level courses; rather, all students are placed into the same college-bound heterogeneous course sequence.

Advocates of heterogeneous grouping suggest that it permits high-achieving students the opportunity to engage in enhanced social development while offering lower-achieving students increased (a) self-esteem and confidence, (b) leadership opportunities, (c) motivation, (d) educational benefits, and (e) trust in the educational system (Adams-Byers, Whitsell, & Moon, 2004; Oakes, 1985; Slavin, 1987).

Researchers have noted several advantages when educators transition from homogeneous grouping to heterogeneous grouping including: (a) improved social/emotional development (Boaler, 2006; Oakes, 2000; Slavin, 1990; Villa & Thousand, 2003), (b) more equitable access to high-track coursework (DiMartino & Miles, 2004; Lotan, 2006), (c) reduced student misbehavior (Berends & Lapore, 1995; Glatthorn, 1995), (d) improved attendance rates (Gamoran, Nystrand, Berends, & LePore, 1995; Glatthorn, 1995), (e) reduced school dropout rates (Slavin, 1990), and (f) improved academic performance (Burris, Welner, Wiley, & Murphy, 2007).

The disadvantages associated with heterogeneous instructional groupings in schools are largely implementation concerns. Inequities may persist even when administrators make every effort to ensure heterogeneity in instructional groupings. Therefore, in a classroom that contains a diverse group of learners, it is vital that the teacher understands the techniques of differentiated instruction. The different learning characteristics of students placed in mixed-ability classes require differentiated instructional techniques (Denig, 2004; Marzano, Pickering, & Pollock, 2004; Lauria, 2010; Farkas, 2003). There are many questions and differing opinions concerning how to

best serve a classroom of diverse learners. Similarly, there are many challenges associated with implementing differentiated instruction in mixed-ability middle-school mathematics classes. Rubin (2003) suggested, "The wide range of reforms included under the label of detracking has made it difficult to assess its influence on students. The few quantitative studies on the topic present contradictory data" (p.542). This researcher discovered informally that the primary impediment to the creation of heterogeneous math opportunities for students was found in the uncertainties that educators had when addressing the needs of a diverse body of learners, some with limited computational ability of "basic math skills." While the literature identifies math instruction as the most difficult to conduct in a heterogeneously grouped setting (Rubin, 2006), there is limited research concerning the manner in which math teachers can satisfy the differentiated needs that students bring to the classroom.

Lewis and Cheng (2006) suggested that appointment to a particular track continues to be a socially constructed process. They surveyed a national sample of principals (n = 304) about the criteria principals used to place students in vocational, general, and college tracks and the criteria used to forecast the trajectories of students after graduation from high school. Lewis and Cheng (2006) attempted to determine if race and socioeconomic status (SES) were predictors of track placement. They found schools serving socioeconomically disadvantaged and ethnic minority students were more likely to have vocational and non-college tracks overrepresented in the curriculum. They also found that principals' expectations of students' destinations after high school were highly correlated with the socioeconomic status of said students. Lewis and Cheng (2006) found that even though many schools claim that they have abolished tracking, the traditional structures of

tracking endure.

Summary

While all of these studies offer meaningful insights into mixed-ability math instruction, more research is needed to learn about those issues that teachers consider most relevant when implementing and sustaining middle-school mathematics classes. Whether or not detracking itself becomes a prevalent practice, issues of equity and difference will remain central to the concerns of educators. The literature focusing upon instructional grouping is largely limited to non-experimental studies and lacks consideration for situations where heterogeneity is the norm rather than the exception in school classrooms. There have been very few, if any, studies that address rural school systems where all classrooms are made up of individuals having varying interests, attitudes, talents, and background. Quite simply, rural middle schools that fit this profile are largely non-existent. Because of the increased inclusion of English language learners, SWDs, and economically disadvantaged students in tracked and de-tracked settings, it follows that the issue of heterogeneity for educators will become increasingly prevalent in the scholarly literature. The best practices drawn from this research in de-tracked academic settings can be of use to all concerned educators and calls into question the practice of sorting students by ability.

Chapter 3

RESEARCH DESIGN AND METHODS

Overview

This researcher has sought to determine the possible relationships between instructional grouping practices and student achievement in middle-school math classes through quantitative methods research. This chapter provides a framework for the research by identifying the questions that guided the research, the design, and the methods used for data collection and analyses. The purpose for the study was to determine if and how the achievement of the general population of students is influenced when the top-performing students are removed from the regular course of study into accelerated math programming.

The scores on NYS standardized assessments are used to measure program effectiveness and student achievement in New York State in Grades 3 through 8. The researcher used archival data from a proprietary data-base maintained by the New York State Education Department website called the New York State Student Information System (NYSSIS). The research method for this study was quantitative and, while limited in scope, may be useful for the purposes of policy formulation that provides for a more equitable distribution of financial resources, evaluation of staff that includes some measure of student achievement, and organizational structures that promote learning regardless of student ability.

Description of the School District

This study was conducted using data from a rural school district that served approximately 2,281 students in central New York State. The majority of students who

Table 6

Typography of Ability Groups To Be Studied Using Mean Scores on NYS Math Assessments

	NYS Math Scores Grade 7 2009-10 (heterogeneously grouped)	NYS Math Scores Grade 8 2010-11 (ability-grouped)
Group A: Lower-achieving students (to include economically-disadvantaged and SWDs)	μ: Pre-tracked Group A: Grade 7 math students (general education) in 2009-2010	μ: Lower-tracked Group A: Grade 8 math students (general education, tracked)
Group A1: Economically disadvantaged students	μ: Pre-tracked Group A1: Grade 7 math students (economically disadvantaged)	μ: Lower-tracked Group A1: Grade 8 math students (economically disadvantaged)
Group B: Higher-achieving students	μ: Pre-tracked Group B: Grade 7 math students in 2009-2010.	μ: Higher-tracked Group B: Grade 8 math students accelerated to ninth-grade math in 2010-2011 (but still required to take the eighth grade assessment)

At the beginning of the school years in 2008 and 2009, students were randomly assigned to Grades 6 and 7 math classes; however, in September 2010 students now in the eighth grade were separated according to ability. A single track of higher-achieving students was removed to "accelerate" to the ninth grade math class (Group B); however, the remainder of their lower-achieving Grade 8 cohort was assigned to the standard Grade 8 math curriculum and, in some cases, given remediation through AIS or special education services. The mean scores on the Math 7 exam (pre-tracked) for Group A were statistically compared to the scores on the Math 8 exam for Group A (minus the "accelerated" Group B students).

Instrumentation

The scores on the NYS Intermediate (Grades 6, 7, and 8) Assessments in Math

have provided the quantitative data for this study. These data were selected as the measure for math achievement because they are a standardized value and have high reliability. According to NYSED:

> Reliability coefficients provide measures of internal consistency that range from zero to one. The NYSED calculates two reliability coefficients for the Grades 3-8 Mathematics tests – Cronbach's alpha and Feldt-Raju, were computed for the Grades 3–8 Mathematics Tests. Both types of reliability estimates are appropriate to use when a test contains both MC and CR items. Calculated Cronbach's alpha reliabilities ranged from 0.88–0.94. Feldt-Raju reliability coefficients ranged from 0.89–0.95. The lowest reliability was observed for the Grade 3 test, but as that test has the lowest number of score points it is reasonable that its reliability would not be as high as the other grades' tests. The highest reliability was observed for Grades 4 and 8 tests. All reliabilities exceeded 0.85 across statistics, which is a good indication that the NYSP Grades 3–8 Mathematics Tests are acceptably reliable. High reliability indicates that scores are consistent and not unduly influenced by random error (NYSED, 2010).

Data collection occurred under ex post facto conditions and, therefore, was not vulnerable to modification by the researcher. Testing procedures were clearly defined by the New York State Education Department, and all personnel assigned as proctors to the tests were trained to administer the tests. The tests were administered under conditions strictly enforced by the school district and the State of New York. No record of test

misadministration has been noted by the researcher. Because these data were presented after the fact and testing procedures were clearly outlined, prescribed, and monitored by NYSED-trained proctors, the strength of the validity of the instrumentation must be considered high.

The researcher contacted the board of education in the school district used in this study in order to discuss the proposal of the study and to review with these officials the use of student data for a better understanding of instructional groupings and possible relationships to student achievement (Appendix C). The board of education unanimously agreed that such a study would be useful in helping them to appropriate public funds that could better serve the needs of the students in the district. A third party research assistant employed by the Oswego County Board of Cooperative Educational Services forwarded electronic files containing student scores to the researcher that excluded identifying information concerning students in the cohort. Student records included test scores and status as to whether the student was economically disadvantaged.

Student achievement was measured using the scores on the NYS Mathematics Assessment for the years 2009, 2010, and 2011 for Grades 6, 7 and 8, respectively. This quantitative study used data archived in the NYSIS student data repository maintained by NYSED. The New York State Testing Program (NYSTP) is an assessment system designed to measure concepts, processes, and skills taught in schools in New York State. State tests in mathematics target student progress toward five content standards in Grades 6 and 7 and four content standards in Grade 8. The Grades 6–8 Mathematics Tests were written for all students to have the opportunity to demonstrate their knowledge and skills in these standards. The established cut scores classify students' proficiency into one of

four levels based on their test performance.

The researcher used archival data that was quantifiable and could be readily used in statistical analysis. The study is delimited to academic achievement data from the NYSTP scores. This delimitation was necessary since NYSTP scores are a standardized measure of student achievement, whereas teacher assigned grades are not standardized measures of achievement. The Grades 6–8 NYSTP Mathematics Tests are used to measure the extent to which individual students achieve the New York State Learning Standards in mathematics and to determine whether schools, districts, and the State meet the required progress targets specified in the New York State accountability system.

In this study, the researcher reviewed the scale score which is a quantification of the ability measured by the Grades 6–8 Mathematics Tests at each grade level. The scale scores were comparable within each cohort (which is the case in this study) but not across grades because the Grades 6–8 Mathematics Tests were not on a vertical scale. The test scores have been reported at the individual level and can be disaggregated according to student wealth and disability characteristics. Further, students were classified as Level I (Below Standards), Level II (Meets Basic Standards), Level III (Meets Proficiency Standards), and Level IV (Exceeds Proficiency Standards). The original proficiency cut scores used to distinguish among Levels I, II, III, and IV were established during the process of Standard Setting in 2006. In 2010, changes in the test administration window between the 2008–2009 and 2009–2010 school years as well as a decision to align the proficiency standards with Grade 8 student performance on the NYS Regents Math exams led to changes in the proficiency cut scores.

The annual technical reports developed and published under contract with the New

York State Education Department by CTB/McGraw-Hill LLC provide tables based upon Cronbach's coefficient alpha measure of internal consistency (NYSED, 2011, pp. 49-50). All reliabilities exceeded 0.85 across statistics, a good indication that the NYSTP Grades 6–8 Mathematics Tests are acceptably reliable. High reliability indicates that scores were consistent and not unduly influenced by random error.

Internal and External Validity

The same testing conditions were present for all students in the sample in all three consecutive years, strengthening testing validity. However, because the design of the study was non-experimental and the placement of students in instructional groups was purposeful (non-random), the researcher did not present causal relationships between variables. The only characteristic that globally applied to all students who took the NYS Math Assessment was that all were residents of Oswego County, New York. Attrition validity issues may have been present since a small percentage of students enrolled and dis-enrolled in the school may have affected the composition of the cohort from year-to-year. Standard means have been calculated for each student group in the study (see Table 3) and were based upon the students whose test scores were included in the data at the time of NYS Math Assessment. As students move in and out of the district, the cohort has changed over time, although not to a significant degree. For example, a student who was present as a general education student in Grade 8 may have attended a different school district in Grade 7. Further, student classification may have changed from one year to the next because of special education services or out-of-district placement. Validity issues may also have been present in that certain sections of self-contained special education high-needs math classes were not considered so as not to skew the achievement data. The

scores from these students were excluded as they typically sit for an alternative assessment permitted by NYSED.

In addition to internal validity concerns, there may have been issues concerning external validity. The sample sizes of the higher-achieving student group, the SWD, and the economically disadvantaged student groups may have presented a population validity concern because of the small sample size of each. Ecological validity concerns are a function of the school setting, and therefore the results of this research may not be representative outside this school. The results may be generalizable to other "like-kind" schools in the state as classified by demographic and NCLB characteristics. Lastly, historical validity may have been affected since there were no controls for student placements and interventions prior to the years included in this study.

Data Collection

The standardized test data retrieved by a third party from the New York State Student Information System (NYSSIS) data archive were used by this researcher to determine the academic achievement of general education students in lower-tracked math classes in the absence of higher-achieving students who are permitted to accelerate. Standardized test scores for students were collected to answer the following research questions:

1. What is the difference, if any, between the NYS Middle Level Math Assessment performance for lower-achieving students in Grade 6 (heterogeneous instructional grouping) and the performance for the same students in Grade 7 (also grouped heterogeneously)?
2. What is the difference, if any, between the NYS Middle Level Math Assessment

performance for lower-achieving students in Grade 7 (heterogeneous instructional grouping) and the performance for the same students in Grade 8 (homogeneous instructional grouping)?

3. What is the difference, if any, between the NYS Middle Level Math Assessment performance for economically disadvantaged students in Grade 7 (heterogeneous instructional grouping) and the performance for the same students in Grade 8 (homogeneous instructional grouping)?

The data fields that were requested from NYSSIS included a unique student identification code (an eight-digit identifier code specific to this study that replaced the NYSSIS code that is assigned to all students enrolled in public schools in New York State), the raw score on the NYS Math Assessment for each year, information as to whether the student was economically disadvantaged, and category of disability, if any. These data were retrieved from ex post facto archival records. These student records did not include personal information or identities of students.

During the term of this study, this researcher was employed as the superintendent of the school district wherein the school is located. All efforts were made to ensure that neither the identities of the students nor identifying information concerning the students were known to the researcher. Any and all student information was safeguarded and kept confidential by the third-party research specialist employed by the Oswego County Board of Cooperative Educational Services who was authorized to access NYSSIS and replaced each student ID code in NYSSIS with a unique eight-digit code for each student specific to this study.

Data Analysis

All NYS Math Assessment scores were gathered from students enrolled at the Mexico Middle School, located in Oswego County, New York. Student scores were taken from a cohort of approximately 150 students in 2008-09 (Grade 6), 2009-10 (Grade 7), and 2010-11 (Grade 8) through the NYSSIS website. This is a password-protected site that makes student scores available to authorized users while requiring the user to ensure student confidentiality. The researcher was not an authorized user of the NYSSIS database and, therefore, did not have access to student data. The analysis focused mainly upon student growth on standardized testing, as measured by variances in standard means from one year to the next, within the context of changes that occurred concerning instructional groupings at the middle school from Grade 7 to Grade 8. The release of student data was purposeful and intended to provide an explanation of changes in student achievement, if any, and resulting information that might be used to determine students in need and areas of content in which remediation might be necessary. In addition to the raw score, each score was designated within a range and coded to indicate "not meeting standards" (Level 1), "partially meeting standards" (Level 2), "meeting standards" (Level 3), and "exceeding standards" (Level 4). Once again--and the researcher must emphasize this point--a third-party replaced the student names with coded identifiers specific to this study.

No human subjects participated in this research. The confidentiality of all members of the school system, including staff and students, was protected by the researcher who took every precaution to safeguard information taken from student records. Standard means derived from test scores were analyzed and compared using the Statistical

Package for the Social Sciences (SPSS), version 16.0 software. SPSS was used to analyze data. The researcher used the ANOVA function on SPSS to determine if there were any additional correlations. The researcher used inferential statistics in order to compare test scores of students from the heterogeneous math classes in Grades 6 and 7 to the scores of students from eighth-grade math classes which did not include the presence of their higher-performing peers. The researcher also attempted to determine if the absence of higher-achieving peers (Group B) from the cohort had any influence on the academic achievement of those students who were not permitted to accelerate (Group A).

In order to conduct a comparison of the means of the two student groups (for example, the mean score for lower-achieving students placed in a mixed-ability class in 2009-10 compared to the mean score for the same students in an ability-grouped class in 2010-11), the researcher used a t-test for two related samples with repeated measures (Witte & Witte, 2007, p. 314). To compare the means of the two related samples, the data were analyzed using paired-samples, two-tailed t tests for all three research questions. In all cases, a level of significance of $p<.05$ was used to determine whether the difference between means was statistically significant.

The null hypotheses for Research Questions 1, 2. and 3 are:

Ho l: There is no difference in performance on the NYS Math Assessments for lower-achieving students in mixed-ability math classes between Grades 6 and 7.

Ho 2: There is no difference in performance on the NYS Math Assessments for lower-achieving students in mixed-ability math classes in Grade 7 and ability-grouped students in Grade 8.

Ho 3: There is no difference in performance on the NYS Math Assessments for

lower-achieving, economically disadvantaged students in mixed-ability math classes in Grade 7 and ability-grouped economically disadvantaged students in Grade 8.

The rejection of the null hypothesis for Question 1 would indicate that there was a significant difference in student performance when students were assigned to heterogeneous classes. Further, the rejection of the null hypotheses for Questions 2 and 3 would also suggest that there were statistically significant differences in the year-to-year (annualized) changes in standardized test scores for the NYS Math Assessments for middle school students assigned to lower-tracked math classes as part of a homogeneous instructional grouping.

Summary

Researchers have primarily focused on the analysis of school and community reactions and responses to school initiatives involving a shift from homogeneous to heterogeneous grouping rather than focusing on the influence that detracking has upon student achievement. While some recent studies suggest positive achievement gains for former low-track students placed in heterogeneous classes, other studies suggest a reduction in the achievement gains of high-track students; in particular, gifted and talented students placed in heterogeneous classes. This researcher used a quantitative study in attempting to analyze the influence of heterogeneous grouping on improving student achievement and identify common themes. A rural middle school located in Central New York State was used for this study. In this chapter the researcher presented the design and methods used to conduct a study of students assigned to lower-tracked math classes.

Chapter 4

RESULTS OF DATA ANALYSIS

This chapter presents the data and statistical analyses of data collected to examine the questions presented by the researcher. The first part of this chapter presents the hypothesis that guided the research and an overview of the manner in which data were collected and analyzed. Following this initial overview, the researcher presents the results of the quantitative statistical analysis used to interpret the data. This was done in order to test the research hypothesis and determine the influence, if any, that instructional grouping has on math achievement in a rural middle school. Student achievement in middle-level math was determined by standardized scores on the NYS Math Assessment for sixth, seventh, and eighth grades.

Hypothesis

Based on the review of the literature, the working hypothesis for this study is that the sorting of students by ability level does not increase student achievement and may, in fact, widen the achievement gap for economically disadvantaged students in low-wealth rural school districts. The design of this research is non-experimental, longitudinal, and explanatory (Johnson, 2001).

Data Collection

The researcher requested and reviewed archived student achievement data from the NYSTP Grades 6-8 Mathematics Assessment for 2009 through 2011 for a single cohort. The test scores were then tabulated according to grade level and disaggregated according to ability grouping. The scores for the students who were assigned to an accelerated math program in Grade 8 in the 2010-2011 school year (Group B) were removed from the

general student group (Group A) for all three years of the study. A statistical mean was calculated for Group A at each grade level once the higher-achieving students' scores were removed. Using SPSS statistical software, the means for each paired sample group were compared between years when instructional grouping remained heterogeneous (Grade 6 to Grade 7) and between years when instructional groupings changed from heterogeneous to homogeneous (Grade 7 to Grade 8). The comparison of means was conducted using a paired-sample t-test to determine statistical significance ($p \leq .05$).

Data Analyses and Results

The first research question asked the difference, if any, in performance on the NYS Math Assessments for lower-achieving students in mixed-ability math classes between Grades 6 and 7. The researcher's purpose for this question is to determine if and how the achievement of the general population of students may be influenced when the top-performing students are not removed from the regular course of study into accelerated math programming. The students in this cohort were grouped heterogeneously in both sixth and seventh grade. More specifically, these were randomly grouped students that were placed in sections that were randomly assigned to teachers. The null hypothesis is that there is no difference between each pair of scores in two repeated samples. In this question, the repeated samples are the NYSTP Math scores between sixth and seventh grade in this cohort of students. The null-hypothesis states that there is no difference between the means for the matched pair populations. The researcher is testing to ascertain whether or not the change in the matched pair mean scores happened by random chance. The decision rule for rejecting the null hypothesis was to reject the null hypothesis if the calculated significance of a 2-tailed test is equal or less than .05.

Paired samples t-tests were conducted to determine the significance of the influence of instructional grouping on NYSTP Math scores between sixth and seventh grade (the results from the SPSS statistical analysis are listed in Table 7). In this case, the instructional grouping remained heterogeneous for the cohort in Grades 6 and 7. In 2009, the students were randomly assigned to a mixed-ability instructional group for the purposes of math instruction (n=123) and had a mean score of 674.70 on the NYSTP Grade 6 Math Assessment. At the completion of seventh grade, the same cohort of students took the NYSTP Grade 7 Math Assessment and had a mean score of 676.33 (n=123). The researcher retains the null hypothesis because the 2-tailed level of significance is greater than the .05 level of significance that is required and stated in the decision rule. The mean difference in test scores between the paired samples from sixth to seventh grade was 1.626 with a p-value of .310. Because this is greater than the alpha of .05, the researcher could not reject the null hypothesis. This means that the increase in the mean scaled score from Grade 6 to Grade 7 was likely the result of random chance and not due to heterogeneous instructional grouping. The researcher found no evidence that there is a significant difference between matched-pair mean scores for the group of students who took the NYSTP Grade 6 Math Assessment in 2009 and the NYSTP Grade 7 Math Assessment in 2010.

Table 7

Paired Samples t-Test Comparing Grades 6 and 7 NYSTP Math Scores

Paired Samples Statistics (Pair 1)				
	Mean	N	Standard Deviation	Std. Error Mean
Score 6	74.7	123	25.86	2.331
Score 7	676.33	123	19.273	1.738

Paired Samples Correlations (Pair 1)			
	N	Correlation	Sig
Score 6 and Score 7	123	.730	.000

Paired Samples Test (Pair 1)								
	Paired Differences							
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper	T	f	Sig. (2-tailed)
Score 6 Score 7	-1.626	17.671	1.593	-4.780	1.53	-1.021	122	.310

The first research question was centered upon what differences were present, if any, in math scores when higher-achieving students were randomly mixed with lower-achieving students in math classes between Grades 6 and 7. Because the null hypothesis was retained, the researcher could neither support the practice of randomly assigning students to math classes as a means to improve test scores nor discourage the practice of heterogeneous grouping as a way to prevent lower student achievement.

The second research question focused upon the difference, if any, in performance on the NYS Math Assessments for lower-achieving students in mixed-ability math classes in Grade 7 and ability-grouped students in Grade 8. The researcher's purpose for the second question is to determine if and how the achievement of the general population of

students may be influenced when the top-performing students are removed from the regular course of study into accelerated math programming. The students in this cohort were grouped heterogeneously in seventh grade; however, the higher-achieving students were removed from the general population and placed in an accelerated course in Grade 8. The paired samples in this question reflect the presence of higher-achieving students with lower-achieving students in seventh grade, but higher-achieving students were absent from math classes in which lower-achieving students were placed in Grade 8. The null hypothesis is that there is no difference between each pair of scores in two repeated samples. In this question, the repeated samples are the NYSTP Math scores between seventh and eighth grade in this cohort of students. The null-hypothesis states that there is no difference between the means for the matched-pair populations. The researcher is testing to discover whether or not the change in the matched pair mean scores happened by random chance. The decision rule for rejecting the null hypothesis was to reject the null hypothesis if the calculated significance of a 2-tailed test is equal or less than .05.

Paired samples t-tests were conducted to determine the significance of the influence of instructional grouping on NYSTP Math scores between seventh and eighth grade (the results from the SPSS statistical analysis are listed in Table 8). In this case, the instructional grouping was heterogeneous for the cohort in seventh grade (2009) but was "tracked" into higher and lower-achieving instructional grouping in the eighth grade (2010). In 2010, students were randomly assigned to a mixed-ability instructional group for the purposes of math instruction (n=125) and had a mean score of 675.69 on the NYSTP Grade 7 Math Assessment. At the completion of eighth grade in 2011, the same cohort of students took the NYSTP Grade 8 Math Assessment and had a mean score of

668.48 (n=125). The researcher rejects the null hypothesis because the 2-tailed level of significance is less than the .05 level of significance that is required as stated in the decision rule. The mean difference in test scores between the paired samples from seventh to eighth grade was 7.208 with a p-value of .002. Since this is less than the alpha of .05, the researcher rejected the null hypothesis. This means that the decrease in the mean scaled score from Grade 7 to Grade 8 was not likely the result of random chance. The researcher found evidence that there is a significant difference between matched-pair mean scores for the group of students who took the NYSTP Grade 7 Math Assessment in 2010 and the NYSTP Grade 8 Math Assessment in 2011.

Table 8

Paired Samples t-Test Comparing Grades 7 and 8 NYSTP Math Scores

Paired Samples Statistics (Pair 2)				
	Mean	N	Standard Deviation	Std. Error Mean
Score 7	675.69	125	19.789	1.770
Score 8	668.48	125	31.203	2.791

Paired Samples Correlations (Pair 2)			
	N	Correlation	Sig
Score 7 and Score 8	125	.604	.000

Paired Samples Test (Pair 2)								
	Paired Differences							
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper	T	Df	Sig. (2-tailed)
Score 7 Score 8	7.208	24.888	2.226	2.802	11.614	3.238	124	.002

The second research question was centered on what differences were present in math scores when higher-achieving students were randomly mixed with lower-achieving students in math classes in Grade 7 and then removed from the general population in Grade 8. Because the null hypothesis was rejected, it appears that the sorting of students by ability level does not increase achievement for lower-achieving students assigned to non-accelerated courses.

The third research question asked what the difference was, if any, in performance on the NYS Math Assessments for lower-achieving, economically disadvantaged students in mixed-ability math classes in Grade 7 and ability-grouped economically disadvantaged students in Grade 8? The researcher's purpose for the third question is to determine if and how the achievement of economically disadvantaged students may be influenced when the top-performing students are removed from the regular course of math study and placed into an accelerated program. The economically disadvantaged students in this cohort were grouped heterogeneously in seventh grade, but the higher-achieving students were removed from the general population and placed in an accelerated course in Grade 8. The paired samples in this question reflect the presence of higher-achieving students with lower-achieving, economically disadvantaged students in seventh grade, but higher-achieving students were absent from math classes in which lower-achieving, economically disadvantaged students were placed in Grade 8. The null hypothesis is that there is no difference between each pair of scores in two repeated samples. In this question, the repeated samples are the NYSTP Math scores between economically disadvantaged seventh-grade students and economically disadvantaged eighth-grade students in this cohort. The null-hypothesis held that there is no difference between the means for the

matched-pair populations. The researcher is testing to discover whether or not the change in the matched-pair mean scores happened by random chance. The decision rule for rejecting the null hypothesis was to reject the null hypothesis if the calculated significance of a 2-tailed test is equal or less than .05.

Paired samples t-tests were conducted to determine the significance of the influence of instructional grouping on NYSTP Math scores between Grade 7 and 8 economically disadvantaged students (results from the SPSS statistical analysis are listed in Table 9). In this case, the instructional grouping was heterogeneous for the cohort in Grade 7 but was "tracked" into higher and lower-achieving instructional grouping in Grade 8 and focused solely on economically disadvantaged students in both samples.

Table 9

Paired Samples t-Test Comparing Grades 7 and 8 NYSTP Math Scores (Low SES)

Paired Samples Statistics (Pair 3)				
	Mean	N	Standard Deviation	Std. Error Mean
Score 7	668.44	48	21.194	3.059
Score 8	668.48	48	42.845	6.184

Paired Samples Correlations (Pair 3)			
	N	Correlation	Sig
Score 7 and Score 8	48	.539	.000

Paired Samples Test (Pair 3)								
	Paired Differences							
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper	T	Df	Sig. (2-tailed)
Score 7 Score 8	11.083	36.129	5.215	.593	21.574	2.125	47	.039

In 2010, the economically disadvantaged students were randomly assigned to a mixed-ability instructional group for the purposes of math instruction (n=48) and had a mean score of 668.44 on the NYSTP Grade 7 Math Assessment. At the completion of eighth grade in 2011, the same cohort of students took the NYSTP Grade 8 Math Assessment and had a mean score of 657.35 (n=48). The researcher rejects the null hypothesis because the 2-tailed level of significance is less than the .05 level of significance that is required as stated in the decision rule. The mean difference in test scores between the paired samples from seventh to eighth grade was 11.083 with a p-value of .039. Because this is less than the alpha of .05, the researcher rejected the null hypothesis. This means that the decrease in the mean scaled score from grade seven to grade eight for economically disadvantaged students was not likely the result of random chance. The researcher found evidence that there is a significant difference between matched-pair mean scores for the group of economically disadvantaged students who took the NYSTP Grade 7 Math Assessment in 2010 and the NYSTP Grade 8 Math Assessment in 2011.

The third research question was centered on what differences were present in math scores when higher-achieving students were randomly mixed with lower-achieving, economically-disadvantaged students in math classes in Grade 7 and removed from the general population in Grade 8. Because the null hypothesis was rejected, it appears that the sorting of students by ability level does not increase achievement for lower-achieving, economically-disadvantaged students assigned to non-accelerated courses.

Summary

In this study, the researcher compared the standardized test scores for a group of lower-achieving students who were able to interact with higher-achieving students in Grades 6 and 7 but who were unable to interact with higher-achieving students and accelerated instruction in Grade 8 due to the practice of sorting by ability level. The results of these analyses indicate that sorting by ability level, in this case by higher-track and lower-track, does not contribute to improved test scores for lower-tracked and economically disadvantaged students. The following chapter includes a summary of the findings as well as recommendations for policy, practice, and further research.

Chapter 5

SUMMARY, CONCLUSIONS, DISCUSSION, AND RECOMMENDATIONS FOR POLICY, PRACTICE, AND FOR FURTHER RESEARCH

The researcher examined how students' math achievement is affected when students have restricted access to accelerated math study in a dual-tracked math system. The study was conducted in a low-wealth rural school district. By using an explanatory non-experimental research design, the researcher gained an understanding of the manner in which schools can degrade the performance of students in math by separating them into lower and higher achieving instructional groupings. In the current era of government-mandated school accountability (2012) that prescribes remediation for underperforming students through privately outsourced programs, it becomes especially vital that schools deliver a rigorous course of study to all of its students.

School districts are required to protect students who are classified as learning disabled and must provide a rationale whenever SWDs are placed in a setting other than the general education classroom (Brady, 2010). While the rights of special education students are protected under the IDEA (Individuals with Disabilities in Education Act), the quality of education is not necessarily supported for all students. In fact, the practice of tracking students according to ability level is common practice in New York State public schools in math. Here, low achievers are placed in remedial programs in order to determine how the student responds to intervention (RTI) as part of AIS requirements under NCLB. Low-achieving math students are not typically allowed to take accelerated math classes due, in large part, to the requirements of the accountability movement in education and the commonly-held assumptions by math teachers that "the basics" must be

mastered before students are permitted to study Algebra I (Loveless, 1984; Rubin, 2008).

This researcher found no evidence to support the concept that the separation of students into ability groups in math had a positive influence on any category of students – disabled, at-risk, high-achieving, or low-achieving. In this middle school, as in many middle schools across New York State, high-achieving students receive a curriculum that is different from the curriculum taught to average or low achievers or heterogeneously grouped students. This is due to the belief that when high-achieving students study in heterogeneously grouped classes, their achievement diminishes. These beliefs are often grounded in the conclusions presented in low-track/high-track studies (Burris, 2003). This researcher has conducted a cursory examination of the performance of high-achieving students as they moved from heterogeneous instructional grouping in seventh grade to an eighth-grade accelerated program in math. However, because of the small sample size of the high-achieving student cohort (n=24), this researcher was unable to draw any statistically significant conclusions from the student-achievement data.

The researcher studied the average academic performance of the lower-achieving students when higher-achieving students were excluded from the non-accelerated eighth-grade math classroom. The literature on accelerated math study and its benefits to students continues to provide a strong rationale to discontinue ability grouping and to move toward more universal acceleration. An increase in the study of algebra in the eighth grade is associated with an increase in the study of advanced math during the high school years, even after controlling for factors such as math proficiency, SES, and parental education level (Law, 2011). The study of advanced math is further associated with high rates of college enrollment and even higher college completion rates. In addition, the study of

algebra in the eighth grade enhances the opportunity for the study of calculus in high school, a course that provides students with advantages such as (1) greater success in college calculus study and (2) an advantageous signal to colleges in the application process (Adelman, 1999; Warburton, Bugarin, and Nunez, 2001).

Despite what is known about accelerated math study, not all American students are afforded the opportunity to study an accelerated curriculum. Less than 25% of all American eighth graders study algebra. In Japan, however, all eighth graders study algebra (Drueck, Carroll, Fuson & Bell, 1995). The percentages of African American and Latino students studying accelerated math are even lower than the United States' average. Only 13% of Black students and 12% of Latino students take eighth grade algebra, as compared with 22% of White students and 42% of Asian/Pacific Islanders (Swail, Cabrera, Lee, & Williams, 2005). Swail et al. (2005) found that taking pre-calculus and calculus in high school increased the chances of college completion of Latinos by 12 %. Given this, those in the field of public education can no longer ignore post-secondary dropout rates for at-risk ethnic and SES groups. Dropout rates for said students remain comparatively high and appear to be a progressively growing trend in the K-12 educational setting.

The studies summarized above are based on tracked systems; that is, systems in which students are assigned to different instructional groups based on initial achievement levels of learners. Such differentiation is an attempt by educators to respond to the differences in student achievement by varying both instructional pace and curriculum. A vast body of literature exists that debates this grouping practice and its effects upon different learners (Hoffer, 1992). Some studies support the practice while others do not.

Emerging from the debate is the following question: If some students are not given access to the study of algebra in the eighth grade in heterogeneously grouped classes, what are the short-term results? Answering that question was the purpose for this study. In this chapter, a summary of the study is presented to include the research problem, findings, and conclusions. In addition, recommendations for policy, practice, and for future research are provided.

Summary

Research regarding programs that include more students in higher-track classes (Leow, Marcus, Zanutto, & Boruch, 2004), as well as a study of providing an enriched, accelerated curriculum to at-risk students (Gamoran, Porter, Smithson, & White, 1997), has shown promising results. It appears from such studies that an accelerated, high-track curriculum benefits students who generally receive low-track, remedial instruction. This researcher examined the inverse of this model by studying the effects of excluding lower-achieving students from a high-track math curriculum in the eighth grade after said students had previously been placed in a heterogeneous math group with high-achieving students in Grades 6 and 7. The researcher examined whether lower-achieving students were able to make significant gains in achievement on standardized math testing once high-achieving students were removed from their math classes. It is a unique contribution in that all previous studies known to the researcher are based on data that do not consider the combination of variables of math achievement in a tracked, middle-level math program in a high poverty, rural school system.

As the researcher has noted in the introduction, the accelerated curriculum is usually provided to high achievers, while other students of initial, average, and low

achievement are placed in classes where teachers instruct students in pre-algebra or Math 8 curricula. The three-track system is so common that the research literature on tracking usually examines only its effects on three groups of learners: students of low, average, and high achievement. Therefore, this researcher examined the effects of removing a single track of high-achieving students from a previously heterogeneous group of middle-level math learners. Again, there are no studies known to this researcher that consider this pre-track/post-track effect on "non-accelerated" math students in low-wealth middle schools.

This study was non-experimental and used a longitudinal, explanatory design (Johnson, 2001). The data used for this ex post facto study were archival (Kerlinger, 1968). The data were from a rural middle school classified as a "School in Need of Improvement Year 1 (SINI 1)" by the NYSED in the 2011-2012 school year. Enrollment in the district ranged from 2,349 students in 2009, to 2,149 in 2011. Middle school enrollment was 766 in 2009, and 691 students in 2011. The data analyzed in this study were the NYS Mathematics Assessments for sixth, seventh, and eighth-grade students in the 2008-2009, 2009-2010, and 2010-2011 school years. The data collected were analyzed to answer three research questions:

1. What is the difference, if any, between the NYS Middle Level Math Assessment performance for lower-achieving students in Grade 6 (heterogeneous instructional grouping) and the performance for the same students in Grade 7 (also grouped heterogeneously)?
2. What is the difference, if any, between the NYS Middle Level Math Assessment performance for lower-achieving students in Grade 7 (heterogeneous instructional grouping) and the performance for the same students in Grade 8 (homogeneous

instructional grouping)?

3. What is the difference, if any, between the NYS Middle Level Math Assessment performance for economically disadvantaged students in Grade 7 (heterogeneous instructional grouping) and the performance for the same students in Grade 8 (homogeneous instructional grouping)?

Based on the review of the literature and the prior related research studies, the hypothesis for this study was that the removal of the higher-achieving students would have a statistically significant influence ($p \leq .05$) on the academic achievement of the lower-achieving student in a middle school math course. The sample groups compared a cohort of lower-achieving students in math classes in Grades 6, 7, and 8. In Grades 6 and 7, the lower-achieving and higher-achieving cohorts were grouped heterogeneously, while in Grade 8, the higher-achieving students were placed in an accelerated algebra track. Independent t-tests were conducted for all three research questions with the use of the SPSS Statistical Software. For Research Question 3, the effect of sorting students by ability was observed only upon those students who were classified as economically disadvantaged; i.e., from low SES backgrounds.

The first research question was centered on the differences, if any, that were present in math scores when higher-achieving students were randomly mixed with lower-achieving students in math classes between Grades 6 and 7. Because the null hypothesis was retained, the researcher could neither support the practice of randomly assigning students to math classes as a means to improve test scores nor discourage the practice of heterogeneous grouping as a way to prevent lower student achievement. This means that the increase in the mean scaled score from grade six to grade seven was likely the result of

random chance and not due to heterogeneous instructional grouping. The researcher found no evidence that there is a statistically significant ($p \leq .05$) difference between matched-pair mean scores for the group of students who took the NYSTP Grade 6 Math Assessment in 2009 and the NYSTP Grade 7 Math Assessment in 2010.

The second research question was centered on those differences that were present in math scores when higher-achieving students were randomly mixed with lower-achieving students in math classes in Grade 7 and then removed from the general population in Grade 8. Because the null hypothesis was rejected, it appears that the sorting of students by ability level does not increase achievement for lower-achieving students assigned to non-accelerated courses. In this case, the instructional grouping was heterogeneous for the cohort in seventh grade but was "tracked" into higher- and lower-achieving instructional groupings in the eighth grade. In 2010, students were randomly assigned to a mixed-ability instructional group for the purposes of math instruction ($n=125$) and had a mean score of 675.69 on the NYSTP Grade 7 Math Assessment. At the completion of eighth grade in 2011, the same cohort of students took the NYSTP Grade 8 Math Assessment and had a mean score of 668.48 ($n=125$). The researcher rejects the null hypothesis because the 2-tailed level of significance is less than the .05 level of significance that is required as stated in the decision rules. The mean difference in test scores between the paired samples from seventh to eighth grade was 7.208 with a p-value of .002. Because this is less than the alpha of .05, the researcher rejected the null hypothesis. This means that the decrease in the mean scaled score from Grade 7 to Grade 8 was not likely the result of random chance. The researcher found evidence that there is a statistically significant ($p \leq .05$) difference between matched pair mean scores for the group

of students who took the NYSTP Grade 7 Math Assessment in 2010 and the NYSTP Grade 8 Math Assessment in 2011.

The third research question was centered on what differences were present in math scores when higher-achieving students were randomly mixed with lower-achieving, economically-disadvantaged students in seventh-grade math classes but removed from the general population in Grade 8. Because the null hypothesis was rejected, it appears that the sorting of students by ability level does not increase achievement for lower-achieving, economically-disadvantaged students assigned to non-accelerated courses: The decrease in the mean scaled score from Grade 7 to Grade 8 for economically disadvantaged students was not likely the result of random chance. The researcher found evidence that there is a statistically significant ($p \leq .05$) difference between matched-pair mean scores for the group of economically disadvantaged students who took the NYSTP Grade 7 Math Assessment in 2010 and the NYSTP Grade 8 Math Assessment in 2011.

Conclusions

The analyses of the variances of NYS Math Assessment scores for lower-achieving students assigned to non-accelerated math courses yields salient findings concerning the manner in which instructional grouping influences the achievement of students assigned to the lower-track. The results of the study were consistent with similar research conducted on students who were not permitted to accelerate. In this study, when lower-achieving students were assigned heterogeneously in the sixth and seventh grades, there were no statistically significant differences in their levels of achievement. However, when the students were sorted into high- and low-tracks, the scores of lower achieving students declined significantly.

Previous research regarding instructional grouping has, for the most part, focused upon the influence of tracking on different categories of students. Further, there are a number of studies that are largely qualitative in nature that consider the reasons why students are grouped by ability in the first place. Given the nature of these findings and the widespread sorting of students according to ability level in New York State--often in spite of these findings--this researcher initiated this study with the working hypothesis that no significant influence would be found when students were sorted into a high-track curriculum and lower-track curriculum for the purposes of eighth-grade math instruction.

Much of the research that has addressed the effects of instructional grouping are referred to as "track/no track" studies. The work of Henry Levin (1988) supports the idea that students with learning deficits should be exposed to more rigorous learning opportunities. School administrators who understand how struggling students respond to math acceleration can provide a more positive intervention than would otherwise be gained through remediation or a lower-tracked curriculum. In spite of the judicial background that denounces the practice of tracking as illegal, higher-achieving students are still afforded the opportunity to accelerate in New York State schools. A review of the literature and past research indicates that all students, regardless of ability level, can benefit from placement in a heterogeneous classroom that stresses an accelerated curriculum (Kulick, 1992; Slavin et al., 2009). School administrators must consider how instructional grouping promotes, or suppresses, student achievement. Many states are currently adopting a "common-core" curriculum in math to ensure that schools are held accountable for student learning that will be offered at an acceptably defined standard. In extremely few instances, however, have states addressed the influence of ability grouping

on student performance and, in most cases, continue to stress remediation through AIS as the prescription for student learning deficits.

At the close of the 2010-2011 school year, most schools in New York State were listed as being "in need of improvement" as evidenced by a review of student performance on Math and ELA Assessments. In order to remedy this situation, the NYS Board of Regents and the Commissioner of Education applied for federal funding as part of the President's "Race to the Top" initiative. In order to qualify for this competitive grant, the Commissioner needed to demonstrate that New York State schools were incorporating standardized test scores into teacher evaluations. This component of the teacher performance review could further serve to prevent the heterogeneous placement of students into accelerated math courses due to teacher concerns of less-than-favorable evaluations as a result of students' failure to make adequate progress. In light of the demands associated with improved student performance in math, it is significant that school administrators understand that tracking does not contribute to student gains and, in all likelihood, suppresses student achievement for many as evidenced in this study.

The purpose for this study was to determine if and how the achievement of the general population of students may be influenced when the top-performing students are removed from a regular course of study and placed into accelerated math programming. Based on previous research and a review of the literature, this researcher has established that the null hypotheses of sorting students by ability into low and high tracks would have no statistically significant influence on the academic achievement of the lower-achieving students. The concern of the school administration and the teachers was that the lower-achieving students did not have the computational skills to be successful in the more

rigorous instructional setting that was to be found in an accelerated algebra section. Reports of teacher perceptions indicated that, although they favored heterogeneous instructional grouping as a moral imperative, teachers were concerned with their ability to differentiate instruction and the slowed, "less-than-challenging" pacing for advanced students that would result from a mixed-ability class.

Recommendations for Policy, Practice, and Further Research

While NCLB legislation has put forth the notion that children are being left behind due to an inability to service their education needs adequately, this legislation provides little insight as to how students performing poorly in math are influenced by instructional grouping. An understanding of the results of this study is intended to provide school administrators with additional information that will prove useful in developing practices that will prove beneficial to lower-achieving math students. While the limitations of this study do not allow generalization of the results, school administrators will be given a rationale to consider heterogeneous placement as a means to improve student performance rather than establishing educational structures that segment students into high- and low-track instructional groupings. This becomes especially relevant since recent accountability measures provide greater financial support to remediation but little to encourage acceleration in school districts that are economically stressed. In spite of this, it is evident from this study and related research that schools and communities that sort students according to ability in math are suppressing student achievement.

Previous researchers have largely focused on the negative teacher and community perceptions of heterogeneous instructional grouping that promotes tracking according to ability and the inequities that result when the composition of lower-tracked classes is

largely at-risk student groups. Clearly, human rights must be taken into consideration when lower-tracked classes contain high percentages of students who are economically disadvantaged or are of racial or ethnic minority groups. Careful consideration needs to be taken by school administrators to ensure that students from at-risk categories are not channeled into low-track instructional settings. When tracking degrades student performance, particularly for economically disadvantaged students, school administrators are obligated to seek other solutions. These solutions include altering the structural framework of instructional groupings to include class size and heterogeneous placement of students. This aspect of school accountability is stressed in many states since student performance data on standardized assessments are disaggregated by student-wealth, and schools are subsequently held accountable when economically disadvantaged students underperform.

Beyond this, school administrators should promote an understanding by their faculties and parents of the research that considers the limited impact that heterogeneous instructional grouping has on the higher-achieving students. Here, school administrators can remove barriers to heterogeneous placement of students that may arise from misplaced parental and staff concerns. While random placement of students to randomly assigned teachers is not entirely possible, a review of student test data aggregated by teacher may improve the likelihood that at-risk students are given improved access to a high-level curriculum in a particular school. The school administrators in the school used for this study are considering adding additional sections of algebra and biology which are also offered as accelerated courses. While this still maintains a "dual-track" system, the shift will provide opportunities to lower-achieving students who would have otherwise fallen

into the lower track. Incrementally abolishing the dual-track over time has implementation considerations that are worthy of future study.

The shift in the composition of the lower-tracked classroom in eighth grade warrants further review. When top performing students are accelerated into an algebra class, the percentage of at-risk students in the lower-tracked classes increases. The influence of this "concentration effect" should also be considered in future studies. It is possible that the lower achievement of the students in the low-tracked math class may have been the result of the low expectations that both the teachers and the community hold for those students. When students are heterogeneously grouped in Grades 6 and 7, the resultant after-school support from teachers includes a blend of remediation and enrichment. Once students were tracked in the eighth grade, however, the depth and scope of after-school support from teachers seemed to favor remediation for the low-achievers and enrichment for the high-achieving students, again an area for further investigation. The establishment of a culture that emphasizes enrichment and rigor, both during and after school, for all students is a paramount consideration for school administrators seeking to improve student achievement.

Math teachers may be reluctant to accept instructional grouping that is not ability based, due to the challenges associated with a classroom containing diverse learners. This apprehension is often the result of a lack of understanding of the features of effective instruction for diverse learners. The research literature on teaching diverse learners consistently reveals a common set of instructional features that lead to higher achievement by all students. While the theoretical basis of these instructional strategies are implied in this study, it would be helpful to gain a better understanding of the important features of

effective instruction for students at risk for academic difficulties.

The National Mathematics Advisory Panel (NMAP) was commissioned in April 2006 to review the national trends in math achievement and empirical research on effective math instruction and to develop recommendations for teaching math in elementary and secondary schools. The NMAP released its recommendations in a 2008 report that found insufficient research to support whether teacher-directed or student-directed instruction is more beneficial to students (NMAP, 2008). Further, it is currently unknown (as suggested in the NMAP study) exactly what and how much math knowledge a teacher needs to be optimally effective. In this study, the factor that the classes were heterogeneously grouped in sixth and seventh grades and ability-grouped in the eighth grade needs to be considered and how this change in grouping may have influenced instructional strategies.

There are several factors that should be addressed when interpreting the results of this study and in consideration of future research. No distinction was made concerning the influence of students with disabilities (SWDs) on the overall achievement of said group. There were no SWDs with the higher-achieving student group and there may have been a "concentration effect" on the lower-achieving student group. Is there then a ratio of high-achieving students to low-achievers that is required to prevent the "dropping-off" in student scores that was evidenced when the classes were ability-grouped in Grade 8? Additional study of the effects of heterogeneous grouping under these conditions is warranted, particularly SWDs and other at-risk student categories that raise possible human-rights concerns.

Despite the inherent human-rights implications and the inherent risks associated

While a review of the literature suggests that high-achieving students are not influenced by the presence of low-achieving students in math classes, this researcher was not able to reach this specific conclusion from this study because of the small sample size of the high-performing eighth grade cohort. An area of future research might consider a track/no-track study comparing initial high-achievers across many New York State schools that either place students in heterogeneous or homogeneous math groupings and related achievement issues, if any. While the placement of low-achieving eighth grade students in Algebra I is uncommon in New York State, the possibility of positive student outcomes associated with heterogeneity and acceleration, regardless of ability level, may contribute to this practice becoming more common.

In addition to addressing the limitations outlined above, researchers interested in the topic may find it advantageous to use this study to identify areas for future research. Such research might pursue the following related areas:

- The middle school in this study currently provides remedial instruction for math students through an assigned extra block of time in remedial math instruction. This would suggest that additional study concerning acceleration as an alternative to remediation is in order. This researcher strongly suggests that struggling students learning algebra can also concurrently master computational tasks, or "the basics." Rubin (2007) suggests that math is generally considered to be one of the most difficult subjects to de-track since teachers generally desire to sort students according to each child's computational skills. A topic for further study might well be directed at the identification of features of math instruction that will permit differentiated instruction in a mixed-ability classroom.

- In order to implement any type of detracking reform in the middle school identified in this study, a qualitative study on the culture of the district that has thus far prohibited the implementation of structural changes would provide insight for the administrators considering change. What are the essential components needed to de-track a rural school with minimal political upheaval? What leadership styles might be used to implement, and sustain such a reform? Research in this area might well begin with the questions posed by Carol Burris (2003): "What is the relationship of school culture to successful detracking? Are the attitudes of teachers and parents significantly different in this district than in other districts?" While this type of reform may yield successful results in a suburban school district where low-SES and at-risk student groups are the exception, uncertainties exist that raise the questions over this type of reform in a rural district with significantly fewer community resources.
- Given the questions raised by this researcher over tracking/detracking in this study, the district used in this study is currently engaged in promoting and adding additional course offerings in the physical sciences. How will improved student access to accelerated coursework in math at the middle school influence the study of advanced science at the high school? How is the study of advanced science--living, physical, or social--in high school influenced by the study of accelerated mathematics at the middle school? Frykholm and Glasson (2005) suggest that there is a relationship between course-taking patterns in math and science. Middle school science courses which are largely based on reading comprehension and developing a "scientific vocabulary" are becoming increasingly quantitative as a

result of the recent changes to the statewide curriculum.

The effects of class size should be an area of future research since any sort of reform that restructures the composition of learners in a classroom could very well be impacted by the types of learners and the number of students assigned to a teacher in a class. In their seminal study on class size effects, Finn and Achilles (1990) suggest that classes that have smaller enrollments in kindergarten through fourth grade promote higher student achievement. How then would class size influence students assigned to heterogeneously grouped math classes in a middle school math program?

Finally, this study indicates the need for more secondary school studies of de-tracking where the high-track curriculum is taught to all learners. How does a teacher effectively meet the needs of all students in classrooms having a wide range of prior achievement? What support, if any, must be given to struggling learners when the high-track curriculum is taught? Is this practice key to closing the achievement gap between affluent students and students in poverty? Recent research suggests that providing all students with challenging, standards-based curriculum in math may be the key to closing the achievement gap (Haycock, 2001).

Although this study has limitations and delimitations and cannot be widely generalized, it does contribute to a growing body of research that can be considered when planning and structuring classes. It is encouraging to note that the research now suggests that heterogeneous instructional grouping provides greater benefits to students than homogeneous grouping and that, in this study and others, tracking inhibits achievement of students in middle-level math. More so than ever before, administrators are in an ideal position to better understand the influence of tracking on student performance and to

create master schedules and student support systems to ensure that students of varying ability levels have access to the highest quality curriculum. Given this scenario, it would not be unrealistic that a principal of a middle school could create a math sequence where every eighth-grade student could take Algebra I (assuming that each student had early access to skills acquisition that result from explicit and systematic instruction).

As districts across New York State and the country engage in implementing education reforms designed to improve student achievement, serious consideration must be given to heterogeneous instructional groupings that will give students of varying ability equal access to challenging, high quality curriculum and instruction in math. Taking the next steps to de-tracked middle school math instruction will require districts to implement research-based processes that will place diverse learners in the same classrooms. Despite the problems described in this study, restructuring schools to provide improved access to more rigorous academic programs is a reform that holds promise for students and society as a whole. The mere existence of a tracked instructional program subconsciously suggests to students that their school is not committed to equity and, ultimately, the best possible performance for all students. The movement to heterogeneously grouped math classes warrants a redistribution of resources within schools from the most advantaged to the least advantaged students. The act of detracking students in middle school math courses can offer a solution to these inequalities while providing the opportunity to redress related achievement concerns.

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Appendix A

Glossary of Terms

The following terms were used operationally for this study:

Academic Intervention Services (AIS) – Programs that school districts in New York State are required to provide "to assist students who are at risk of not achieving the learning standards in English language arts, mathematics, social studies and/or science, or who are at risk of not gaining the knowledge and skills needed to meet or exceed designated performance levels on state assessments" (School Law, 2010).

Ability Grouping – The practice of grouping students according to ability and, for the purpose of this research study, flexible grouping primarily within classrooms.

Adequate Yearly Progress (AYP) – An annual measure of student progress utilizing data obtained on state constructed and mandated testing instruments (Rebore, 2007).

Detracking – The process of dismantling institutional and organizational structures and/or instructional barriers that sort students according to ability.

Differentiated Instruction – An instructional design model that emphasizes the importance of being able to simultaneously recognize and address the diverse learning needs as well as the abilities of all learners in a single classroom setting (Tomlinson & McTighe, 2006).

Heterogeneous Grouping – "A method of grouping students with varying abilities, learning styles, backgrounds, and racial and ethnic origins, with an emphasis on challenging curriculum and instruction for all students" (Wheelock, 1994, p. 76).

Higher-Achieving Students – Students placed in the highest academic track or strand available based on perceived or tested ability levels.

Homogeneous Grouping – "The practice of grouping of students in the same classes and work groups according to perceived abilities or performance levels: low, average, high" (Wheelock, 1994, p.76).

Lower-Achieving Students – Students traditionally placed in the lowest academic track and/or strand based on perceived or tested ability levels.

New York Board of Regents – Seventeen (17) members elected for five (5) year terms by the New York State legislature. The Regents are responsible for the general supervision of all educational activities within the State, presiding over The University and the New York State Education Department (The New York Board of Regents, 2007).

No Child Left Behind Act (NCLB) – "While NCLB has certain provisions that apply only to Title I schools, the law clearly requires all states to develop a single system of accountability so there will be uniform standards for all children. Each state is required to develop student testing programs and demonstrate satisfactory student improvement each year. States are also required to pay particular attention to the progress of children from minority groups and children with disabilities" (Rebore, 2007, p. 4).

Regents Diploma – A benchmark or standard by which students are recognized to have achieved a certain level of proficiency. In order to earn a New York Regents Diploma students must successfully complete 22 credits in specified subject areas and evidence academic proficiency by obtaining a minimum score of 65 on the Regents Examination in five subject areas: Comprehensive English, Mathematics, Science, United States History and Government, Global History and Geography.

Regents Examination – The assessment utilized for the purpose of issuing a Regents Diploma.

Tracking – The practice of "sorting and grouping students by perceived ability" (Oakes, 1985, Rubin, 2003). Also, tracking has the connotative meaning of permanent grouping. Tracking has become a negative term in education as evidenced in the research of Slavin (1995) and Oakes & Wells (1997).

Appendix B

IRB non-Review Certification

SETON HALL UNIVERSITY
1856

Department of Education Leadership, Management and Policy

IRB non-Review Certification

STUDENT: Robert R. Pritchard

Title of Dissertation: THE INFLUENCE OF ABILITY GROUPING ON MATH ACHIEVEMENT IN A RURAL MIDDLE SCHOOL

I certify, by my signature below that the above indicated study does not require IRB review as a result of a lack of involvement with human subjects (see OHRP flow chart) and a indicated by any or all f the following (check all that apply).

1. Historical research ☐
2. Public data-base ☐
3. *Proprietary data-base ☑ * NYSSIS (see note at the bottom of the page)
4. Freedom of Information ☐
5. Right to know – sunshine law ☐

Student signature: Robert Pritchard Date: 10/09/11

Advisor signature: C M Achilles Ed.D. Date: 10/14/2011

Reviewed by: _____ Date: _____
Martin Finkelstein, Ph.D. – Higher Ed

Reviewed by: _____ Date: 10/14/11
Daniel Gutmore, Ph.D. – K-12

* Proprietary data that does not identify individuals.

*** New York State Student Information System (NYSSIS - a proprietary database) assigns a unique, permanent identifier to each student in public schools throughout New York State. It generates and maintains a unique student identifier and stores essential identifying information about students in a secure and confidential environment. It ensures that only authorized users are capable of accessing or entering student records (in this case, Ms. Mary Ann Preston, a third party research specialist employed by the Oswego County Board of Cooperative Educational Services).**

The researcher has agreed to have Ms. Preston provide him with NYS Math Assessment scores for a cohort of approximately 150 students. This information will be coded and the students' identities will be confidential - even to the researcher. The researcher has also agreed to use this archived data solely for the purpose of his doctoral research study for Seton Hall University on the influence of ability grouping on the academic performance of general education students in math.

Appendix C

District Approval to Conduct Study

Russell Partrick, President
Mexico Central School District Board of Education
40 Academy Street
Mexico, New York 13114
(315) 963-8400 ext. 5401
(315) 963-3325 (fax)

September 5, 2010

RE: Robert R. Pritchard's Dissertation Research

To Whom It May Concern:

As President of the Board of Education for the Mexico Academy and Central School District, I approve of Robert R. Pritchard's efforts to conduct research in our school system in support of his doctoral degree requirements. While the overall performance of the middle school has been favorable – as illustrated by the performance indices of the general student population on New York State Intermediate level assessments – the performance indices for at-risk subgroups have fallen short by comparison.

We are hopeful that the findings of this study will reveal insight into how to better address student achievement in our middle school. This may influence Board of Education decisions that will permit ongoing policy development and promote best practices, not only in this district, but in other school systems as well.

I have spoken with Robert and understand the scope of his research and how he will collect and present his data. All information to be gathered will be done in a confidential and appropriate manner and not involve any human subjects. I further understand that this study is expected to run from Fall 2011 through Spring 2012.

Should you have any questions, please feel free to contact me.

Sincerely,

Russell Partrick
President, Board of Education
Mexico Academy and Central School District