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Detracking High School Physical Science Classes through Teacher Efficacy: An Action Research Study

Vincent Scott Taylor
University of South Carolina

DETRACKING HIGH SCHOOL PHYSICAL SCIENCE CLASSES THROUGH TEACHER EFFICACY: AN ACTION RESEARCH STUDY

by

Vincent Scott Taylor

Bachelor of Science
The Citadel, 2000

Master of Education
Converse College, 2004

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Accepted by:

Susan Schramm-Pate, Major Professor

Richard Lussier, Committee Member

Russell Conrath, Committee Member

Kenneth Vogler, Committee Member

Cheryl L. Addy, Vice Provost and Dean of the Graduate School

DEDICATION

I dedicate this dissertation to my devoted family and their abundance of love for me through this process. To my beloved wife, Jennifer. Without her immense sacrifices, overwhelming patience, and persistence, this journey would never have come to fruition. To my son Aaron, who was a consistent source of encouragement, I hope this process instills within you a strong work ethic with an appreciation of the value of education. To my parents, I am thankful for the perpetual support you have provided me since my youth.

ABSTRACT

This study uses the action research method to determine whether students enrolled in a basic science course (Physical Science College Prep) can be successful learning more advanced material (Physical Science Advanced) by increasing teacher efficacy. Currently, there are three levels of Physical Science courses taught at the study school, a high school in South Carolina, USA. The most basic course, Physical Science College Prep, is comprised of 76% minority students, and 56% who receive a free or reduced-cost lunch. In the spring semester of 2017, a group of students (n = 14) completed two units of study: Unit One - Experimental Design and Unit Two - Classification of Matter. The students experienced a variety of teaching methods and techniques, including problem-based learning, lectures, classroom discussions, and laboratory experiments. The results showed that the students were able to maintain a B-grade average. In fact, the overall average grades actually increased from 87.08 in Unit One to 87.67 in Unit Two. The results of this study accompany a recommendation for district and school administrators to de-track the Physical Science course. Instead of offering the more basic College Prep course, all students can be successful in the Advanced and Honors-level courses.

Keywords: tracking, efficacy, detracking, high school, physical science

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CHAPTER 1: INTODUCTION TO THE ACTION RESEARCH

Introduction

Topic

Student achievement in tracked ninth-grade science classes has long-term academic and social ramifications. *Tracking* is "the practice of grouping students into separate classes based on achievement" (Loveless, 2009) and many observers argue that tracking "polarizes the student body into pro-school and anti-school factions", while "students tend to form friendship with others in the same track" (Gamoran, 1992). In many schools, tracking students in math and English begins in middle school, and the idea is reinforced in high schools when "across the country, mathematics classes are usually grouped by topic…meaning that a student's placement largely depends on the course taken their previous year" (Loveless, 2009). However, at this research site, tracking in science classes starts in ninth grade (which is the first year of high school). The justification given for tracking is that it helps prepare students for future career and/or educational paths.

At the research site, students enrolled in Physical Science Honors or Physical Science Advanced are within a "track" to take college-level courses their junior or senior year. These college-level include both advanced placement (commonly referred to as A.P) and dual enrollment. Students enrolled in Physical Science College Prep are on a track to complete the three science classes necessary for high school graduation. The administration at the district level recognizes some of the detrimental effects of tracking and starting in the fall of 2016, this researcher's district embarked on a new initiative working with Equal Opportunity Schools to "find students missing from the most rigorous classes and change their life trajectories" (Equal Opportunity Schools, n.d).

As the only school in the state of South Carolina chosen to undertake this ambitious project, Equal Opportunity Schools will work with this researcher's school to remove barriers and create opportunities for more students to take the college level courses. Equal Opportunity Schools will work with the administration and teachers to help identify juniors and seniors who are "stuck literally just across the hall from advanced high school classes they are ready to succeed in" (Equal Opportunity Schools, n.d). Waiting the students are juniors or seniors in high school does not necessarily have an adverse effect on college acceptance. Tanya Abrams (2013) of the *New York Times* interviewed Jeff Rickey, Dean of Admission at St. Lawrence University, who said, "We will consider grades in the academic courses over the arc of the years, but also each year separately. That allows us to see performance over time and determine any trends." He also went on to say, "the student should take the most challenging course that is best for him or her."

Students should not have to wait until they are juniors or seniors to feel the effects of the "tragedy of twenty-feet" (Equal Opportunity Schools, n.d) when there are higher-level courses with greater opportunities just across the hall. To some students, tracking is a barrier because "track placements appeared arbitrary, designed to serve the needs of their schools' master schedules rather than the needs of the students" (Yonezawa & Jones, 2002). As freshmen in high school, students tracked into lower achieving science classes are literally just across the hall from higher achieving science classes.

A precedent has already been set at the research site for detracking or possibly reducing the number of tracks. In 2009, the school and district saw fit to remove the lowest level of social studies classes, only offering two levels of social studies—honors and advanced. Following suit from the South Carolina State Department, the grading scale does not recognize a difference in the grade point average (G.P.A) between a student who makes an 87 in a College Prep course or an 87 in an Advanced level course. The uniform grading scale throughout the state of South Carolina only distinguishes GPA for honors and advance placement courses. Starting in the 2017-2018 school year, the research site will remove the lowest-performing math class (Foundations of Math), and all students not enrolled in Geometry or Algebra II Honors classes will enroll in Algebra I. Approximately 35% of the students enrolled in Algebra I will complete the course over two semesters, while the remaining 65% will follow the traditional block schedule of one semester. Students completing Algebra I in the ninth grade will have a better opportunity to enroll in higher-level math and science courses further on in high school.

Protheroe (2008) defines efficacy as the "teachers' confidence in their ability to promote students' learning." Several factors lead to a high teacher efficacy to include past experiences, success rate of the students, and even school culture. Teacher efficacy is broken down into two parts: teachers own feeling of confidence in teaching abilities and the general influence that teachers have over students in the classroom. Both are important but have proved to be independent of each other (Protheroe, 2008). Tschannen-Moran, Hoy, and Hoy (1998) developed a scale (Figure 1.1) to measure teacher efficacy in three categories: efficacy in student engagement, efficacy in instructional strategies, and efficacy in classroom management

Currently, the research site offers three levels of physical science classes that are tracked: Physical Science Honors, Physical Science Advanced, and Physical Science College Prep. Within the last two years, in an effort to promote college and career readiness, the South Carolina State Department of Education changed the name of the Physical Science College Prep class to Physical Science Advanced, and Physical Science Tech Prep to Physical Science College Prep. In this researcher's district, no recommendation process exists for students entering the ninth-grade; however, middle-school science teachers regularly use the current math course, the recommended ninth-grade English course, student behavior, student interest, parent interest, and teacher intuition to recommend a course.

The state of South Carolina does not allow middle schools to group science students according to academic ability. In turn, teachers insist it is difficult to challenge the intellect of all students in the classroom. Academically, as freshmen, some students might not be ready to commit to the honors or advanced level due to time restraints or simply a lack interest. For some high school freshman science students, enrolling in an upper-level class does not seem to fit their academic abilities or future career path. Tracking students at an early age implies more uncertainty with regard to the students' true capabilities (Elk, Steeg, & Webbink, 2011) and does not take into account student growth and maturity over time. At this researcher's school, academic rigor and academic maturity are two key components used for tracking science classes.

Academic rigor has a substantial role in developing an honors or advanced level class. Physical science classes are taught for a semester (approximately ninety days), and all physical science classes are generally designed to hold the chemistry units in the first nine weeks and the physics portion in the second nine weeks. Several differences exist between the honors, advanced, and college prep levels, including time commitments, curricula, and unit tests.

At the research site, a physical science honors student should spend anywhere between 45—60 minutes per night completing homework, to understand the concepts in preparation for class the next day, and to master the material in preparation for upcoming tests. In comparison, an advanced student should spend between 30—45 minutes per night and college prep students between 20—30 minutes per night. In order for an honors student to fully grasp the concepts, he or she must connect ideas from one section to another within a unit, relate the section to previous material, apply the elements from the lab back to the material in a unit, and work to comprehend the material (not just memorize facts). In addition, because of the extra material covered in classes at the honors and advanced levels, students have greater responsibility to review material outside of the classroom.

Not only are there different requirements outside of the classroom, but the structure of the class is more demanding as well. In the scope and sequence of the classes, the honors level completes one more unit of study on the topic of thermal energy. In comparison to Physical Science Advanced and Physical Science College Prep, each unit of a Physical Science Honors course involves a deeper understanding of material, greater topical coverage, and increased understanding of how the material is applicable to the real world. Table 1.2 demonstrates an example of the curriculum differences in Unit Three (Atomic Structure) between Physical Science College Prep, Physical Science Advanced, and Physical Science Honors. While developing this understanding of the atom in Unit Three, the Advanced and College Prep classes complete all the topics in fifteen days, while the Honors class completes it in just twelve.

The last major difference is the unit testing (Table 1.3). Students in all three levels typically have one class period (90 minutes) to complete a test. The multiple-choice questions on the tests for each level are generally the same and the students at all three levels receive a formula sheet as a reference for the math portion of tests. Besides some minor point value differences, the primary distinction is in the “thought questions". The thought questions are extremely difficult and designed to focus on taking the knowledge learned within the unit and applying it to new situations outside of class.

The following is an example of a thought question:

Frick is on a diving board 50 m above the surface. In a frictionless world, what would his velocity be when he hits the water?

The students are given the formulas $PE = mgh$ (Potential Energy = mass x gravity x height), $KE = \frac{1}{2}mv^2$ (Kinetic Energy = ½ x mass x velocity^2), and gravity is 9.8 m/sec^2. The student would have to know in a frictionless world that the *KE* would equal the *PE* and therefore, $mgh = \frac{1}{2}mv^2$. Algebraically, they would then infer that the masses would cancel out, gravity is a constant, which is given, and now they can solve for the velocity. In addition, correct understanding of the order of operations is critical for completing this problem properly. All of these steps are completed using high-functioning algebraic concepts. In stark contrast, each Physical Science College Prep test consists of only 50 multiple-choice questions, but does include math problems that are multiple choice. At this researcher's school, academic rigor is one difficult aspect of the honors course and, subsequently, the advanced level class, but academic maturity moves beyond the academic knowledge the student has, to the actual process skills and habits of the individual.

Some of the students who are academically gifted do not have the academic competency or resources to act on that ability. Students at the research site need to acquire the following educational skills in order to use these talents efficiently:

- maintaining proper study habits
- making connections to previous information
- understand information, rather than just memorizing facts

For most students, advantageous study habits are not part of their educational repertoire. Teachers develop these study habits in school and then reinforcement should occur at home. Likewise, for most students, the ability to draw connections to previous information is a skill learned through constant repetition of information from both the teacher, and the parents or guardians outside of school. In the classroom, perceived parental support is a good predictor of student skill development, GPA, and self-efficacy (Cutrona et al., 1994).

In Physical Science Honors, students must have a firm grasp, understanding, and working knowledge of algebraic concepts. Currently, the school has six different level math classes: Algebra I Advanced Part I, Algebra I Advanced Part II, Algebra I Advanced, Geometry College Prep, Geometry Honors, and Algebra II Honors. Those students who have completed Algebra I in middle school have an understanding of how the "properties and relations of numbers and symbols enables students to solve problems that would be difficult without the methods of algebra" (XYZ High School Curriculum Guide, 2017). Students who have not completed Algebra I are encouraged not to take Physical Science Honors.

Problem Statement

A conundrum facing this researcher's school is the tracking of ninth-grade students in physical science classes. While tracking is well-intentioned, if it discriminates against some students, then the county is not fulfilling its commitment to providing the "highest quality education for all children by providing a highly qualified staff, a challenging curriculum, first class facilities, and a safe and nurturing environment" (XYZ County, n.d). The problem of practice in this researcher's school is that the Physical Science College Prep course does not disseminate the necessary academic curriculum necessary for higher education. How can the students enrolled in this course achieve the outcomes required for enrolling in higher education?

Statement of Purpose

The purpose of this study is to determine if students enrolled in Physical Science College Prep could possibly experience academic success with the Physical Science Advanced methods and curriculum. Teacher efficacy and student expectations could promote an academic trend towards detracking physical science, and then enrolling in advanced placements or dual enrollment courses in high school. The research literature and the raft of interventions proposed in this dissertation (concerning the nature of teacher efficacy and student expectations) work to alleviate the problem of practice, and facilitate greater student achievement for the College Prep students.

Research

An abundance of research exists demonstrating the adverse effects of tracking, the inherent policies of tracking, and political pressure in detracking. Loveless (2009) eloquently summarized these three concerns. He wrote that tracked students "often reflected their socioeconomic backgrounds" and schools should, “relinquish their role as agents in reproducing inequities in the larger society.” Further, the National Association for Gifted Children endorsed tracking for high achievers, but those in opposition to tracking demand equity for all students in the curriculum. However, some studies also infer that the effects of tracking are difficult to ascertain, due to many factors not accounted for in the literature. These include a commonly accepted definition of tracking, the fact that some teachers take into consideration items other than test scores, and parental requests. While some critics of detracking argue that existing studies did not randomly assign students into groups, other factors, such as motivation and engagement in subject matter, present greater challenges to research. Chapter 2 will provide a more substantial review of research into tracking.

Rationale

Many factors could explain why a student struggles in middle school, such as academic maturity, parental involvement (too little or too much), social issues, extracurricular activities, and health problems. However, if students who would otherwise have been enrolled in Physical Science College Prep have a teacher who is effective at setting “higher standards for themselves and their students” (Ross, McKeiver, & Hogaboam-Gray, 1997), they could be successful with the Physical Science Advanced curriculum. This could increase their chances of enrolling in advanced placements and dual enrollment courses in high school.

Grouping or tracking students is highly controversial. Evidence from one study suggests, “Sorting students into selective schools and classes was associated with the increasing gaps between high and low achievers over time" (Gamoran, 2009) and "certain groups of students are consistently disadvantaged" (Bernhardt, 2014). However, it is also reasonable to suggest that, "grouping students using methods that convey academic expectations" (Harris, Leithwood, & Strauss, n.d) could be feasible as well. In order for grouping to work properly, "there needs to be a clear understanding among all teachers within a department about what skills, prior knowledge, and academic dispositions students need to have in order to be successful in 9th and 10th grade" (Bernhardt, 2014). Gamoran (2009) suggested that it was a challenge to "distinguish the effects of track assignments from the effects of pre-existing differences among students assigned to different tracks." At this researcher's school, each level of science is intended to create conditions in which "teachers can efficiently target instruction to students' needs" (Gamoran, 2009) and to prepare the students for future academic pursuits. However, data collected from the Equal Opportunity Schools initiative exposes a flaw in this intent. Of the student population, 30% of White and Asian students enrolled in advanced placement and dual enrollment courses are in the medium- to high-income bracket; only 8% of the white and Asian students in the low-income bracket enroll in such courses. In contrast, African-Americans are at 8% and 4%, respectively.

Physical Science Honors is a course designed for students who are pursuing a career in the sciences and are interested in a four-year college degree. The course is also a very strong foundation and a pre-requisite for Chemistry Honors, Physics Honors, and Biology Honors. Students who perform well in those honors-level classes may enroll in advanced placement courses in their junior and senior years in high school. Physical Science Advanced is a course designed for those students who are interested in a two- or four-year college degree, but are not necessarily interested in pursuing a career in the sciences. Physical Science Advanced acts as the foundation for the Chemistry Advanced, Physics Advanced, and Biology Advanced courses. Physical Science College Prep is a course designed for those interested in a two-year school, trade school, or going directly into the workforce. This course is a foundation for Chemistry College Prep, Physics College Prep, and Biology College Prep.

At the research site, the school does not confine students to one track, and the students and parents have the ability to move between tracks during course registration. If a student successfully completes Physical Science College Prep with an A grade, then that student can receive a recommendation for Biology Advanced. Likewise, if a student successfully completes Physical Science Advanced with a solid A grade, then that student can receive a recommendation for Biology Honors and therefore be on track to take an advanced placement or dual enrollment course in high school. In addition, if a parent wishes to override the teacher's recommendation and place the student in a higher-level class, the school will accommodate that request. However, the current district policy states that if a parent override occurs, the student must complete the class at that level. Despite how difficult the material is to the student or how low the student's grade is, changing to a lower-level course is not an option.

The principal and guidance counselors at this researcher's school arrange the teacher schedule according to teacher preference, teacher qualifications, and coaching schedule. The district administration arranged the school year into two semesters with four 90-minute blocks each semester and teachers allotted one block each semester for planning purposes. In season, coaches are in need of fourth-block planning due to coaching responsibilities occurring immediately after school at different locations throughout the district. At the end of each school year, the teachers complete a preference form stating which level of classes they would like to teach the following school year, but they do not choose the number of classes of each level. In addition, according to the State Department of South Carolina, a teacher must have a gifted and talented endorsement in order to teach the honors level.

Conceptual Framework

In a typical school year, the guidance department fills about six sections of honors, eighteen sections of advanced, and eighteen sections of college prep. In general, the principal assigns each teacher at least two college prep class. A teacher will either teach two Physical Science Honors and four sections of Physical Science College Prep, or four sections of Physical Science Advanced and two Physical Science College Prep classes.

In 2016, approximately 850 students attended the study school. Of the student population, Physical Science Honors accounted for 17%, Physical Science Advanced 46%, and Physical Science College Prep 38%. The honors level consisted of only 19% ethnic minority students while the Physical Science College Prep consisted of 73% ethnic minority students. In addition, concerning the poverty index, 12% of the Physical Science Honors students were on free and reduced lunch while Physical Science College Prep had 59% on free and reduced lunch. Some people (the author included) are concerned that tracking in physical science at the study school does a disservice to minority and poverty-stricken students, and that the school has not offered academic equity to all of its students. The school has conveyed "messages that can have deleterious effects on student performance and outcomes" (Atwater, 2000). If this is so, then corrective action should occur to allow all students the same opportunity for educational success.

Students enrolled in Physical Science College Prep could potentially have success in the Physical Science Advanced curriculum and, therefore possibly allowing the administration to eliminate some tracking. Students who complete the advanced or honors level courses will gain the academic skills and experience necessary to enroll in advanced placements or a dual enrollment course.

Methodology

Research Question

What would be the short-term effect on classwork, laboratory work, and test scores on in-house, teacher-prepared assessments of student achievement of an organized program of teacher efficacy and student expectations for students in the Physical Science College Preparatory program?

Research Objectives

*Research Objective 1***:** Create a classroom environment conducive to student learning through high teacher efficacy.

Research Objective 2: Based on empirical studies of tracking and the results of this study, formulate an action plan in accordance with the district science coordinator to eliminate Physical Science College Prep, or eradicate tracking altogether, in physical science courses at the study school.

Sources of Data

The first source of data was a survey given to teachers and students throughout the entire high school under study. The results from the Equal Opportunity Survey collected in October of 2016 provided percentages of each population in advanced placements and dual enrollment courses. In addition, the researcher obtained all assignments of the students enrolled in his second semester, first block class during the 2016-2017 school to include laboratory experiments, quizzes, daily work, and a unit test for analysis. Unit One consisted of four laboratory experiments, two quizzes, three daily work assignments, and one unit test. Unit 2 consisted of three laboratory experiments, two quizzes, three daily assignments, and one unit test. The final source of data collected was from student surveys and the results of the Teachers' Sense of Efficacy Scale (long form).

Ensuring the academic welfare of every student in an educational setting is absolute, and deserves the administration's utmost attention. Principals' and teachers' duties require the limiting of physical distractions both in and out of the classroom, as well as limiting possible academic distractions. Tracking students could interfere with the academic pursuits of some students, possibly limiting their future educational attainments. Chapter Two of this action research study will scrutinize tracking-related studies; Chapter Three will introduce the research design; Chapter Four will address the results of the study; and Chapter Five outlines the action research plan.

Weaknesses of the Study

The single class does limit and present several weaknesses within the study. The total number of participants is fifteen, which is a fraction of the total student population at the research site. The study does not take into account second, third, or fourth block classes; other teachers and their sense of efficacy; and first and second semester classes.

Directions: This questionnaire is designed to help us gain a better understanding of the kinds of things that create difficulties for teachers in their school activities. Please indicate your opinion, between a 1 and 9, about each of the statements below. Your answers are confidential.

How much can you do?

1 = nothing

3 = very little

5 = some influence

7 = quite a bit

9 = a great deal

1. How much can you do to get through to the most difficult students?
2. How much can you do to help your students think critically?
3. How much can you do to control disruptive behavior in the classroom?
4. How much can you do to motivate students who show low interest in schoolwork?
5. To what extent can you make your expectations clear about student behavior?
6. How much can you do to get students to believe they can do well in schoolwork?
7. How well can you respond to difficult questions from your students?
8. How well can you establish routines to keep activities running smoothly?
9. How much can you do to help your student's value learning?
10. How much can you gauge student comprehension of what you have taught?
11. To what extent can you craft good questions for your students?
12. How much can you do to foster student creativity?
13. How much can you do to get children to follow classroom rules?

14. How much can you do to improve the understanding of a student who is failing?

15. How much can you do to calm a student who is disruptive or noisy?

16. How well can you establish a classroom management system with each group of students?

17. How much can you do to adjust your lessons to the proper level for individual students?

18. How much can you use a variety of assessment strategies?

19. How well can you keep a few problem students form ruining an entire lesson?

20. To what extent can you provide an alternative explanation or example when students are confused?

21. How well can you respond to defiant students?

22. How much can you assist families in helping their children do well in school?

23. How well can you implement alternative strategies in your classroom?

24. How well can you provide appropriate challenges for very capable students?

Figure 1.1: Teacher Sense of Efficacy Scale (long form)

TABLE 1.1: Differences in curriculum for Unit 3: Discovering the Atom

Course	College Prep	Advanced	Honors
Topics	Elements and Symbols	Elements and Symbols	Elements and Symbols
	Organization of the Atom	Organization of the Atom	Organization of the Atom
	Organization of the Periodic Table	Organization of the Periodic Table	Organization of the Periodic Table

	Atomic Mass	*Electronic Configuration*	*Electronic Configuration*
	Isotopes	Atomic Mass	Atomic Mass
		Isotopes	Isotopes
			Ionization Energy
			Moles

TABLE 1.2: Unit Tests

Course	College Prep	Advanced	Honors
Test format	50 multiple choice (2 points each)	20 multiple choice (3 points each)	20 multiple choice (1 point each)
		5 Math (5 points each)	6 math (5 points each)
		1 short answer (5 points)	2 short answers (5 points each)
		2 thought questions (6 points each)	5 thought questions (6 points each)
		1 Essay (10 points)	1 Essay (10 points)

GLOSSARY

ADVANCED - a specific level assigned to a high school credit class intended for students who would like to enter a two- or four-year college degree.

ADVANCED PLACEMENT - a college-level course offered in high school where the teacher must be certified through the national Advanced Placement Program. Students are required to score at least three (out of five) on the final nationalized exam to receive a college credit.

ALIGN - when the material in a classroom or assessment is coordinated with current standards.

ALGEBRAIC CONCEPTS - skills gained within an algebra class that are not unique to mathematics, but are applicable to other subject areas as well.

ASSESSMENT - a measure of progress of a student that can take many forms, such as a quiz, a chapter test, or a final exam.

COLLEGE PREP - a type of high school credit class intended for students who intend to enter a two-year college degree.

CORRELATION - a relationship, either positive or negative, between two different assessments used to predict future performance

DETRACKING – a process within a school or district where the administration reduces or eliminates tracks such Honors, Advanced, and College Prep. Students in each class are grouped heterogeneously.

DUAL ENROLLMENT - a college-level class in which the high school works with a local college or university, and a college professor teaches the class at the high school for college credit.

EDUCATION DEPARTMENT - An entity appointed by the state government responsible for overseeing all education decisions within that state

END-OF-COURSE TESTING – state-level mandated testing administered at the end of specific courses, as determined by the Department of Education

ESOL – English for speakers of other languages. The school provides students who are not native English speakers with extra resources (typically a class throughout the year) to help with learning English.

FREE OR REDUCED LUNCH – one manner in which the government evaluates a school to determine the socio-economic status. When more than 75% of the students receive free or reduced lunch then the government labels the school I as a Title 1 school and then the school will receive additional specific federal funding.

FRESHMAN CAMPUS – a part of the high school, but specifically referring to the ninth-graders, faculty, and staff.

GRADING SCALE – a uniform manner across the state of South Carolina to assign a grade a corresponding grade point average number between 0.000 and 5.875. Students who would make a hundred in an Advanced Placement course would have a 5.875. Students who would make a 100 in an honors course would have a 5.375.

HIGH SCHOOL - Ninth through to twelfth-grade students, faculty and staff.

HONORS - a specific level assigned to a high school credit class intended for students who intend to enter a four-year college degree.

INDICATOR - when the result of an assessment is used to describe or predict performance on another assessment, or a student's level of ability.

INDIVIDUALIZED EDUCATION PLAN (IEP) – Designed for students who need special education services, such as time extensions for assignments, tests read out to them, and/or course notes printed for them.

INTERNAL VALIDITY - the accuracy of a causal relationship.

MIDDLE SCHOOL - Students, faculty, and staff in fifth to eighth grades.

PREDICTIVE RELIABILITY - how well the results of one study apply to another study.

RECOMMENDATION PROCESS – the process by which students are enrolled in a certain level of class for the following school year.

RELIABILITY - the quality of a measurement, as determined by the consistency or repeatability of the measures.

STANDARD - guidelines from the Department of Education that are designed for a subject area or a specific class.

TEST-RETEST - when the same test is administered to students on multiple occasions to measure the consistency of the results.

TYPE 1 ERROR - the incorrect rejection of a true null hypothesis, otherwise known as a false positive.

504 – A plan that is similar to an IEP, but is for students with a physical or mental impairment that hinders their learning.

CHAPTER 2: RESEARCH

Introduction

Problem of Practice

High schools across America have to face a number of academic, social, and financial dilemmas, including inadequate numbers of buses, illegal drugs, passing rates, overcrowded classrooms, and truancy. One particular issue the study school must confront is the way tracking in physical science courses provides disproportionate amounts of educational materials and methods of teaching for students that are low-achievers, minorities, and of low socioeconomic status.

Rationale

This study school is a place where "All students can learn and are a part of a community of learners - students, faculty and parents - who share the responsibility of education excellence" (Shared Values/Belief Statements, n.d.). Part of the responsibilities of the faculty, administrators, and teachers is to ensure the academic success of each child. The intention of having three different levels of physical science courses is to offer unique curriculum and teaching methods matched to students' abilities, and provide the appropriate level of college or career readiness. The purpose of this study is to determine whether students customarily placed in Physical Science College Prep could be successful in the Physical Science Advanced course, through teacher efficacy.

Causes of the problem of practice

Research on tracking continually grapples with the following question: Is tracking in physical science course doing a disservice to minorities, females, or the poverty-stricken? At the study school, the Physical Science College Prep course has an enrollment consisting of 73% minorities and 59% on free and reduced lunch—a drastic difference from the Physical Science Honors course. Teachers recommend each student to a course level based on their academic performance, behavior, and standardized tests from middle school. However, many factors could have led to low scores or misbehavior, including academic immaturity or lack of academic support at home.

In middle school, the guidance and administration group students in the science classes with varying abilities in both math and English. In contrast, in high school, the courses such as Algebra I and English I group student according to ability and prerequisites. This grouping allows some students to obtain the academic skills needed for Physical Science Honors. At the research site, Physical Science Honors is a rigorous course that demands a tremendous amount of time. Not only is the curriculum difficult, but less reinforcement of material occurs, and the expectation is for students to have greater responsibility for reviewing the material. One other point that separates the Honors level from College Prep is the testing. The typical Honors test moves beyond multiple-choice formats (which only require regurgitation of information) to formats where students must demonstrate an actual understanding of the material. One-third of such tests requires students apply their knowledge to an unfamiliar, real-world situation.

Salvittie and Hwang (2015) confirm the use of multiple-choice tests with The Center for Excellence in Science Education at Penn State University. They listed a number of positives that could arise from multiple-choice tests, including ease of distribution to large groups and ease of marking. Ease of marking allows the teacher to grade the assessment very rapidly and in some cases, with the use of computers, almost instantaneously. However, the multiple-choice format often leads students to memorize material instead of understanding it and in a question with a standard four answers, have a twenty-five percent chance to guess the correct answer. On the other hand, free-response-type test formats offer other advantages, including the ability to give partial credit, evidence of thought processes, and more thought-provoking answers. Lin and Singh (2013) found that multiple-choice testing could reasonably reflect free-response testing if the multiple-choice answers were weighted. Free-response questions are useful and can reflect student understanding when the individuals grading the test hold fast to a rubric.

Research Question

What would be the short-term effects on classwork, laboratory work, and test scores on in-house, teacher-prepared assessments of student achievement of an organized program of teacher efficacy and student expectations for students in the Physical Science College Preparatory program?

Importance of a Literature Review

The literature review is an essential element of this dissertation. It provides the reader and researcher with a background of the subject before the research is undertaken. However, the review "goes beyond the search for information and includes the identification and articulation of relationships between the literature and your field of research" (Boote and Beile, 2005). The discernment of these relationships provides an insight to previous studies, the uniqueness of the study, and a demonstration of a knowledge of the topic.

Previous studies related to this dissertation offer a solid foundation for action research. For example, Jeannie Oakes is a nationally known teacher-researcher in the field of tracking who specializes in understanding how tracking affects minority students. Armed with knowledge of the tracking and the data collected from this dissertation, this researcher can meet the needs of a specific classroom, school, or district.

This literature review will give readers the opportunity to not only see other research that is similar to this dissertation but also how the dissertation is different. Joan A. Spade, in 1997, completed a study in tracking in mathematics and science courses, but not necessarily using the math course or skills to track students into physical science level courses. The literature sets a framework that demonstrates the characteristics that are exclusive to the particular time and setting.

One of the greatest opportunities for this teacher-researcher to gain credibility from the reader is through the literature review. The strength of this credibility increases when the teacher-researcher can demonstrate vast knowledge of the field of research and can establish the preparedness to complete the research but also to convey the results in an appropriate manner. Understanding the politics of tracking, as demonstrated by Jeff Clause in 1999, allows the reader to consider carefully the research from all angles. If the reader can have the confidence in the teacher-researcher and the methods used, then it will carry over to have confidence in the results as well.

Methodology

To investigate the research questions, this researcher used a mixed-method design. This study used the Equal Opportunity Schools survey, which the district distributed to parents, students, and teachers in the fall of 2016. The teacher portion of the survey included questions on demographics, the teacher's role at the school, what the school could do to help students transition to upper-level classes, and the school environment. The student portion of the survey included questions on self-efficacy, academic preferences, future academic goals, and views on how well the school promotes an academic environment. In addition, the researcher collected from daily assignments, quizzes, laboratory experiments, and unit tests during Units 1 and 2.

Descriptive statistics are “commonly used when trying to describe the collective level of performance, attitude, or opinion of a group” (Mertler, 2014, p.

169). A single score for each student was obtained from the mean and standard deviation of the class grades. Data points from Unit One were compared to those of Unit Two using a scatter plot. Correlation analysis investigated the relationships between student scores and demographic data, course enrollment, and question number eight from the student survey. Question number eight states: On a scale of 1-5, do you believe your teacher knew you could be successful in this class? (1 being not motivated at all and 5 being very motivated)

The results from the Equal Opportunity Survey will compare the demographic data (poverty and ethnicity) of enrollment in the advanced placement dual enrollment courses. Once the data is collected and analyzed, the researcher will meet with the study school's guidance counselors and principals to establish a course of action to allow all students, who have the ability and desire, to enroll in upper-level classes. In order to eliminate or even modify the current tracking procedures from the middle school and high school science teachers for physical science, a meeting would occur with the district science coordinator and the director of curriculum and instruction.

Theoretical Base

Tracking is a prominent and often-accepted practice in the public school system throughout the United States. Often placed into groups based on criteria of presumed ability or expectations, school systems implement tracking to reduce variability in the student population of a class. However, tracking can exaggerate the academic differences initially associated with those groups. The political and social implications of tracking pose a deep-seated controversy (Welner & Burris, 2006) in the schools, as parents often believe that other struggling students will impede the learning of their child. Little evidence supports the benefits of tracking, and its continued use segregates minorities and the working-class poor into the lower-level courses. Some have suggested that tracking offers students a challenging curriculum and gives them critical thinking skills, but the result is that struggling students often receive mediocre lessons. Those benefiting from tracking are often upper-level students, while the lower-level students have reduced self-esteem and develop negative self-efficacy (Schramm-Pate & Vogler, 1985).

Historical Context

The district administration, district science coordinator, and the school department head use the South Carolina state standards to develop the curriculum in physical science classes. However, the state education personnel did consider the concepts of tracking when they wrote the physical science standards. These standards are a set of basic skills, understandings, and principles that all students should attain before they leave a physical science class in the ninth grade. In order to create classes of different ability levels, schools use supplemental material, and draw on chemistry/physics standards intended for juniors and seniors in high school for the upper-level classes. Thus, the district administration, district science coordinator, and the school department head design the upper-level classes to go beyond the requirements of the standards for that level and, in some instances, address them more in-depth.

Physical Science Standards in the State of South Carolina

A curriculum specialist at the South Carolina Department of Education wrote the physical science standards for students at the College Prep level. Standard 1.5 states that students should be able to “Organize and interpret the data from a controlled scientific investigation by using mathematics (including formulas and dimensional analysis), graphs, models, and/or technology” (“Science,” 2015). The standards go into further detail to state that students should be able to use a formula to solve for one variable if given the values of the other variables, and should be proficient at calculating density, velocity, voltage, acceleration, and work. Another objective is to be able to determine mathematically the number of neutron, protons, and/or electrons in an isotope of any element when given its mass number and atomic number. Students should be able to complete simple graphs comparing solubility in saturated and unsaturated solutions, and phase-change graphs of time vs temperature. Finally, students should be able to complete the following tasks concerning graphs:

- Construct distance/time graphs from data showing the distance traveled over time for selected types of motion (rest, constant velocity, acceleration).
- Compare the shape of these three types of graphs, and recognize the type of motion from the shape of the graph.

- Discuss the significance of the shapes of the graphs in terms of the motion of the objects ("Science," 2015).

As with every school in the state, the study school uses the state standards to align the curriculum in the classroom, including physical science, with state expectations. The current standards indicate that students in physical science courses should be able to employ several algebraic concepts, including "Construct distance/time graphs from data showing the distance traveled over time for selected types of motion (rest, constant velocity, acceleration)" and "Compare the shape of these three types of graphs and recognize the type of motion from the shape of the graph" ("Science," 2015). These physical science standards are similar to the Algebra I standards 1.SPID.7, which state: "Create a linear function to graphically model data from a real-world problem and interpret the meaning of the slope and intercept(s) in the context of the given problem", and A1.NQ.1, which states: "use units of measurement to guide the solution of multi-step tasks. Choose and interpret appropriate labels, units, and scales when constructing graphs and other data displays" (South Carolina, 2015). Other Algebra I standards that would serve as good foundations include A1.AREI.1: "understand and justify that the steps taken when solving simple equations in one variable create new equations that have the same solution as the original", and A1.ACE.2: "Create equations in two or more variables to represent relationships between quantities" (South Carolina, 2015).

The effects of tracking on minorities and women

With the education of our children in mind, educators should stand by the fact that "all citizens are to be treated equally before the law and within the realms of the public so that all have an equal chance to advance themselves" (Jeffries & Schramm-Pate, 2008, p. 17). Understanding the relationship between race and education is arduous, due to the numerous factors involved in the learning process of a child. This study will look at the effect of teacher efficacy on student expectations and then use "education as a force for social justice" (Jeffries & Schramm-Pate, 2008, p. 61) to eliminate or modify tracking.

In order to conduct a serious discussion of academic success within every race, all factors should be considered, including the perception of school, the stability of the home, and, most importantly, the culture within the race itself. Rosario Dawson, a prominent Afro-Cuban actor/songwriter, was interviewed for an MTV special and said, "I remember being in school and when you were really smart, people were like 'Why you trying to be white?' Unfortunately, there are a lot of demographics where education is looked down upon. Our culture doesn't support education" (personal communication, October 20, 2008). Sears reaffirms this notion in an interview with Grant, one of three African-Americans in an accelerated class. In reference to how other African-Americans saw him, Grant went on to say, "They would always say that you were being uppity because you were in that class. They'd say you were trying to act like an Oreo. They'd shy away from you and then the only people you have to associate with are the whites" (Sears, 1991, p. 133-134). Understanding the culture and the perception of education is paramount for academic success in the classroom.

To understand the effect leveling of classes has on minorities and women, some "emphasize the need to take group membership into account in order to level the playing field" (Jeffries & Schramm-Pate, 2008, p. 17). In the classroom, this would mean that the race/gender composition of each class would directly reflect the race/gender composition of the school and the surrounding area. Yet, this is a direct contradiction of the idea that "our model of liberation does not become the model of oppression for others" (Smith, 2013, p. 89). These others, the ones that are higher achieving, could not receive the proper education that intellectually challenges them. The battle between these two thought processes is again before the United States Supreme Court in *Fisher v. University of Texas at Austin*.

> This term, the U.S. Supreme Court is reconsidering whether it is constitutional for the University of Texas at Austin to use race in its undergraduate admissions decisions, to the detriment of some students and the benefit of others. In *Fisher v. University of Texas at Austin*, Abigail Fisher argues that the school's policy of giving racial preferences to preferred minorities is discriminatory and violates the Equal Protection Clause of the Fourteenth Amendment (von Spakovsky & Slattery, 2015).

The purpose of educators (principals, teachers, etc.) is to provide the proper materials in a classroom, a safe learning environment, and appropriate teaching techniques to reach every student. The teacher, no matter the level of student he or she is teaching, and no matter the race of the child sitting at the desk, should remember that "people can transform their existential realities through personal initiative and collective action" (Jeffries & Schramm-Pate, 2008, p. 17).

Tracking or leveling of students

The purpose of tracking is "intended to create conditions in which teachers can efficiently target instruction to students' needs" (Gamoran, 2009). Whether mixed homogeneously or heterogeneously, classrooms in a school are "charged with providing all students with a common framework of cognitive and social skills essential for full participation in the civic and economic activities of adult society" (Gamoran, 2009). Academic responsibilities, including providing all students with present individual academic needs and preparing them for future academia, are ideas entrusted to the school. Consequently, this "ongoing tension between commonality and differentiation is at the heart of the tracking debate" (Gamoran, 2009).

Gamoran summarized many of the latest findings of tracking and inequality. One conclusion was "tracking per se does not generate inequality, but rather inequality has emerged because of the way in which tracking has been implemented" (Gamoran, 2009). He also concluded that where tracking was prevalent, the lower-achieving students increased in achievement, just not at the same rate as the higher-level students. Despite that thought, "the harmful effects of tracking may be mitigated by incentives for success in lower level classes"

(Gamoran, 2009). These incentives for success could include high-stakes testing targeted at different achievement levels, and the option to change to a higher achievement level.

Gamoran (2009) also states that the "methodological challenge has been to distinguish the effects of track assignment from the effects of preexisting differences among students assigned to each group;" however, "due to unreliability and measure error, not all preexisting conditions may have been captured by the controls, and the potential for selectivity bias remains." Gamoran is stating that it was difficult to tell whether the tracking caused the effects or whether the conditions were already present before the students entered a track.

Tracking or leveling of students in science classes

In 1976, Ian Westbury and Marshall Arlin completed a study on "The leveling effect of teacher pacing on science content mastery." This study investigated the difference in group-paced or teacher-paced science instruction. In this study, the investigators assigned sixty-eight students to one of two groups concerning mastery of learning: self-paced or teacher-paced. The teacher-paced group experienced traditional-style teaching, in which the teacher set the pace for the entire class, which acted as the control group. The control group was 37 sophomores taking biology, while the 31 students in the self-paced group were eleventh-graders taking chemistry. The two groups were of similar composition in race, sex, and socioeconomic status; however, a random assignment of subjects was not available due to the nature of the two classes.

Both groups in this study were required to review seven chapters adapted from Merrill's Xenograde systems. The researcher used this artificial science in order to account for the differences in previous knowledge already obtained in previous science classes. The self-paced class learned the content, and when they felt they were ready, they took the assessments. The teacher-paced instruction taught equivalent content through lectures, and the teacher decided when the students took the assessment. The learning rate was "defined as the number of new concepts of discrete units of information mastered (answered correctly) per hour" (Arlin & Westbury, 1976). The researcher recorded the amount of time spent in each chapter for self-paced students while the teacher-paced class was the control and recorded the amount of time as well. The researcher then calculated the learning rate score as the total number of items answered correctly divided by the total time required taken to complete the seven chapters (Arlin & Westbury, 1976).

The results indicated that, "teacher-paced students learn at a much slower rate than self-paced students." With a homogeneous mixture in the class, the "teacher appears to set a pace that is better adapted to the needs of lower-ability student" (Arlin & Westbury, 1976). The odd-even reliability (corrected by the Spearmen-Brown formula) was .91, indicating an acceptable degree of reliability for the learning rate. The teacher-based group final grade mean was 19.2 and was considerably lower than the self-paced groups mean of 25 ($t = 3.24$, $p < .01$). The chi-square value of 14.8 was "significantly beyond the .01 level" indicating a "maximum detriment to students under the teacher pacing" (Arlin & Westbury, 1976). Concerning the upper-level students, two significant findings were made: 1) the "learning rate of the upper third averaged almost 18 units per hour more than the learning rate of the lower third" and; 2) teacher-pacing limited "the achievement of abler students" (Arlin & Westbury, 1976).

Tracking adversely affects minorities but not women

Oakes (1990) completed a study of 6000 teachers of science and math randomly selected from 1,200 public and private schools. She collected data from a questionnaire on descriptions of their programs, including levels, curriculum, instruction, training, and teacher experience. Also included in the survey were student demographics, including the race, gender, and ability level of students in each class.

Oakes reported differences in what teachers taught, and how teachers taught the material. In secondary schools, high-performing classes focused on further study in science, inquiry skills, laboratory techniques, and systematic approaches to solving problems. Lower-performing classes focused on science and math in daily life and in terms of vocational relevance. The thoughts reported from the teachers suggest that, "Students judged to have low ability may get less because they are thought to need less" (Oakes, 1990). This was the case across the study, as "teachers at the same track levels in very different types of schools appear to place similar emphasis on various curriculum objectives. Especially among low-track levels" (Oakes, 1990).

In the low track levels, teaching material was oversimplified, repetitive, fragmented, focused on recitation, used worksheets to break information into minute bits of information, and required more rote memory and less critical thinking. However, in higher track levels, teachers focused on learning activities, students were on task for a greater percentage of the class time, students spent more time on homework, teachers taught higher-ordered cognitive tasks and used open-ended questions, and students had more control over their work. In secondary schools, the results indicated little to no difference in instructional activities or the amount of time spent on lectures, discussions, small groups, or hands-on tasks. "Moreover, teachers in low-ability classes (where disproportionate percentages of minority students in mixed schools are found) place less emphasis on nearly the entire range of curricular goals" (Oakes, 1990).

The results of this study produced an interesting finding concerning women. The results indicated that "both women and minorities have been shown to be more likely to persist in mathematics and science if they see these subjects as interesting, connected to everyday life, and relevant to their future careers" (Oakes, 1990). Despite some evidence to support the advantages of detracking-leveled classes, there is little evidence about future academic success or failure. The evidence from Oakes' study suggested a possible disproportionate effect on the African-American population, but the evidence was "unable to examine distributional differences related to gender", because "such distinct enrollment patterns did not appear" (Oakes, 1990).

Several issues arose from the data collection, because Oakes (1990) did not collect any data on student achievement. Oakes (1990) noted how "important are differences rooted in the social-class backgrounds of the students," but she did not take into account student motivation, parental involvement, single family homes, or even whether the students received free or reduced lunch (an indicator of low socioeconomic status). Researchers must also consider the learning experiences of students, "because minority students tend to reach high school with lower test scores and less advantaged socio-economic circumstances" (Gamoran, 2009).

One major issue that Oakes did not give much attention to was discipline. In lower tracks, a tremendous amount of time was devoted to the management of students' behavior in the classroom, while in the higher track, teachers required less behavior management. Behavior has a huge impact on instruction, including how much time the instructor spends on teaching material and the success of certain laboratory experiments in science classes.

Tracking: A return to Jim Crow

The Jim Crow era and its subsequent laws in education was regrettable, and proved dismal for improving the education of every American. As ruled by the courts, "separate" was not "equal" and all educational institutions need to ensure the elimination of mindsets such as, "Whites are superior to blacks in all important ways, including the intelligence, morality, and civilized behavior" (Jeffries & Schramm-Pate, 2008, p. 79) from their curricula and procedures. The schools created from the Jim Crow era "relegated black students to an education of crushing limitations with little or no opportunity to learn. Clearly, black children were provided with an educational experience that was separate, still unequal and inferior" (Ansalone, 2006, p. 146). If current tracking models perpetuate this same disastrous arrangement, then each school district should revisit their models to ensure all children actually do have an equal opportunity to receive an education. Fifty years after the Brown vs. Board of Education decision, Anselone wrote, "the nation is experiencing one of the most insidious tactics employed to maintain segregation in schooling by the ubiquitous nature of tracking or the practice of sorting students into different levels or tracks based on their perceived academic ability" (Anselone, 2006, p. 148). If tracking involves "educational processes which creates a restricted learning environment for children in lower tracks" (Anselone, 2006, p. 149), then educators must "work to alleviate unjust situations for other people" (Jeffries & Schramm-Pate, 2008, p. 91). According to Schramm-Pate and Jeffries (2008), our education system must not and cannot relegate African-Americans (or any student) "to the status of second-class citizens," especially below the Mason-Dixon Line, where it is often acceptable for the "South to be less tolerant" (Sears, 1991, p. 10).

Achievement gap and tracking

Chambers (2009) discussed the discrepancy in achievements between black and white students. The study focused on the improper application of achievement gap with African-American education, and analyzed African-American students' experiences in tracked schools. The African-American participants (*n* = 7) consisted of five seniors, one junior, and one recent graduate who was, at the time of the study, enrolled in a small private college. The school's population was diverse, with 73% white, 13% Hispanic, 8% black, 5% Asian/Pacific Islander, and 1% Native American. Within the school, Chambers identified three tracks: *bridge*—those students who were unsuccessful in traditional school settings; *regular track*—those students not enrolled in Advanced Placement courses; and *high-track*—those students enrolled in Advanced Placement courses. The study revealed that a majority of the students in the high track were also involved in extracurricular activities and made up the majority of the school's student leadership. This is a stark contrast to both the bridge and regular tracks, whose students were less involved in these activities.

The normalization of tracking was not apparent to students at an early age, as one student exclaimed, "I didn't feel no certain way [about his reading placement in elementary school]. I mean - I wanted to read better, you know, than I did. But, if it was helping me, it was helping me" (Chambers, 2009). However, many students did have the idea that they thought they were dumb. The placement into tracks became routine and these students "began associating their ability placement with their intellect" (Chambers, 2009). Students often only befriended others in the same track, which meant that students in advanced placement courses had little contact with minority students. One student in the study that was in the Advanced Placement track asserted, "Socially, you get siphoned off from the rest of the world" (Chambers, 2009).

This method of tracking had compounding effects, not only for future academic placement, but also for social experience.

The results of the interview of the seven students lead to four conclusions. First, test results alone do not provide enough evidence for student placement. Second, it clearly demonstrated how most students have little control over their educational placements. Third, when schools focus on test scores, it is more difficult to recognize other factors that may affect academic success. Finally, when students are solely responsible for their own educational performance, it is detrimental to their future academic success. Chambers (2009) claims the idea of an achievement gap is an antiquated model that places blame on the student rather than solely on the inputs of teachers, resources, and policies. Chambers (2009) identified tracking as one mechanism that can circumvent student achievement and set the "stage for disparities in performance" from the very start of their academic journey.

Expectations of tracking

One of the key factors in educational expectations is status attainment. Karlson (2015) investigated this idea, the role of tracking in high school, and how it affects students' academic expectations. Three educational facets are associated with tracking: *differentiation of opportunities*, *peer membership groups*, and *individual competence*. The study used the results from a longitudinal study that started in 1988 and followed 6,013 math students and 7,217 English students (of which, 3,169 did both). The research was unique in that information was available about the students before they entered high school, and then once again two years after entering high school. Therefore, educational expectations could be gauged both before and after the initiation of tracking.

Even with an increase in educational expectations over the last twenty years, this study maintains as a link to educational attainment. To quantify these educational expectations, the researchers asked students the following question: “As things stand now, how far in school do you think you will get?” (Karlson, 2015). An answer of sixteen years meant they would attain a four-year college degree. The results of the study indicated that children amend their educational expectations in relation to their high school educational track and the socially expected success in future courses of that track. The average educational expectation of the number of years in an educational system of those students who entered into Advanced or Honors-level tracks increased from 17.058 to 17.244. Meanwhile, the expectation score of students enrolled in general-level tracks decreased from 15.825 to 15.771. In the eighth-grade, students in the general-level track thought they would not achieve as highly as the Advanced- and Honors-level students would. After tracking was instituted, their expectations declined even further. Tracking only increased the expectations of the advanced- and honors-level students. In addition, the “standard deviation expectation increased from 2.1 years to 2.25 years from eighth to tenth grade, suggesting a widening dispersion in expectations” (Karslon, 2015). When an educational process designates a student to a high or low track on their schedule, the student is more than likely to change their educational expectations to conform to it.

Variable effects of tracking

Gamoran (1992) examined four structural characteristics of tracking: selectivity, electivity, inclusiveness, and scope. He contended that tracking creates an environment of dispersion of achievement, which then in turn generates educationally inequality. This difference allows those in higher tracks to gain more than those assigned to lower tracks. Most survey studies of students, teachers, and field researchers (after controlling for gender, background, race, and prior achievement) have corroborated the idea that tracking differentiates both methods of instruction, the amount of material covered in the class, and academic experiences. Gamoran also contended that the way tracking is designed will affect performance, or the schools' educational productivity. Different designs make some schools more productive than others.

Gamoran (1992) defined *selectivity* as "the amount of homogeneity created by grouping students according to characteristics relevant for learning." Due to tracking, some classes are more homogeneous than the overall student body. Some highly selective tracking systems emphasize the top track, and then place high-achieving students into one homogeneous group. When teachers instruct according to student aptitude, student instruction is more likely to affect student performance. Gamoran (1992) characterized selectivity as "the extent to which students choose or are assigned to tracks." School administrations still greatly influence student schedules, even when students have some choice of classes. Students who believe they had a choice in their classes, no matter which level they chose, are likely to be more motivated than those who had no choice (Gamoran, 1992).

Inclusiveness explains "how tracking systems leave open students' options for future schooling" (Gamoran, 1992). Individuals who do not favor tracking view schools as more inclusive if they assign students to tracks categorized as "college-bound". However, Gamoran hypothesized that as the amount of students enrolled in a certain academic track increased, any benefits gained from inclusiveness will decline. Gamoran (1992) characterized *scope* as the "extent to which students are located in the same track across subjects." With this idea of flexibility, tracking occurs from class to class, instead of across all subjects, which means the enrollment in one class should not affect the enrollment in another class. When there is no elasticity between classes, then socialization effects are greater than in schools that do offer flexibility.

Gamoran (1992) used data from 883 public and Catholic schools from 1982 and 1984. He gathered data from 805 public and 78 Catholic schools and from at least 36 students per school. Scores for multiple choice and verbal tests were gathered when the students were seniors, and the reliabilities of these tests were .85 and .54, respectively. The study concluded that track immobility in math and verbal tests led to greater inequality; however, tracking affected overall achievement in math but not verbal tests. Inequality in math was moderate when inclusiveness was moderate, but achievement was greatest when inclusiveness was high or low. These findings were similar for verbal tests as well. However, his study did not support the literature concerning sector, scope, or inclusiveness.

Tracking and higher education

The Dutch education system offers a unique insight into tracking. Students choose to enter tracking either when they are twelve years old, or stay in a comprehensive class until tracked at the age of fourteen. Those students tracked at an early age enter into either a pre-vocational secondary education system or a lower general secondary education system. Only the students who are in the lower general secondary education system have the option to switch to the higher general secondary education system. Those students who are not tracked early stay in a comprehensive classroom, and are then tracked into the higher general secondary education system or a pre-university education system. Elk, Steeg, and Webbink (2011) used this unique educational circumstance to investigate the effect age has on tracking, as it pertains to higher education.

Elk, Steeg, and Webbink (2011) used longitudinal data collected from the 1989 Secondary Education Pupil Cohort that included about 20,000 students. The final sample (n = 3936) was reduced, as some students who were tracked did not receive advice about higher education, or were enrolled in both tracked and non-tracked classes. The data revealed that the parents of the students in the comprehensive classes (who went on to higher general secondary education or pre-university education) were slightly more educated and had a slightly higher professional level. The students who are in the tracked classes were likely to have two parents in the home and less exposure to detrimental environmental factors. Similarities existed between the two groups: age, gender, and personal characteristics. The scores on the ability tests taken in the first year of secondary education were also equal.

The results of the study also indicated a negative correlation between the time of track entry and higher educational completion rate. Students who entered a track early were less likely to complete higher education. Furthermore, an increase in the number of comprehensive schools demonstrated an increase in the enrollment in comprehensive schools. Tracking had a negative effect for students with high abilities and a high socioeconomic background. Finally, there was no clear difference according to gender.

Detracking

Gamoron reported, “Detracking can result in gains for low achievers without the losses for high achievers” (Gamoran, 2009); however, “success was based in part on favorable circumstances, particularly the resources that enabled the school to offer extra mathematics instruction for struggling students” (Gamoran, 2009). In order for these lower-achieving students to gain educationally, Gamoran (2009) suggested extra resources should be made available. These resources include extra class time, extra assistance being available before or after school, dedicated study periods for “catching-up,” greater parental support, teacher efficacy, and greater student expectations.

Gamoran made an effort to explain three simple obstacles to detracking school curricula: normative, technical, and political challenges.

The normative issue is the idea that things have always been done a particular way. Every child has a different ability, and schools should design the academic curriculum to reflect that need. Many parents come in with preconceived notions that detracking classes would "weaken or dumb down their child's science education" (Clause, 1999). The parents went on to conclude that if their children's high school educations were falling behind, then they would not be able to get into highly selective colleges.

In addition, the technical challenges are difficult to overcome. When students are tracked, schools are "still charged with providing all students with a common framework of cognitive and social skills" (Gamoran, 2009). When schools detrack students and generate heterogeneous classrooms, it is extremely tough to meet the needs of a wide variety of students. The negative results of detracking are compounded when teachers do not have proper training, which is a necessity for the success of students in de-tracked classes.

The greatest hurdle to overcome is comes from politics and parents. Parents want what is best for their child. They know how things were when they were in school, which creates a normative challenge. Jeff Clause (1999) did a case study in tracking reform at a high school in upstate New York. The school was comprised of 1,600 students, of which about 81% were European-American, 8% African-American, and the other 11% Asian, Latino, and Native American. Before he started his case study, he did not take into consideration that "tracking involves instructional and political challenges" (Gamoran, 2009). He was trying to combine the two levels of Honors and College Prep into a single class. At an informational meeting, some parents, administrators, and faculty "explicitly expressed anger and resistance" with the idea that the "merging of the two groups would enhance the education of both" (Clause, 1999). He reported that the community took sides, and later meetings even turned volatile. In order for detracking to occur, diplomatic issues should not be an afterthought, but should be part of the actual framework of the process.

Gamoran (2009) also went on to write that every school would face three challenges when detracking: normative, political, and technical. Normative challenges are "based on long-standing beliefs that young persons differ by ability and that schools should be structured to address those differences" (Gamoran, 2009). The political challenge arises from teachers who prefer to teach higher achieving classes, and from parents prefer their child to take Honors-level classes. Technical challenges include "the difficulty of instructing students of widely varying levels of performance" (Gamoran, 2009).

Welner and Burris (2006) proposed several ideas for combatting the political and social issues of detracking. Supporters of tracking hold fast to the concepts and ideas of a homogeneous, high-level class. Most parents who support tracking cannot defend the quality of the low-level classes, and then adamantly fight to keep their own children out of them. Parents raise "fears that their children will be deprived academic, social, and status advantages associated with high-track placement" (Welner & Burris, 2006). Often apprehensive about reaching low-achieving students, teachers may feel unprepared and lack confidence that these students will respond to the greater academic challenges.

Welner and Burris (2006) closely examined the detracking procedures of South Side High School located in Rockville Centre, New York. Using a substantial amount of data, they came up with the following suggestions. First, a school must have a committed district leadership. Once the school receives support and encouragement from the district level, then they should complete the following steps: eliminate the lowest track first, ease teachers into heterogeneous classes, offer extra academic support outside of the classroom, carefully select new staff to fit the current model, and continuously communicate to parents about the results of the new policy. One major undertaking is to never dismiss parental concerns. The school administration should have an “earnest response to parental concerns about learning and achievement” (Welner & Burris, 2006).

In order to navigate what could be hostile waters of detracking, Welner and Burris (2006) offered a variety of recommendations:

- Commit to the principles of detracking,
- Set clear expectations,
- Engage the community in participation,
- Maintain academic rigor by providing additional academic support, and
- Create smaller learning environments.

Access to higher educatiod

Malamud and Pop-Eleches completed a study in 2011 on school tracking and access to higher education. They were interested in how tracking affected disadvantaged groups. They studied data obtained from Romania in 1973, after an educational reform that postponed tracking until high school, in the hope of enabling lower-level students "to catch up with their more privileged counterparts" (Malamud & Pop-Eleches, 2011). The new reform required two more years of academic curriculum. Oakes agreed with the concept when she wrote about the existence of "unequal learning opportunities because of differences in knowledge, classroom instruction" (Oakes, 1990). However, the study reported, the "postponement of tracking did not help disadvantaged students catch with their more privileged counterparts in getting access to higher education" (Malamud & Pop-Eleches, 2011).

Does separation increase inequality?

Some research has suggested that tracking "reduces achievement gap among disadvantaged students" (Figlio & Page, 2000, p. 497). A challenge to this method of educating our youth would propose that it "systematically redistributes resources away from low-ability students toward high-ability students and that less capable teachers are disproportionately assigned to the low-ability tracks" (Figlio & Page, 2000, p. 497). Figlio and Page (2000) countered this argument, using years of research, and a plethora of data to offer three points of consideration. First, because education is such a complex issue, researchers are unable to evaluate many factors. Such factors are "unobservable to the teacher-researcher that will affect track placement and some of these factors may be correlated with test score growth" (Figlio & Page, 2000, p. 500). One such factor is student motivation. Whether intrinsic or extrinsic, *motivation* is engagement in an activity through to completion (Mann, 2017). Second, it is very difficult to ascertain proper data when there is not an accepted definition of tracking. The meaning of *tracking* varies from school to school, even within the same district. The rules and boundaries for tracking change from the elementary, middle, and high school levels. Figlio and Page (2000) concluded that "researchers and policymakers agree that tracking involves ability grouping, but rarely do studies or policy discussions clarify specifically which types of programs 'count' as tracking programs and which type do not" (p. 501). Third, is school choice. Researchers have not taken into consideration whether tracking takes place in districts that offer a choice of schools; where higher-ability students might prefer to enroll in schools with tracking programs.

Their research considered these three points, and their results counter all the research from the last 40 years or so. The dependent variable was the item response theory (IRT) math scores for the 8^{th} to 10^{th} grades. They chose IRT math scores because it shows student growth from year to year, where a standardized test reflects an "individual's relative position in the test score distribution" (Figlio & Page, 2000, p. 500). In their study, they "were interested in assessing the effect of being schooled in a classroom with similarly-skilled students, relative to the effect of being schooled in a classroom that has a large variance in student abilities" (Figlio & Page, 2000, p. 503). After establishing three alternatives for what tracking means, they obtained a sample of 5,948 students who were in the 10th grade and who also had an 8th grade IRT math score available. The results were as follows: "the estimated coefficient on tracking is negative but trivial in magnitude for high-, middle-, and lower-ability students (-0.19, -0.06, -0.40) and none of the estimates are significantly different from zero" (Figlio & Page, 2000, p. 507). Figlio and Page (2000) therefore concluded that there was no evidence to support the idea that low-ability students are disadvantaged due to being grouped with students of similar ability.

Influence of teacher efficacy on student achievement and motivation

The four sources of teacher self-efficacy are mastery of experiences, emotional and physiological conditions, vicarious experiences, and social persuasion; however, teacher efficacy mainly stems from the three educational factors of pre-service preparation, in-service preparation, and administrative support. *Pre-service preparation* refers to experiences related directly to student teaching, while *in-service participation* involves teachers' involvement in strengthening classroom skills and content knowledge that are necessary for success. Khan (2012) stated that *administrative support* includes actions such as a principal establishing an environment that prioritizes academic success, while also being an advocate for the teacher.

Khan (2012) conducted a study to examine the relationship between teacher efficacy and student achievement. The teacher is the direct link between school programs and policies, and the students. This relationship is crucial to maximizing student achievement, especially in secondary education where teaching has greater implications. Teachers with a high level of efficacy demonstrate good planning, organization, and openness to new ideas. These same teachers are also self-evaluating, are intrinsically motivated, and are more willing to experiment with new ideas. The research investigated the effects of these qualities on student achievement (Khan, 2012).

Khan's (2012) study included all teachers of tenth grade classes in public schools in the Attock District, Indiana. The sample (n = 192) included 32 teachers and 160 students. The findings indicated there was a significant relationship between teacher efficacy and student achievement in math (r = .713) and English subjects (.906). Other compelling data included the difference between male and female teachers' efficacy in math. The influence of male teachers (r = .809) was much higher than that of female teachers (r = .622). However, there was no difference in the effectiveness of male and female English teachers when the sample of students was divided into rural or urban.

Majavezi and Tamiz (2012) indicated that a deeper understanding of teacher efficacy should include their effort, confidence, and persistence when confronted with difficulties in the classroom. With this deeper explanation, efficacy goes beyond intrinsic confidence and too having high expectations of outcomes as well. Teachers who exhibit these characteristics are "more organized, display greater skills of instruction, questioning, explaining, and providing feedback to students having difficulties, and maintaining students on task" (Mojavezi and Tamiz 2012). Also, these same teachers will implement a variety of learning and communicative opportunities to meet the needs of all the students in the classroom.

Majavezi and Tamiz (2012) studied how teacher efficacy affects student achievement and student motivation. The participants (*n* = 120) were senior students in high school from four cities in Iran. An equal amount of male and female teachers all reported having BA degrees in English (*n* = 68), the average age was 31 years (SD = 5.71), and the average number of years of experience was 10.17 (SD not reported). Only students who completed the questionnaire thoroughly and did not have multiple responses to the questions were included in the results.

The data collection consisted of two instruments: a teacher self-efficacy questionnaire created by Tschannen-Moran and Hoy, and a researcher-generated student motivation questionnaire. The results indicated a significant correlation between teacher efficacy and student motivation. Therefore, the study revealed a correlation between teacher efficacy and student motivation in general. However, the greater the teacher efficacy, the less intrinsic motivation the student will report.

Students' Perspective on Tracking and Detracking: Yonezawa and Jones (2006) conducted a study of 12 high schools and over 500 students. They collected data from 75 student groups in meetings just over an hour long. The students respondents were 48% male and 53% female; 24% white and 36% African-American. The most under-represented group was the 13% of students whose GPA was below 1.99 (47% were above 3.0). Most students felt that tracking was inequitable. The study revealed four prominent components of student perspective:

- Placement and tracking practices seemed unfair to students
- Using test scores to guide placement seemed unfair to students
- Tracking meant that struggling students received less rigorous and engaging teachers and curricula
- Some students believed tracking was necessary to preserve a sense of meritocracy

To some students, the school system continued tracking to meet the need of the schools, and many students did not take testing seriously. Some students reported that teachers would focus more on the AP students than the lower level students, but that the lower track should still be challenging too (Yonezawa & Jones, 2006). The students were just as insightful when it came to the idea of detracking, and these beliefs were:

- It would require teachers to believe in all students
- It demands teaching equity
- Students felt they needed more courses that are rigorous

Students reported that tracking into lower-level courses was due to poor performance on standardized tests, poor work habits, and even behavior. They also noted that students are tough enough to shield themselves from societal norms and expectations, and often reflect their parents' attitudes of resistance to tracking (Yonezawa & Jones, 2006).

Teacher Efficacy

Dinther, Dochy, Segars, and Braeken (2013) defined teacher efficacy as "the extent to which the teacher believes he or she has the capacity to affect student performance" and directly relates it to student achievement. High-efficacy teachers are inclined to be less controlling and more humanistic in their behavior, give small group instruction, spend more time in interactive instruction, demonstrate higher levels of planning, and demonstrate more enthusiasm in their teaching. Such high efficacy has a significant relationship with student self-efficacy and accomplishment. Teachers with high efficacy also focus on having high standards and a supportive climate. (Dinther, Dochy, Segars, & Braeken, 2013).

Detracking and Teacher Efficacy

Teachers who can anticipate that they will be effective "set higher standards for themselves and their students" (Ross, McKeiver, & Hogaboam-Gray, 1997). Teachers who demonstrate high efficacy also accept responsibility when their students do not meet the standards, and when things do go wrong, they respond with rejuvenated effort. Teachers build this efficacy from previous successes in the classroom, observation of peers, and feedback from colleagues. Ross, McKeiver, and Hogaboam-Gray (1997) also suggested that teacher efficacy is fluid and can fluctuate according to certain tasks assigned by the administration, or the characteristics of the teaching assignments.

Ross, McKeiver, and Hogaboam-Gray (1997) conducted a study of four math teachers during a new policy approach to detracking. The study occurred during five sixty-minute interviews over the entire school year, and culminated with a two-hour focus group. Ross, McKeiver, and Hogaboam-Gray used a semi-structured interview guide and one teacher shared his feelings about detracking, preparations made for the change, and expectations of the new policy. During subsequent interviews, Ross, McKeiver, and Hogaboam-Gray asked the teachers about problems facing the new policy, their strategies to cope with these problems, and if there were any, any collaborative efforts made within the department. The results indicated a decline in teacher efficacy as a result the teachers were less certain of the results of their preparations. However, as teachers worked through the initial problems, there was a revitilization of teacher efficacy. The study revealed several factors that helped teacher efficacy to return to the levels it was at before the implementation of this new policy. These factors were the accumulation of internal credible evidence, collaboration, and the removal of personal negative feelings.

A Bold Reinvention Gets a Rocky Start

Denver Northfield High School has offered rigorous International Baccalaureate classes for all students and has allowed students to focus on the pathways they were interested in completing. At the heart of the school policies was detracking all of its classes and was "intended to explicitly serve a diverse student body… and to offer all its students equal access to rigorous standards" (Zubrzycki, 2016). Other ideas within this new system of thought included grading the student on demonstrated knowledge, longer school days, physical education every day, later start times, distributed-leadership models, and keeping teachers with the same students for four years.

The school district activated this model to close the gap between affluent and poor students, and to improve all students' academic performance. However, after just a few months, the principal resigned due to a disciplinary incident. The new principal modified several aspects, including start time, length of day, and the distributed-leadership. Subsequently, fewer white students planned on attending the following year, more than half of the teachers left, and district administration cut the advisory program. The principal was under constant pressure to return to the way things used to exist in the school system, both from political pressure and interpersonal feelings. The district initially approved the innovation, but did not provide structure or support throughout its development.

An Integrated Model Proposed

Tschannen-Moran, Hoy, and Hoy (1998) proposed an integrated model of teacher efficacy. The model was adapted from research from several different researchers and models, including Rotter's social theory; RAND (1976); Bandura; Gibson and Dembo (1984); Ashton, Buhr, and Crocker (1994); Riggs and Enochs (1990) and Guskey and Passaro (1994). Focusing on Rotter, RAND, and Riggs and Enochs, Tschannen-Moran, Hoy, and Hoy (1998) went on to define teacher efficacy as "the teacher's belief in his or her capability to organize and execute courses of action required to successfully accomplish a specific teaching task." Through the works of others, they proposed four sources of information—two factors of teacher efficacy and two requirements that teachers must assess in any upcoming teaching situation.

Rotter (1966) concluded that internal and external factors are at play when describing teacher reinforcement. Teachers who believe the environment dilutes any of the teacher's ability to have a positive impact on the educational outcome of their students is referred to as *external*. Teachers who convey the message in their ability to teach "difficult or unmotivated students evidence a belief that reinforcement of teaching lies within the teacher's control, or is internal" (Tschannen-Moran, Hoy, & Hoy, 1998). In 1976, the RAND organization used the foundations of Rotter's work to examine successful reading programs.

The RAND Corporation continues to be a "research organization that develops solutions to public policy challenges to help make communities throughout the world safer and more secure, healthier and more prosperous. RAND is nonprofit, nonpartisan, and committed to the public interest" ("About RAND", 2016). The corporation developed a two-item model to measure teacher efficacy:

> Item 1: When it comes right down to it, a teacher really can't do much because of most of a student's motivation and performance

depends on his or her home environment.

Item 2: If I really try hard, I can get through to even the most difficult or unmotivated students.

Using these two items, the study showed a strong correlation between teacher efficacy and student performance. Tschannen-Moran, Hoy, and Hoy (1998) reported a correlational study where students who were associated with teachers who exhibited Item 1 showed a 24% increase in math scores, while students associated with teachers who exhibited Item 2 showed a 46% increase.

In 1977, Bandura developed a second social theory to refine teacher efficacy. He proposed for a teacher not to just to understand one's self but also for a teacher to discern between this belief and the expected outcome. He defined *self-efficacy* as "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (Tschannen-Moran, Hoy, & Hoy, 1998). However, he went on to write that teacher efficacy is a step beyond just self-efficacy, because the teacher must also understand the likely outcomes of this efficacy. These outcomes could be in the form of rewards, recognitions, punishments, criticism, or self-evaluation and, therefore, control for a certain desired behavior (Tschannen-Moran, Hoy, & Hoy, 1998).

Bandura developed four sources of efficacy information, which were mastery experiences, psychological and emotional cues, vicarious experiences, and verbal persuasion. Mastery experiences are the "perception that a performance has been successful [which] raises efficacy beliefs" (Tschannen-Moran, Hoy, & Hoy, 1998). Understanding their own strengths and weaknesses allows teachers to manage, instruct and evaluate any student. Physical and emotional cues, such as reducing stress, only allowing positive emotions, and feelings of relaxation, will contribute to teacher efficacy. Teachers gain vicarious experiences through watching others teach, understanding the student perspective, and during teacher education. Through these experiences, teachers analyze students in the classroom and decide who can be successful. Verbal persuasion can be general or specific, but gives “encouragement and strategies for overcoming situational obstacles” (Tschannen-Moran, Hoy, & Hoy, 1998). These verbal persuasions will only increase teacher efficacy when they have increased student learning (Tschannen-Moran, Hoy, & Hoy, 1998).

Tschannen-Moran, Hoy, and Hoy (1998) concluded that there are two aspects to teacher efficacy, relating to general and personal teaching. *Personal teaching efficacy* is “one’s own feelings of competence as a teacher” (Tschannen-Moran, Hoy, & Hoy, 1998), but *general teaching efficacy* is related to external influences or outcome expectancy. These external influences allow the teacher to evaluate possible outcomes and predict the likely consequences of these influences.

Finally, the integrated model has two assessments: analysis of the teacher task, and assessment of personal teaching competence. *Analysis of the teaching task* reveals that teachers must “assess what will be required of them in the anticipated teaching situation” (Tschannen-Moran, Hoy, & Hoy, 1998). This would include understanding the students’ abilities, instructional strategies, availability of material, access to technology, and the physical condition of the classroom. *Assessment of personal teaching competence* directly relates to personal efficacy and is the “prediction of the capability to orchestrate an action” (Tschannen-Moran, Hoy, & Hoy, 1998). This assessment deals with both the understanding of the current functioning and the ability to predict future capabilities.

Teacher Sense of Efficacy Scale (long form)

Tschannen-Moran and Hoy (2001) developed the Teacher Sense of Efficacy Scale (long form). Three different studies were completed, and after the first study (n = 224), the number of questions was reduced from 52 to 32. Tschannen-Moran and Hoy submitted the original 52 questions to principal-axis factoring with varimax rotation. Only the questions whose criterion was higher than .60 continued to the second study (n = 217). During the second study, using principal-axis factoring with varimax rotation reduced the scale to 18 questions. Three factors accounted for 51% of the variance in efficacy of student engagement, efficacy for instructional strategies, and efficacy for classroom management. The alpha reliabilities for each factor were .82, .81, and .72, respectively. Construct validity established a correlation of this new scale to previously accepted scales of RAND (r = .35, $p < .01$) and Gibson and Dembo measure (r = .48, $p < .01$). The third study (n = 183) added several more questions, increasing their number from 18 to 24. Once again using principal-axis factoring with varimax rotation, the three factors ranged from .50 to 78.

CHAPTER 3: ACTION RESEARCH DESIGN

Introduction

The South Carolina Department of Education did not write the state standards for physical science with the intent to track students into Honors, Advanced, or College Prep levels. The teachers and district administration created each of these levels at the research site geared towards using the present academic abilities and working towards future academic or career ambitions. Although the state department does distinguish a grade point average between the honors and advanced/college prep levels, standards like "Organize and interpret the data from a controlled scientific investigation by using mathematics (including formulas and dimensional analysis), graphs, models, and/or technology" ("Science," 2015) are written at the college prep level.

The effects of tracking on minorities is well documented, and even though "all citizens are to be treated equally before the law and within the realms of the public so that all have an equal chance to advance themselves" (Jeffries & Schramm-Pate 2008, p.17), some educators and parents continue to believe in tracking. Even though teachers are the leaders in the classroom and should remember that "People can transform their existential realities through personal initiative and collective action" (Jeffries & Schramm-Pate, 2008, p.17), they hold true to the traditions set before them.

Gamoran (2009) stated that the intent of tracking is to target instruction to students and, consequently, this provides "ongoing tension between commonality and differentiation" (Gamoran, 2009). He went on to say that "tracking per se does not generate inequality, but rather inequality has emerged because of the way in which tracking has been implemented" (Gamoran, 2009). In 1976, Ian Westbury and Marshall Arlin completed a study for science classes and "The leveling effect of teacher pacing on science content mastery." The results indicated, "teacher-paced students learn at a much slower rate than self-paced students." Oakes (1990) reported not only a difference in material used in the classroom but also methods in which the teacher disseminated the content to the students. She suggested, "Students judged to have low ability may get less because they are thought to need less" (Oakes, 1990). If models of tracking continue to persist, the same ideas behind the Jim Crow laws could once again present themselves. Years after the Brown decision, "the nation is experiencing one of the most insidious tactics employed to maintain segregation in schooling by the ubiquitous nature of tracking or the practice of sorting students into different levels or tracks based on their perceived academic ability" (Ansalone, 2006, p. 148).

If detracking does occur, teachers and districts will face political and social confrontations both inside and outside the classroom. Gamoran (2009) made an effort to explain three simple obstacles to detracking schools: normative, technical, and political challenges. In addition, resources would need to be available for students to include extra class time, meeting before school or after school for help, having dedicated study time to "catch-up," greater parental support, teacher efficacy, and greater student expectations (Gamoran, 2009). Welner and Burris (2006) proposed several ideas on how to combat the political and social issues confronting detracking to incorporate listening and understanding the concerns of parents and teachers.

Malamud and Pop-Eleches (2011) completed a study on school tracking and access to higher education. Oakes agreed with the concept when she wrote that there are “unequal learning opportunities because of differences in knowledge, classroom instruction” (Oakes, 1990) and the study reported “postponement of tracking did not help disadvantaged students catch up with their more privileged counterparts in getting access to higher education” (Malamud & Pop-Eleches, 2011).

Dinther, Dochy, Segars, and Braeken (2013) defined teacher efficacy as “the extent to which the teacher believes he or she has the capacity to affect student performance” and directly related it to student achievement. Teachers who demonstrate high efficacy know they will be effective and “set higher standards for themselves and their students” (Ross, McKeiver, & Hogaboam-Gray, 1997). Ross, McKeiver, and Hogaboam-Gray (1997) conducted a study of four math teachers during a new policy approach of detracking. The results indicated a decline in teacher efficacy due to the fact the teachers were less certain of the results of their preparations.

Tschannen-Moran, Hoy, and Hoy (1998) proposed an integrated model of teacher efficacy. The model was adapted from research from several different researchers, and they proposed four sources of information—two factors of teacher efficacy and two requirements that teachers must assess in any upcoming teaching situation. Rotter (1966) concluded that several internal and external factors are at play when describing teacher reinforcement: internal and external. Tschannen-Moran and Hoy (2001) developed the Teacher Sense of Efficacy Scale (long form) and three independent studies showed that its 24 questions were highly correlated with other accepted questions for teacher efficacy.

Descriptive statistics are "commonly used when trying to describe the collective level of performance, attitude, or opinion of a group" (Mertler, 2014, p. 169). When the researcher collects the mean of each variable, a single score will result. From this single score of each student, the researcher derives more data, such as standard deviations, that are helpful in determining how similar the scores are. Inferential statistics "are typically used as the means of analysis for research designs that focus on group comparisons," (Mertler, 2014, p. 174). The sample this researcher will collect is a little less than 2% of the population of the school. However, due to the lack of a control or treatment group, the research will not include inferential statistics.

Finally, the researcher will distribute a survey to the students to include how much time they spend studying outside of class, how prepared they feel for the class, and how much support they receive from home. The final question on the survey will be open-ended and ask, "What have you found to be the most difficult in the previous unit." The researcher must make know to the students that all answers are confidential. The students will complete the surveys through an online form, which will facilitate the compiling and analysis of data (Figures 3.1, 3.2, and 3.3).

Purpose Statement

The purpose of this study is to determine whether students enrolled in Physical Science College Prep can be successful in the Physical Science Advanced curriculum. Teacher efficacy and student success at an advanced level gives students greater opportunities to take high-level classes, including advanced placement or dual enrollment courses in high school. This researcher established the concept of teacher efficacy through the research literature and this researcher will use the numerous interventions proposed in this dissertation to alleviate the problem of practice and facilitate greater student achievement for the College Prep students.

Problem Statement

A concern at this researcher’s school is the tracking of ninth-grade students in physical science classes, because tracking does discriminate against some students at the study school. The problem of practice is to consider whether the academic curriculum for students enrolled in the Physical Science College Prep course meets the needs for higher education. How can these students achieve at the levels required for college acceptance?

Hypotheses

Physical Science College Prep students will have at least an average of 70 (which is a C) for scores on daily grades, quiz grades, experiments, and unit tests during Unit Two, due to teacher efficacy.

Research Design

Research Site

The school district is located in the upstate of South Carolina and serves about 53,000 residents in urban, suburban, and rural areas. It is composed of nine elementary schools, three middle schools, one freshman campus, and one main campus high school (grades 10—12). The district was the first in the state to have every school within the district receive accreditation from the Southern Association of Colleges and Schools ("About Us," n.d) and continues to look for the best methods to meet the needs of every student.

Since 2009, the district has seen an 8% increase in population, from 10,335 to 11,187. Currently, whites make up 46%, African-Americans 31%, Hispanics 14%, and Asians 3% of the population. Of all the students in the county, 72.04% are below the poverty index and 60.6% are on free and reduced lunch. Of the entire student body in the district, 16.6% of the population are learning English as a second language. Of all graduates, 42.4% entered a four-year university or college degree, 38.4% entered a two-year college degree, 3.2% entered the military, 8.4% entered the workforce, and 7.6% entered a certificate program. During the 2013—2014 school year, students earned 640 AP college credits and 649 dual credits (“District Summary,” 2013).

The freshman campus embodies the characteristics of the district, and is located on the same grounds as the main campus. In 2016, the freshman campus had 854 students and 66 faculty members. Presently, the science department has eight teachers. The school is comprised of 42% Whites, 33% African-Americans, 13% Hispanics, and 8% others. Since the school’s inception in 2002, there has been a steady increase in both the African-American and Hispanic populations. In 2011, 97.3% of the students enrolled in Algebra I passed the end-of-course test (EOCT). This increased to 99.0% in 2014, while the state average was 85.6%. Additionally, in 2011, 75.5% of the students enrolled in English I passed the EOCT, improving to 84.8% in 2014 while the state average was 77.0% (“School Report Cards,” 2014). Notably, 33% of the student population is African-American, but only 12% are enrolled in advanced placement and dual enrollment courses. At the research site, about 60% of the students are on free or reduced lunch, yet only 5.6% of them enter advanced placement and dual enrollment courses (“District Summary,” 2013)

Participant Selection

The author has spent fifteen years at the study school and has taught Physical Science Honors, Physical Science Advanced, Physical Science College Prep, Earth Science, Biology Advanced, and two types of Project Lead the Way classes: Principles of Biomedical Sciences and Introduction to Engineering and

Design. The author has taught 90 sections, totaling approximately 2000 students. The students in this study will consist of his own first-block Physical Science College Prep students from the second semester of the 2016—2017 school year.

Of the fourteen students in the first block class, 67% are enrolled in Foundations of Algebra, 20% are enrolled in Algebra I Part I Advanced, and 13% are enrolled in Algebra I Advanced. In English, 73% are enrolled in College Prep English and 27% are enrolled in Advanced English. Within the class, two students have 504's, one student has an IEP, and one student is ESOL. The sex ratio is 50% female and 50% male.

Classroom

The room used during the research consisted of a front class space where students sit at tables facing a smart board and a teacher, laboratory demonstration table. The front space has enough tables and chairs to accommodate 24 pupils. The back half of the classroom consists of six laboratory tables with each table seating four individuals. The laboratory is properly equipped with the necessary equipment to perform all experiments for a high school physical science class.

Design

The research design is multi-faceted and includes the Equal Opportunity School analysis, the integrated model for teacher efficacy, and an interpretation of the results of grades, surveys, and correlations over Unit One and Unit Two. First, the researcher will evaluate the results from the Equal Opportunity Schools analysis. District office and school administrators aim to enroll 30% of all demographic groups in either dual enrollment or advanced placement courses. These results will indicate whether the students met the target or not.

To demonstrate and establish teacher efficacy, the researcher will implement a portion of the integrated model as proposed by Tschannen-Moran, Hoy, and Hoy (1998). The sources of efficacy information will include mastery of experiences; verbal persuasion; analysis of teaching task and its context; assessment of personal teaching competence; and personal teaching efficacy.

> *Mastery of experiences*: Before teaching Unit One, the researcher will look back over the last fifteen years of teaching Physical Science College Prep to see which students had academic success and were recommended for Biology Advanced the following school year. In the researcher's daily journal, the researcher will reflect on grades, student behavior, and student participation. The researcher will refer back to this reflection daily for use in instructional strategies.

> *Analysis of the teaching tasks and its context:* Before unit one begins, the researcher will gather historical data on each student to include disciplinary actions, current math class, current English class, ACT math scores, and ACT English Scores. From this data, the researcher will use

the reading and math level of each student to assess the students' current abilities. Then, from those data points, the teacher will develop a simple plan for each student to be successful in Units One and Two. This plan could include, but would not be limited to, extra-time outside of class, greater parental support, or reducing behavioral problems. The researcher will communicate the results of this analysis to each parents and child. In addition, each child will be given a survey before and after Unit One, and after Unit Two. A portion of this survey will measure student motivation. Finally, the researcher will make sure the class laptops are working, classroom supplies are organized, and laboratory materials are available.

Assessment of personal teaching competence: The researcher will complete the Teacher Sense of Efficacy Scale Long Form (Tschannen-Moran & Hoy, 2001). The results of this survey will demonstrate the strengths and weaknesses of the researcher's efficacy. The researcher will record the results in the daily researcher journal and reflect on how to improve the weaknesses and use the strengths to the students' advantage. This researcher will take the Teacher Sense of Efficacy Scale Long Form survey before and after Unit One, and after Unit Two. At the end of Unit One, the researcher must evaluate the success of the students (an average of at least a 70 in the Physical Science College Prep material). If the students were not successful, then the researcher must re-evaluate each student's plan and modify it if necessary for Unit Two.

Verbal persuasion: Throughout the units, the teacher will use verbal persuasion to provide motivation for the students. General verbal persuasions could include statements such as "I believe in you," "We can complete this," and "I have confidence in your abilities to complete this math problem." In addition, at the beginning of the semester, the students will complete an interest inventory and the researcher will analyze these surveys to make specific verbal persuasions such as, "This physical science class can help you towards the career you want as a nurse," or "The math we learn in this class will definitely help you understand auto mechanics." The researcher will record the verbal persuasions given during the day will be recorded in the researchers' daily journal. In the student survey at the end of each unit, the survey will ask about the verbal persuasions from the teacher.

Personal teaching efficacy: The researcher knows the material of Units One and Two extremely well and has taught the material about 90 times over the last fifteen years. The researcher has confidence, not just in how to teach the material, but in how to present it in a manner that is conducive to student learning. The following is the researcher's philosophy to education: You can lead a horse to water, but you cannot make him drink; however, you can put salt in his oats. After seventeen years in the classroom, thirteen years as a youth minister, attendance at over 30 youth conventions, and twenty-two years at youth camps, the researcher has had personal encounters with over six-thousand kids and can intuitively identify the needs of each child in the classroom. This researcher knows he has the ability to motivate every single student in the classroom to work to his or her greatest potential, give their best effort every day, and to know that they all have a bright future in academia.

The next step is to complete Units One and Two of the academic portion of the research. Unit One, *Learning Experimental Design from a Wax Paper Box*, is an introductory unit to science processes, skills, and math concepts relates to physical science. During the unit, the students complete four laboratory experiments, three sections of notes, two quizzes (one math, one content), and a one-unit test. The researcher recorded all scores in an Excel spreadsheet without student identifiers and then at the end of Unit One, survey number two is administered. Next, Unit Two, *Experiencing Classification of Matter Through Salt and Water*, consists of three laboratory experiments, three section of notes, two quizzes (one math, one content), and one unit test. Once again, all scores are recorded into the same Excel spreadsheet as for Unit One. The researcher will then distribute survey number three immediately following the test on Unit Two (refer to Table 3.1 for a detailed outline of Units One and Two). Finally, an analysis of data from Unit One and Unit Two and associated surveys will be analyzed.

There are three main analyses that need to take place: an analysis of the course work, analysis of the overall averages after each unit, and a correlational study of final averages to question number eight in the survey. The data analysis will start with averages for each of the following items: classwork, quizzes, laboratory work, and tests. From the average of each item, the researcher can determine the standard deviation.

Correlation analysis will be conducted to compare question number eight (On a scale of 1-5, do you believe your teacher knew you could be successful in this class?) to the students' final average test score after Unit One and then after Unit Two. Other correlational analysis will consider final averages for race, sex, socio-economic status, current math class, and current English class.

The researcher will present the results of the study to the building administration if the data suggests there is a relationship between teacher efficacy or if the students have sufficient academic success at the Physical Science Advanced level. The suggestions will include eliminating tracking altogether for physical science or at least modifying it to just Physical Science Honors and Physical Science Advanced. In addition, the administration should consider extending Physical Science Advanced to an entire year instead of just one semester (a similar model was instituted with Algebra I for the 2017-2018 school year). Currently, concerning grade point averages, the state department does not recognize a difference between GPAs attained for Physical Science Advanced and Physical Science College Prep.

Conclusion

The action research will use a mixed-methods design to discern whether teacher efficacy alone can allow Physical Science College Prep students to successfully complete a unit of study in the Physical Science Advanced curriculum with a grade of 70 or higher (n = 14). The Equal Opportunity Schools analysis report, survey after Unit One, and the survey after Unit Two will be analyzed as well. Finally, a correlational analysis will reveal whether relationships exist between grades, other courses, demographics, and perceived teacher efficacy.

TABLE 3.1: Detailed Timeline

Day	UNIT	
	UNIT 1	*UNIT 2*
1	1.1 - Lab Safety, Lab Equipment, and Scientific Method	2.1 The Separation - Sugar / Salt Lab
2	1.2 - Wax Paper Box (MacGyver Lab)	2.2 What is Matter?
3	1.2 - Review 1.3 - The Way Science Works (Notes), Classwork = Variables worksheet	2.3 Heat Fusion Lab
4	Review 1.3 - The Way Science Works 1.4 Variables Lab	2.4 Kinetic Theory of Matter and Thermal Expansion
5	1.5 Standards of Measurement (notes),	2.5 Properties and Changes of Matter
6	1.5 Standards of Measurement Activity	2.6 Density Notes and Lab
7	1.6 Graphing (notes, worksheets)	Density Quiz Unit 2 Review
8	1.6 Graphing Activity	Unit 2 Test
9	1.7 Conversions (notes, worksheets)	
10	1.7 Conversions - Review Worksheets	
11	1.7 Conversions - Review Worksheets	
12	1.7 Conversion Lab and Quiz	
13	1.8 Communicating with Graphs - Fruit Loop Lab	
14	Unit 1 Review	

1. How much time do you anticipate you are going to spend per day outside of school (CAVS, before school, after school) completing work for Physical Science?

    0-10 min   11-20 min   21-30 min   31-40 min   41 min or more

2. What do you think is going to be the most difficult part of the unit?

    Classwork   Homework   Quizzes   Experiments   Test   Time

3. Concerning the content of the class, what do you think is going to be the most difficult part?

    Math   Reading   Writing

4. Do you think additional instructional time would benefit you and help improve your academic success?

Yes   No   Maybe

5. Thinking of tests, what do you think would be most difficult part?

Multiple Choice   Math
Thought Questions   Essays
Short Answer   Time to complete

6. On a scale of 1-5, how motivated are you to complete assignments to the best of your ability? (1 being not motivated at all and 5 being very motivated)

7. On a scale of 1-5, how motivated does your teacher need to be to help you to complete assignments?   (1 being not motivated at all and 5 being very motivated)

8. What one thing would have been helpful for you to make good grades in this unit?

Figure 3.1: Survey given before the introduction of Unit One

1. How much time did you spend per day outside of school (CAVS, before school, after school) completing work for Physical Science?

0-11 min   11-20 min   21-30 min   31-40 min   41 min or more

2. What was the most difficult part of the unit?

Classwork   Homework   Quizzes   Experiments Test   Time

3. Concerning the content of the class, what was the most difficult part?

Math   Reading   Writing

4. Would additional instructional time benefit you and help improve your academic success?

Yes   No   Maybe

5. Thinking of the test, what was the most difficult part?

Multiple Choice   Math
Thought Questions   Essays
Short Answer   Time to complete

6. On a scale of 1-5, how motivated were you to complete assignments to the best of your ability? (1 being not motivated at all and 5 being very motivated)

7. On a scale of 1-5, how motivated did your teacher seem to help you to complete assignments? (1 being not motivated at all and 5 being very motivated)

8. On a scale of 1-5, do you believe your teacher knew you could be successful in this class? (1 being not motivated at all and 5 being very motivated)

9. What one thing would have been helpful for you to make good grades in this unit?

Figure 3.2: Survey at the end of Unit One

1. How much time did you spend per day outside of school (CAVS, before school, after school) completing work for Physical Science?

   0-10 min 11-20 min 21-30 min 31-40 min 41 min or more

2. What was the most difficult part of the unit?

   Classwork Homework Quizzes Experiments Test Time

3. Concerning the content of the class, what was the most difficult part?

   Math Reading Writing

4. Would additional instructional time benefit you and help improve your academic success?

   Yes No Maybe

5. Thinking of the test, what was the most difficult part?

   Multiple Choice Math
   Thought Questions Essays
   Short Answer Time to complete

6. On a scale of 1-5, how motivated were you to complete assignments to the best of your ability? (1 being not motivated at all and 5 being very motivated)

7. On a scale of 1-5, how motivated did your teacher seem to help you to complete assignments? (1 being not motivated at all and 5 being very motivated)

8. On a scale of 1-5, do you believe your teacher knew you could be successful in this class? (1 being not motivated at all and 5 being very motivated)

9. What one thing would have been helpful for you to make good grades in this unit?

Figure 3.3: Survey at the end of Unit Two

CHAPTER 4: FINDINGS & INTERPRETATIONS OF RESULTS

Introduction

The intent of this action research study was to explore the effects of tracking on minorities, females, and those of a low socioeconomic status. It used a case study where the concept of detracking the Physical Science course was investigated at the researcher's school. Following a precedent already set in two departments (Social Studies and Math) at the study school, the question is asked: Can this research inform the building principal and district administration about detracking the high school Physical Science course? The purpose of this chapter is to analyze the data and discuss the findings. The researcher obtained an abundance of data through Equal Opportunity School analysis, teacher constructed surveys, quizzes, laboratory experiments, daily assignments, and unit tests. These findings relate to the research question that guided the study. This researcher collected and analyzed the data to find a possible relationship between teacher efficacy and sustained scores on assignments.

Timeline

For Unit One, the study followed the timeline described during Chapter 3 (Table 3.1). However, the researcher felt it was necessary to add additional days during the instruction of Unit Two due to an observation of low math and writing skills amongst the students. The researcher perceived that additional time was vital for the students to grasp the material and perform at a sufficient level. Corrections to the timeline for Unit Two are given in Table 4.1.

TABLE 4.1: Corrected Timeline for Unit Two		
Day	**UNIT Two**	
	Anticipated	*Actual*
1	2.1 The Separation - Sugar / Salt Lab	2.1 The Separation - Sugar / Salt Lab
2	2.2 What is Matter?	2.2 What is Matter?
3	2.3 Heat Fusion Lab	*~ Practice writing prompt for short answers*
4	2.4 Kinetic Theory of Matter and Thermal Expansion	2.3 Heat Fusion Lab
5	2.5 Properties and Changes of Matter	2.4 Kinetic Theory of Matter and Thermal Expansion
6	2.6 Density Notes and Lab	*~ Practice writing prompt for the essay*
7	Density Quiz Unit 2 Review	2.5 Properties and Changes of Matter
8	Unit 2 Test	2.6 Density Notes
9		*~ Additional Density Problems*
10		*~ Additional Density Problems*
11		Density Quiz Density Lab
12		Unit 2 Review
13		Unit 2 Test

Findings of the Study

A compilation of data—student surveys, daily assignments, daily quizzes, laboratory experiments, and unit tests—occurred over two units. Demographic information about the students was gathered before Unit One, along with the class schedule, and the eight-grade ACT Aspire math, English, reading, and writing scores. The scores, and other factors such as student gender and their current math and English classes were analyzed. Students also took a survey before Unit One pertaining to academic interests, academic understandings, and study habits. This same survey was distributed after Unit One and Unit Two. The data collected from the units was analyzed to see if there was a connection between student success and student schedules, ACT Aspire scores, and demographic information. A teacher efficacy scale long form survey was completed three times to track efficacy throughout the study (Table 4.2).

TABLE 4.2: Teachers' sense of efficacy scale

Question #	Before Unit 1	After Unit 1	After Unit 2
1	5	8	9
2	6	6	8
3	9	9	9
4	7	8	8
5	9	9	9
6	7	8	8
7	9	9	9
8	8	8	8
9	7	8	9
10	7	7	8
11	8	8	8
12	8	7	9
13	8	8	8
14	7	8	8
15	8	8	8
16	8	8	8
17	7	8	8
18	9	9	9
19	7	8	8
20	8	8	8
21	8	8	8
22	5	6	8
23	7	8	8
24	7	8	8

Efficacy in Student Engagement: Items 1, 2, 4, 6, 9, 12, 14, 22
Efficacy in Instructional Strategies: Items 7, 10, 11, 17, 18, 20, 23, 24
Efficacy in Classroom Management: Items 3, 5, 8, 13, 15, 16, 19, 21

Of the students enrolled in the first block class (n = 16) at the end of Unit Two, two students were not included in the study. One student was only in attendance for a total of three days over the two units, and one student entered into the class on the day the class took the Unit One test. Neither of these students were included in the final analysis of the data, resulting in a sample size of 14.

The researcher also made several meaningful observations through the two units consistent with high teacher efficacy and the future academic implications of tracking. One observation during the density portion of Unit Two led to some clear understandings of the academic awareness of the students in the Physical Science College Prep class. When discussing the methods of how to demonstrate the steps of a density problem, the researcher said, “The methods we are using are the same methods they use for the AP classes such as AP Chemistry.” The response was overwhelming. Unanimously, the class said, “What’s AP?” Of the fifteen students present in the room at the time, none knew about the availability of higher learning opportunities at the school.

Before Unit One

ACT scores: Tables 4.3 and 4.4 demonstrate the students, on average, entered into the ninth grade well below grade level in all five categories of the ACT—English, Math, Reading, Science, and Writing. The English scale score (SS) was on average 418, which correlates to a grade equivalent (GE) of 5.4; the math scale score was on average 416, which correlates to a 4.2 grade level. As for college readiness, all fourteen students were below the benchmark in Math, Reading, Writing, and Science, but 33% met the benchmark for the English readiness portion of the ACT Aspire.

TABLE 4.3. ACT Aspire Score and Corresponding Grade Level

ACT Aspire Test	Average	Range	Grade Level
ACT Aspire English > Total > Scale Score	418	411-428	5.4
ACT Aspire Math > Total > Scale Score	416	404 – 423	4.2
ACT Aspire Reading > Total > Scale Score	414	405-422	3.2
ACT Aspire Science > Total > Scale Score	414	409-420	1.9
ACT Aspire Writing > Total > Scale Score	420	418-222	not available

TABLE 4.4. Readiness Benchmarks

ACT Aspire Test	Below	Met
ACT Aspire English > Total > Readiness Benchmark	67%	33%
ACT Aspire Math > Total > Readiness Benchmark	100%	0%
ACT Aspire Reading > Total > Readiness Benchmark	100%	0%
ACT Aspire Science > Total > Readiness Benchmark	100%	0%
ACT Aspire Writing > Total > Readiness Benchmark	100%	0%

Survey Results: Question number one of the student surveys indicated that 47.1% of the students anticipated spending 0-10 minutes of time outside of class completing work for the Physical Science College Prep course, while 41.2% indicated 11-20 min, 5.9 % indicated 21-30 min, 5.9% indicated 31-40 minutes, and 0% indicated 41 or more minutes. Question number two pertained to what the students anticipated was going to be the most difficult part of this class, and the results were 0% for classwork, 5.9% for homework, 5.9% for quizzes, 0% for experiments, 52.9% for tests, and 35.3% for time to complete assignments. Concerning the content of the course, 70.6% of the students thought math was going to be the most difficult part, 29.4% thought it would be writing, and none selected reading. In question four, 41.2% of the students thought additional time would improve their academic success, but only 11.2% said it would not be beneficial ("maybe" accounted for 47.1%). The results also indicated that 52.9% of the students anticipated the writing portion of the tests would be the most difficult part, while none thought the multiple choice or short answer test would be. On a scale of 1 to 5, with 5 being "very motivated", 41.2 % of the students rated themselves as a 3, while only 17.6% indicated they were a 5. Before the start of the unit, 35.3% of the students felt the teacher had to be very motivated in order to assist the students to succeed in the class. Only 5.9% thought the teacher did not need to be motivated at all.

To help the researcher better understand the academic needs of the students, question number seven of the survey given before Unit One asked, "What one thing will be beneficial for the teacher to know that would help you succeed in this class?" The answers varied and included receiving help from the teacher, giving extra work, not assigning homework, not assigning a lot of homework, not giving hard tests, and not giving too much paper work. The students also indicated several other factors that could affect their grades, including being visual learners and busy outside of school, and one student indicated he has a problem seeing due to visual difficulties.

Correlational Study: Table 4.5 provides descriptive statistics of the various ACT Aspire subject tests within the Physical Science course of interest. On average, students scored less well in Science than in other subjects, followed by Reading, Math, and English, respectively.

Table 4.5: ACT Aspire Descriptive Statistics for Students in Physical Science

ACT Test	Mean	Std. Deviation	*n*
Aspire8_Overall	416.36	3.713	14
Aspire8_EnglishSS	418.36	5.227	14
Aspire8_EnglishGE	5.50	2.739	14
Aspire8_MathSS	416.64	3.342	14
Aspire8_MathGE	4.46	1.525	14
Aspire8_ReadingSS	414.57	5.445	14
Aspire8_ReadingGE	3.290	1.988	14
Aspire8_ScienceSS	414.36	4.236	14
Aspire8_ScienceGE	1.96	1.599	14
Aspire8_WritingSS	420.64	2.307	14

SS = Scale Score, GE = Grade Equivalent

Table 4.6 shows that the relationship between lunch status and ACT Aspire scores was not statistically significant.

Table 4.6: Correlations Between Students' Lunch Status and ACT Aspire scores

ACT Test	Pearson Correlation, *p*-value
Aspire8_Overall	r = -.342, p =.231
Aspire8_EnglishSS	r = -.036, p = .903
Aspire8_MathSS	r = -.407, p = .149
Aspire8_ReadingSS	r = -.487, p = .077
Aspire8_ScienceSS	r = -.337, p = .239
Aspire8_WritingSS	r = -.388, p = .171

Table 4.7 shows that a statistically significant, positive relationship exists between sex and ACT Aspire composite/overall score. Female students were associated with higher ACT Aspire overall scores, and male students were associated with lower ACT Aspire overall scores. Similarly, a statistically significant and positive relationship existed between sex and ACT Aspire Science scores. Female students had higher ACT Aspire Science scores than males.

Table 4.7: Correlation Between Student Sex and ACT Aspire scores (*n* = 14)

ACT Test	Pearson Correlation, p-value
Aspire8_Overall	r = .539*, p = .047
Aspire8_EnglishSS	r = .269, p = .352
Aspire8_MathSS	r = .111, p = .706
Aspire8_ReadingSS	r = .436, p = .119
Aspire8_ScienceSS	r = .683*, p = .007
Aspire8_WritingSS	r = .418, p = .137
	* = statistically significant

Table 4.8 shows that the relationship between students' math course status and ACT Aspire scores was not statistically significant. That is, there was no association between ACT Aspire scores and enrollment in a College Prep or an Advanced math course.

Table 4.8: Correlation Between Math Course and ACT Aspire scores (*n* = 14)

ACT Test	Pearson Correlation, *p*-value
Aspire8_Overall	r = .051, p= .864
Aspire8_EnglishSS	r = -.112, p= .703
Aspire8_MathSS	r = .083, p= .779
Aspire8_ReadingSS	r = .345, p= .227

Aspire8_ScienceSS	r = -.102, p= .729
Aspire8_WritingSS	r = .120, p= .684

Table 4.9 shows that the relationship between students' English course status and ACT Aspire scores are not statistically significant. Meaning, there is no association between ACT Aspire scores and enrollment in a college prep or an advanced English course.

Table 4.9: Correlation Between English Course and ACT Aspire Scores (*n* = 14)

ACT Test	Pearson Correlation, *p*-value
Aspire8_Overall	r = .158, p = .590
Aspire8_EnglishSS	r = .143, p = .625
Aspire8_MathSS	r = .070, p = .812
Aspire8_ReadingSS	r = .172, p = .556
Aspire8_ScienceSS	r = -.055, p = .851
Aspire8_WritingSS	r = .244, p = .401

Teacher Efficacy: To determine the Efficacy in Student Engagement, Efficacy in Instructional Practices, and Efficacy in Classroom Management, the subscale scores were calculated using the unweighted means of the items in groupings. The subscale categorical questions were as follows: efficacy in student engagement - 1, 2, 4, 6, 9, 12, 14, 22; efficacy in instructional strategies - 7, 10, 11, 17, 18, 20, 23, 24; and efficacy in classroom management - 3, 5, 8, 13, 15, 16, 19, 21. The teacher efficacy scale for the three sub-categories above before Unit 1 were 6.50, 7.86, and 8.13, respectively.

After Unit One

Math Quiz and Minor Grades: Table 4.10 lists both the math quiz and minor grades for Unit 1. The minor assignments required very little to no work outside of class. This researcher wrote the math quiz for Unit 1 on a very basic level and it consisted of ten multiple-choice questions. Table 4.8 demonstrates how the students scored in Unit 1. The Unit 1 math quiz mean was 88.00, median of 88.00, and a standard deviation of 5.37. Even though the minor grades were close to the means and medians of the math quizzes, the minor grades had a higher standard deviation.

TABLE 4.10 Math Quizzes and Minor Grades Averages for Unit One

	Math Quizzes			Minor Grades		
	Mean	Median	SD	Mean	Median	SD
Unit 1	88.00	88.00	5.37	87.67	88.46	7.84

Major Grade: Table 4.11 records the major grade for Unit 1. The test, written at a College Prep level by the researcher, consisted of 50 multiple-choice questions with the last ten being math questions. The students had 90 minutes to complete this test. The results of the math portion of the test indicated the students had a mean of 70, a median of 70, and a standard deviation of 17.54. The overall average of the students' scores showed a mean of 79.21, median of 77, with a standard deviation of 9.23. There was no writing or thought portion to the Unit 1 test.

Table 4.11: Major Grades for Unit One (TEST)

Overall			Math Portion			Writing Portion			Thought Portion		
Mean	Median	SD	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD
79.21	77.00	9.23	70.00	70.00	17.54	n/a	n/a	n/a	n/a	n/a	n/a

Final Grades and GPAs: Table 4.12 lists the final grades of the class with a corresponding GPA. The mean for the overall averages after Unit One was 87.08, with a median of 88.15, and a standard deviation of 7.42. An 87.08 is equal to a high B average and the corresponding GPA was a 3.59 (SD = .79). With this GPA and a high enough SAT or ACT score, students would qualify for the life and maybe even the Palmetto Fellows scholarship (Scholarships, 2017).

TABLE 4.12: Final Averages and Corresponding GPA for Unit One

Final Average			GPA		
Mean	Median	SD	Mean	Median	SD
87.08	88.15	7.42	3.59	3.60	0.79

Survey Results: After Unit One, student surveys indicated (from question number one) that 53.8% of the students spent 0-10 minutes of time outside of class completing work for the Physical Science College Prep course. Meanwhile, 30.8% indicated 11-20 minutes, 7.7% indicated 21-30 minutes, 0% indicated 31-40 minutes, and 7.7% indicated 41 or more minutes. Question number two pertained to what was the most difficult part of this class. Some 15.4% of students indicated classwork, 7.7% homework, 7.7% quizzes, 7.7% experiments, 30.8% tests, and 30.8% time to complete assignments. Concerning the content of the course, 76.9% of students reported the most difficult part was math, and 15.4% said it was reading (writing was at 0%). In question four, 30.8% of the students thought additional time would improve their academic success and 69.2% responded that it "maybe" would. "No" accounted for 0% of responses. Some 30.8% thought the short answer portion of the test was the most difficult part, while 23.1% thought the math and essay components were the most difficult part. On a scale of 1 to 5, with 5 being very motivated, 38.5% of the students rated themselves as a 3, while only 30.8% indicated they were a 5 (and 0% responded as 1 – not motivated at all). After Unit One, 69.2% of the students felt the teacher had to be very motivated in order to assists the students succeed, while none thought the teacher did not need to be motivated at all.

To help the researcher better understand the academic needs for Unit Two, the students were asked: "What one thing will be beneficial for the teacher to know that would help you succeed in this class?" The answers varied, including receiving help from the teacher, requesting no essay or written parts on the Unit Two test and more laboratory experiments, giving more homework and worksheets, and lecturing more.

Correlational Study: Table 4.13 shows there was no statistically significant relationship between students' lunch status and student outcomes from Unit One.

Table 4.13: Correlations Between Student Lunch Status and Outcomes from Unit 1 (*n* = 14)

Class Assignment	Pearson Correlation , p-value
Quiz_Unit1_Math_Conversion	r = .111, p= .706
Unittest_Unit1_Math_Overall	r = -.257, p= .375
Unittest_Unit1_Math_MathPortion	r = .090, p= .770
AVG_Unit1_MinorGrades	r = -.054, p= .855
AVG_Unit1_Test	r = -.257, p= .375
AVG_Unit1_Overall	r = -.075, p= .798
AVG_Unit1_GPA	r = .062, p= .833
Class_Absence	r = -.01, p= .973
Extra_Help_Unit1	r = -.189, p= .519
A1: Do you believe your teacher knew you could be successful in this unit?	r = -.493, p= .073
A2: Do you believe your teacher knew you could be successful in this unit?	r = -.244, p= .400

Table 4.14 shows there was one statistically significant relationship between sex and other student outcomes: females sought extra help more than males did.

Table 4.14: Correlations Between Sex and other Outcomes from Unit 1 (*n* = 14)

Class Assignment	Pearson Correlation, p-value
Quiz_Unit1_Math_Conversion	r = .319, p = .266
Unittest_Unit1_Math_Overall	r =.302, p = .294
Unittest_Unit1_Math_MathPortion	r =.264, p = .384
AVG_Unit1_MinorGrades	r = .032, p = .914
AVG_Unit1_Test	r = .302, p = .294
AVG_Unit1_Overall	r = .057, p = .845
AVG_Unit1_GPA	r = .181, p = .535
Class_Absence	r = .330, p = .249
Extra_Help_Unit1	r = .632*, p = .015
A1: Do you believe your teacher knew you could be successful in this unit?	r = -.089, p = .761
A2: Do you believe your teacher knew you could be successful in this unit?	r = .149, p = .611

Teacher Efficacy: The Efficacy in Student Engagement, Efficacy in Instructional Practices, and Efficacy in Classroom Management subscale scores were calculated using the unweighted means of the items in groupings. The subscale categorical questions were as follows: efficacy in student engagement - 1, 2, 4, 6, 9, 12, 14, 22; efficacy in instructional strategies: 7, 10, 11, 17, 18, 20, 23, 24; and efficacy in classroom management - 3, 5, 8, 13, 15, 16, 19, 21. The teacher efficacy scale before Unit 1 were 7.38, 8.14., and 8.25, respectively.

After Unit Two

Math quizzes and daily grades: Table 4.15 lists the math quiz and minor grades for Unit Two. The students could have completed some of the minor assignments during class time, but some time outside of the classroom was required. Unlike Unit One, the students had to demonstrate all five steps of the algebraic process in solving for density on the math quiz in Unit Two. Table 4.15 demonstrates how the students scored in Unit Two. The Unit Two math quiz mean was 86.21, with a median of 87.50 and a standard deviation of 10.18. The minor grades had a mean of 88.53, a median of 90.06, and a standard deviation of 7.75.

TABLE 4.15: Math Quiz Grade and Minor Grades for Unit Two

	Math Quizzes			Minor Grades		
	Mean	Median	SD	mean	Median	SD
Unit 2	86.21	87.50	10.18	88.53	90.06	7.75

Major Grade: The Unit Two test consisted of 30 multiple-choice questions, five math questions (where the student had to demonstrate these five steps: the formula, plug in the numbers, answer, unit, and variable), three short answer questions, two thought questions, and an essay. The students had 90 minutes to complete this test. Table 4.16 shows the data values for the major grade from Unit Two. The math portion had a mean of 88.50, a median of 91.50, and a standard deviation of 12.06. For the writing portion, the students had a mean of 69.50, a median of 74, and a standard deviation of 16.50. The thought portion had a mean of 42.57, a median of 33, and a standard deviation of 24.69. The overall mean of the Unit 2 test was 76.14, with a mean of 76, and a standard deviation of 12.50.

Table 4.16: Major Grade and Subsequent Parts for Unit Two (TEST)

	Overall		
	Mean	Median	SD
Unit Two	76.14	76.00	12.50

Math Portion			Writing Portion			Thought Portion		
Mean	Median	SD	Mean	Median	SD	Mean	Median	SD
88.50	91.50	12.06	69.50	74.00	16.50	42.57	33.00	24.69

Final Grades and GPA: Table 4.17 lists the final grades of the class with a corresponding GPA. The mean for the overall averages after Unit 1 was 87.08, with a median of 88.15, and a standard deviation of 7.42. An 87.08 is equal to a high B average and the corresponding GPA was a 3.59 (SD = .79). With this GPA and a high enough SAT or ACT score, students would qualify for a Life Scholarship and possibly a Palmetto Fellows scholarship (Scholarships, 2017).

TABLE 4.17: Final Average and Corresponding GPAs for Unit Two

	Final Average			GPA		
	Mean	median	SD	mean	Median	SD
Unit Two	87.67	88.56	7.45	3.72	3.80	0.75

Survey Results: After Unit Two, student survey question number one indicated that 53.8% of students spent 0-10 minutes outside of class completing work for the Physical Science College Prep course, while 15.4% indicated they spent 11-20 minutes, 0% indicated 21-30 minutes, 15.4% indicated 31-40 minutes, and 15.4 % indicated 41 or more minutes. Question number two asked about what was the most difficult part of the class. Students indicated that 15.4% of them thought it was classwork, 0% homework, 7.7% quizzes, 0% experiments, 53.8% tests, and 23.1% time to complete assignments. Concerning the content of the course, the students reported the most difficult part was writing (84.6%) and math (15.4%) (reading was 0%). In question four, 46.2% of the students thought additional time *would* improve their academic success, and 53.8% reported additional time *might* improve their academic success (“no” accounted for 0%). The results also indicated that 61.5% thought the essay portion of the test was the most difficult part while 23.1% considered the thought questions the most difficult part. On a scale of 1 to 5, with 5 being very motivated, 30.8% of the students rated themselves as a 5 while 46.2% indicated they were a 4 (0% for a 1 and a 2). After Unit Two, 76.9% of the students felt the teacher had to be very motivated in order to assist the students to succeed while only 0% thought the teacher did not need to be motivated at all.

Correlation Study: Table 4.18 shows there was no statistically significant relationship between students' lunch status and other student outcomes from Unit Two.

Table 4.18: Correlations Between Student Lunch Status and Outcomes from Unit Two (n = 14)

Class Assignment	Pearson Correlation, p-value
Quiz_Unit2_Math_Density	r = -.043, p =.884
Unittest_Unit2_Math_Overall	r = -.373, p = .189
Unittest_Unit2_Math_ShtAnsEssay	r = -.077, p = .794
Unittest_Unit2_Math_Thought	r = .011, p = .970
Unittest_Unit2_Math_MathPortion	r = -.513, p = .061
AVG_Unit2_MinorGrades	r = -.066, p = .822
AVG_Unit2_Test	r = -.373, p = .189
AVG_Unit2_Overall	r = -.108, p = .713
AVG_Unit2_GPA	r = -.118, p = .687
Class_Absence	r = -.010, p = .973
Extra_Help_Unit2	r = -.268, p = .355
A1: Do you believe your teacher knew you could be successful in this unit?	r = -.306, p = .095
A2: Do you believe your teacher knew you could be successful in this unit?	r = -.273, p = .501

Table 4.19 shows there are two statistically significant relationship between sex and other student outcomes. Females sought extra help more than males did and females scored higher on the thought math and thought portion of the test.

Table 4.19: Correlations Between Sex and other Outcomes from Unit One (*n* = 14)

Class Assignment	Pearson Correlation, *p*- value
Quiz_Unit1_Math_Conversion	*r* = .319, *p* = .266
Quiz_Unit2_Math_Density	*r* = .526, *p* = .053
Unittest_Unit1_Math_Overall	*r* = .302, *p* = .294
Unittest_Unit1_Math_MathPortion	*r* = .264, *p* = .384
Unittest_Unit2_Math_Overall	*r* = .491, *p* = .074
Unittest_Unit2_Math_ShtAnsEssay	*r* = .299, *p* = .300
Unittest_Unit2_Math_Thought	*r* = .608*, *p* = .021
Unittest_Unit2_Math_MathPortion	*r* = -.065, *p* = .825
AVG_Unit1_MinorGrades	*r* = .032, *p* = .914
AVG_Unit1_Test	*r* = .302, *p* = .294
AVG_Unit1_Overall	*r* = .057, *p* = .845
AVG_Unit1_GPA	*r* = .181, *p* = .535
AVG_Unit2_MinorGrades	*r* = .469, *p* = .091
AVG_Unit2_Test	*r* = .491, *p* = .074
AVG_Unit2_Overall	*r* = .513, *p* = .061
AVG_Unit2_GPA	*r* = .526, *p* = .053
Class_Absence	*r* = .330, *p* = .249
Extra_Help_Unit1	*r* = .632*, *p* = .015
Extra_Help_Unit2	*r* = .599*, *p* = .024
A1: Do you believe your teacher knew you could be successful in this unit?	*r* = -.089, *p* = .761
A2: Do you believe your teacher knew you could be successful in this unit?	*r* = .149, *p* = .611

Table 4.20 shows that a statistically significant relationship exists between "asking for extra help on Unit Two" and sex: females sought extra help on Unit Two at higher rates than males did. Statistically significant relationships existed between "asking for extra help on Unit Two" and ACT Aspire scores; students who sought extra help on Unit Two had higher scores on the ACT Aspire overall, and reading, science, and writing, compared to those who did not seek help. Similarly, statistically significant relationships existed between "extra help on Unit

Two”, the Unit Two test, and the overall average for Unit Two. Lastly, a statistically significant relationship existed between students who “ask for extra help on Unit Two” and students who “ask for extra help on Unit One”; students who “ask for help on Unit Two” were also more likely to “ask for help on Unit One”.

Table 4.20: Correlations Between Extra Help Unit 2 and Student Outcomes (*n* = 14)

	Pearson Correlation, *p*-value
Class_Absence	*r* = .095, *p* = .747
Lunch_Num	*r* = -.268, *p* = .355
Math_Course_Num	*r* = .018, *p* = .952
English_Course_Num	*r* = .492, *p* = .074
Sex_Num	*r* = .599*, *p* = .024
Aspire8_Overall	*r* = .697*, *p* = .006
Aspire8_EnglishSS	*r* = .477, *p* = .085
Aspire8_MathSS	*r* = .239, *p* = .411
Aspire8_ReadingSS	*r* = .650*, *p* = .012
Aspire8_ScienceSS	*r* = .596*, *p* = .024
Aspire8_WritingSS	*r* = .656*, *p* = .011
Quiz_Unit1_Math_Conversion	*r* = -.011, *p* = .970
Quiz_Unit2_Math_Density	*r* = .231, *p* = .427
Unittest_Unit1_Math_Overall	*r* = .128, *p* = .662
Unittest_Unit1_Math_MathPortion	*r* = -.113, *p* = .714
Unittest_Unit2_Math_Overall	*r* = .533*, *p* = .050
Unittest_Unit2_Math_ShtAnsEssay	*r* = .405, *p* = .151
Unittest_Unit2_Math_Thought	*r* = .531*, *p* = .051
Unittest_Unit2_Math_MathPortion	*r* = .057, *p* = .846
AVG_Unit1_MinorGrades	*r* = .337, *p* = .239
AVG_Unit1_Test	*r* = .128, *p* = .662
AVG_Unit1_Overall	*r* = .342, *p* = .232
AVG_Unit1_GPA	*r* = .434, *p* = .121
AVG_Unit2_MinorGrades	*r* = .445, *p* = .111
AVG_Unit2_Test	*r* = .533*, *p* = .050
AVG_Unit2_Overall	*r* = .494, *p* = .072
AVG_Unit2_GPA	*r* = .495, *p* = .072
Extra_Help_Unit1	*r* = .824*, *p* = .000

A1: Do you believe your teacher knew you could be successful in this unit?	r = .032, p = .981
A2: Do you believe your teacher knew you could be successful in this unit?	r = -.205, p = .481

Interpretation of the Results of the Study

Math Quizzes and Minor Grades: As the students moved from Unit 1 to Unit 2, the minor grades and quizzes became more difficult, more time consuming, and required more time outside of class. Table 4.21 demonstrates how the students responded with this increase in academic rigor and academic maturity. Even though the Unit Two math quiz required the demonstration of all five steps (algebraic concepts as they are taught the students = formula, plug in the numbers, answer, unit, and variable), the average only dropped by 1.79 points; however, the standard deviation almost doubled from 5.37 to 10.18. The minor grades, which included the quizzes and daily assignments, actually showed slight improvement, from an average of 87.67 to 88.53 (with a drop in the standard deviation of .09).

TABLE 4.21: **Student Scores in Response to Increased Academic Rigor**

	Math Quizzes			Minor Grades		
	Mean	Median	SD	mean	Median	SD
Unit 1	88.00	88.00	5.37	87.67	88.46	7.84
Unit 2	86.21	87.50	10.18	88.53	90.06	7.75

Major Grades: Despite the increased academic rigor of the Unit Two test compared to the Unit One test, the students still only had 90 minutes to complete it. The overall average of the tests did decrease by almost three points, from 79.21 in Unit 1 to 76.21 in Unit Two. The analysis also revealed an increase in the standard deviation of almost three points. The students proved to be successful with the math portion of the test, the average increasing from 70 to almost 89 (with a decrease in the standard deviation of five points). In the writing portion (short answer and essay portion), the students scored a little below average; however, the students struggled heavily with the thought portion of the Unit Two test, averaging 42, which is 18 points below passing.

Table 4.22 Major Grades for Unit One and Unit Two tests

	Overall		
	mean	Median	SD
Unit 1	79.21	77.00	9.23
Unit 2	76.14	76.00	12.50

	Math Portion			Writing Portion			Thought Portion		
	Mean	Median	SD	Mean	Median	SD	mean	Median	SD
Unit 1	70.00	70.00	17.54	n/a	n/a	n/a	n/a	n/a	n/a
Unit 2	88.50	91.50	12.06	69.50	74.00	16.50	42.57	33.00	24.69

Final Grades and GPA: As the students' averages from Unit One to Unit Two increased, so did the GPA (Table 4.23). The GPA increased by .2 points and the standard deviation decreased by .04 points. With a GPA of 3.8 and a high enough SAT or ACT score, students would qualify for the life and maybe even the Palmetto Fellows scholarship (Scholarships, 2017).

TABLE 4.23 Final Average Test Scores and Corresponding GPA's

	Final Average			GPA		
	Mean	Median	SD	Mean	Median	SD
Unit 1	87.08	88.15	7.42	3.59	3.60	0.79
Unit 2	87.67	88.56	7.45	3.72	3.80	0.75

Correlational Studies

Table 4.24 shows that statistically significant relationships exist between students' Unit One overall average test scores and other student outcomes. One relationship shows that as students' Unit One overall average test scores increased, their Unit Two math quiz (density) scores also increased. Students with higher Unit One overall average scores also had higher average Unit One minor grades, average Unit One GPAs, average Unit Two minor grades, average Unit Two overall scores, and average Unit Two GPAs.

Table 4.24: Correlations Between Students' Unit One Overall Average Test Scores and other Student Outcomes (*n* = 14)

Student Outcome	Pearson Correlation, *p*-value
Lunch_Num	*r* = -.075, *p* = .798
Math_Course_Num	*r* = .183, *p* = .530
English_Course_Num	*r* = .452, *p* = .104
Sex_Num	*r* = .057, p =.845
Aspire8_Overall	*r* = .025, *p* = .932
Aspire8_EnglishSS	*r* = -.100, *p* = .735
Aspire8_EnglishGE	*r* = -.066, *p* = .823
Aspire8_MathSS	*r* = -.271, *p* = .348
Aspire8_MathGE	*r* = -.268, *p* = .354
Aspire8_ReadingSS	*r* = .229, *p* = .431
Aspire8_ReadingGE	*r* = .315, *p* = .273
Aspire8_ScienceSS	*r* = .086, *p* = .770
Aspire8_ScienceGE	*r* = .32, *p* = .265

Aspire8_WritingSS	*r* = .135, *p* = .645
Quiz_Unit1_Math_Conversion	*r* = .200, *p* = .494
Quiz_Unit2_Math_Density	*r* = .551*, *p* = .041
Unittest_Unit1_Math_Overall	*r* = .242, *p* = .404
Unittest_Unit1_Math_MathPortion	*r* = .300, *p* = .319
Unittest_Unit2_Math_Overall	*r* = .031, *p* = .915
Unittest_Unit2_Math_ShtAnsEssay	*r* = .289, *p* = .316
Unittest_Unit2_Math_Thought	*r* = .148, *p* = .614
Unittest_Unit2_Math_MathPortion	*r* = -.035, *p* = .906
AVG_Unit1_MinorGrades	*r* = .996*, *p* = .000
AVG_Unit1_Test	*r* = .242, *p* = .404
AVG_Unit1_GPA	*r* = .941*, *p* = .000
AVG_Unit2_MinorGrades	*r* = .683*, *p* = .007
AVG_Unit2_Test	*r* = .031, *p* = .915
AVG_Unit2_Overall	*r* = .667*, *p* = .009
AVG_Unit2_GPA	*r* = .653*, *p* = .011
Class_Absence	*r* = .264, *p* = .362
Extra_Help_Unit1	*r* = .388, *p* = .170
Extra_Help_Unit2	*r* = .342, *p* = .232
A1: Do you believe your teacher knew you could be successful in this unit?	*r* = .413, *p* = .142
A2: Do you believe your teacher knew you could be successful in this unit?	*r* = .181, *p* = .535

Table 4.25 shows there is no statistically significant relationship between the math course (college prep vs. advanced) in which students are enrolled and ACT Aspire outcomes, math quizzes, unit tests, and other student outcomes including absences and extra help.

Table 4.25: Correlations Between Mathematics Course Enrollment and Student Outcomes (*n* = 14)

Student Outcome	Pearson Correlation, *p*-value
Aspire8_Overall	*r* = .051, *p* = .083
Aspire8_MathSS	*r* = .083, *p* = .779
Quiz_Unit1_Math_Conversion	*r* = .167, *p* = .569
Quiz_Unit2_Math_Density	*r* = .438, *p* = .117
Unittest_Unit1_Math_Overall	*r* = -.163, *p* = .578
Unittest_Unit1_Math_MathPortion	*r* = -.19, *p* = .534
Unittest_Unit2_Math_Overall	*r* = .063, *p* = .831

Unittest_Unit2_Math_MathPortion	*r* = .031, *p* = .917
AVG_Unit1_MinorGrades	*r* = .201, *p* = .490
AVG_Unit1_Test	*r* = -.163, *p* = .578
AVG_Unit1_Overall	*r* = .183, *p* = .530
AVG_Unit1_GPA	*r* = .051, *p* = .083
AVG_Unit2_MinorGrades	*r* = .481, *p* = .082
AVG_Unit2_Test	*r* = .063, *p* = .831
AVG_Unit2_Overall	*r* = .474, *p* = .087
AVG_Unit2_GPA	*r* = .458, *p* = .100
Class_Absence	*r* = -.128, *p* = .663
Extra_Help_Unit1	*r* = .189, *p* = .519
Extra_Help_Unit2	*r* = .018, *p* = .952

Table 4.26 shows that a statistically significant relationship exists between the English course (College Prep vs. Advanced) in which students are enrolled and the Unit Two test (short answer and essay). Students enrolled in Advanced English had higher Unit Two test (short answer and essay) scores compared to students enrolled in College Prep English. A statistically significant relationship exists between current English course and Unit Two minor grades. Students enrolled in Advanced English had higher Unit Two minor grades than students enrolled in English College Prep. Similarly, statistically significant relationships existed between English course and Unit Two Overall Average and Unit Two GPA. Again, students enrolled in Advanced English had higher Unit Two overall averages and Unit Two GPAs compared to students enrolled in College Prep English.

Table 4.26: Correlations Between English Course Enrollment and Student Outcomes (*n* = 14)

Student Outcome	Pearson Correlation, *p*-value
Aspire8_Overall	*r* = .158, *p* = .590

Aspire8_EnglishSS	*r* = .143, *p* = .625
Aspire8_ReadingSS	*r* = .172, *p* = .556
Aspire8_ScienceSS	*r* = -.055, *p* = .851
Aspire8_WritingSS	*r* = .244, *p* = .401
Unittest_Unit2_Math_ShtAnsEssay	*r* = .604, *p* = .022
Unittest_Unit2_Math_Thought	*r* = .190, *p* = .515
AVG_Unit1_MinorGrades	*r* = .425, *p* = .130
AVG_Unit1_Test	*r* = .397, *p* = .160
AVG_Unit1_Overall	*r* = .452, *p* = .104
AVG_Unit1_GPA	*r* = .493, *p* = .073
AVG_Unit2_MinorGrades	*r* = .564*, *p* = .036
AVG_Unit2_Test	*r* = .321, *p* = .262
AVG_Unit2_Overall	*r* = .585* *p* = .028
AVG_Unit2_GPA	*r* = .575*, *p* = .032
Class Absence	*r* = .125, *p* = .669
Extra_Help_Unit1	*r* = .300, *p* = .297
Extra_Help_Unit2	*r* = .492, *p* = .074

Surveys: The researcher conducted a series of Chi-square tests to determine whether a relationship existed between survey items and time (before Unit One, after Unit One, and after Unit Two). The results indicated statistically significant relationships across time for students answering this question, “Concerning the content of this class, what do you think is going to be the most difficult part?” The test was significant ($X^2_{(2, 45)} = 24.38$, $p < .001$). Because the Chi-square test was significant, follow-up tests were conducted to evaluate pairwise relationships among the category means. The first sub-hypothesis determined if students think the most difficult part will be writing or math across time. The Chi-square test was statistically significant ($X^2_{(2, 43)} = 19.50$, $p < .001$). Most students thought math was the most difficult part of class before Unit One and after Unit Two, while most students thought writing would be most difficult when answering after Unit Two. A second test was significant ($X^2_{(2, 20)} = 9.18$, $p <$

.01). Results of this sub-hypothesis found that most students thought writing was going to be the most difficult part of class compared to reading, when responding after Unit Two. The third test found cells for reading volatile for analysis (i.e., empty cells). Hence, the results are unusable. All other omnibus tests were not statistically significant, thus, follow-up tests were not conducted. Figure 4.1 shows the results for students' perceptions of the most difficult part of the course in over time.

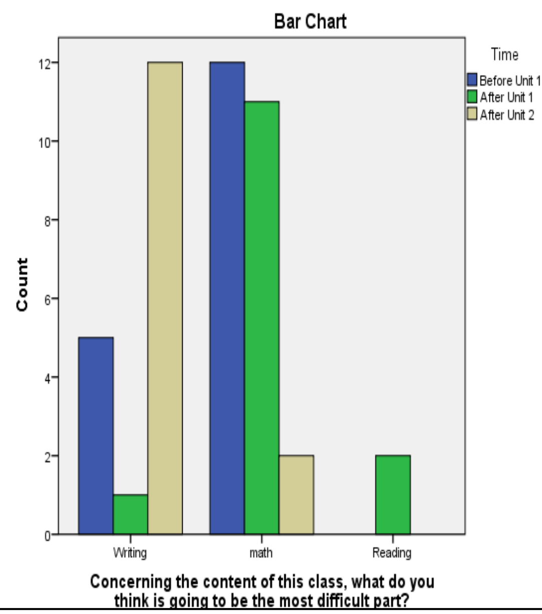

Figure 4.1: Students' Survey Responses to the Most Difficult Part of Class across Time.

Table 4.28 shows all omnibus chi-square tests conducted from survey results across time. Again, a statistically significant relationship exists between what students thought was going to be the most difficult part of the class (i.e., math, reading, writing) across time (i.e., before Unit One, after Unit One, and after Unit Two).

Table 4.28: Survey Responses Compared Across Time using Chi-square tests.

Survey Response Item	Time (Before Unit 1, After Unit 1, After Unit 2)
How much time do you anticipate you are going to spend per day outside of class completing work for Physical Science?	$X^2_{(8, 44)} = 9.66$, $p = .471$
What do you think is going to be the most difficult part of this class?	$X^2_{(10, 45)} = 8.98$, $p = .739$
* Concerning the content of this class, what do you think is going to be the most difficult part?	$X^2_{(4, 45)} = 24.38$, $p < .001$
Do you think additional instructional time would be beneficial to you and help you improve your academic success?	$X^2_{(4, 45)} = 5.63$, $p = .283$
Thinking of tests, what do you think would be the most difficult part?	$X^2_{(10, 45)} = 17.99$, $p = .152$
On a scale of 1-5, how motivated are you to complete assignments to the best of your ability?	$X^2_{(8, 45)} = 5.98$, $p = .754$
On a scale of 1-5, how motivated does your teacher need to be to help you to complete the assignments?	$X^2_{(6, 45)} = 99.55$, $p = .192$
On a scale of 1-5, do you believe your teacher knew you could be successful in this unit?	$X^2_{(2, 28)} = 4.76$, $p = .165$

Significant Observations

Throughout the units, the researcher was developing an environment in classroom of teacher's belief in the student's ability to complete the assignments at their highest level. It was also paramount in the environment for the students' belief in themselves to complete the class at their highest level, and creating an environment where both teachers and students are supportive of each other. Seven more observations that are significant were made over the two units.

Observation #2: At the very beginning, the researcher told student Q, "Very good answer. I want more of that!" The student's response was, "If I answer smart then you will think I am smart. Then I have to live up to that." The class agreed with his comment.

Observation #3: The researcher overheard a conversation between student X and student Y. Student X commented, "I'm just trying to pass." The researcher interrupted the conversation and said, "No we are not. We are trying to get you up to the advanced level."

Observation #4: At the beginning of the section on conversion, the researcher exclaimed to the class, "Today we are going to be doing a little math." Student Z, announced to the whole class, "I hate math because I am not good at it." After one day of instruction the student announced to the class, "If we take a quiz on this, I am going to ace it."

Observation #5: At the end of Unit One, a new student enrolled into the first block class. The new student asked student V about the researcher, and student V said, "I love Mr. Taylor. He actually cares about us and helps us through our problems. He invests in each student."

Observation #6: One day the researcher walked into the room and was sick with a snotty nose and sore throat. Up to that point, the researcher had started every day with a high-five for every student, but he was sick, it did not happen. A couple of minutes into class, the students realized we did not start the day with high-fives, and after an explanation, the students were saddened because they did not get their high-five for the day.

Observation #7: At the end of the advanced unit, the researcher told the students, "I told you guys you could do it. I knew if we worked hard we could be successful." There were several student responses, including, "I think we were placed in the college prep class because we just did not want to work in middle school," and "My eighth-grade teacher told me I was placed in college prep because of my behavior."

Observation #8: The researcher had to add a couple of days to the Unit Two timeframe. Unit Two had one additional extra day for the math section on density, and the researcher added a total of two days throughout the unit to discuss and practice short answers, essays, and thought questions.

The observations during Units One and Two led to several conclusions. First, the students did not know what advanced placement was, and, therefore, they did not know about the academic opportunities that were available to them at the high school level. Advanced placement and dual enrollment classes there are available to the students in their junior and senior years in high school, and these college level classes include Chemistry, English, and US History. What is even more significant is that the school offers one AP course—Human Geography—to the freshmen at the research site. Second, teacher efficacy and belief in the students' outcomes should be set from the beginning. Creating an environment of success is crucial for the desired academic achievement. Third, changing the students' mindsets on academic ideas (such as math) is possible. However, this change is dependent on the environment of the classroom. Next, the students in the class understand the necessity of a positive academic environment in the classroom for academic success, but these same students will also help sustain what is beneficial to everyone. In addition, the middle school teachers placed these students in Physical Science College Prep because of performance, and not necessarily ability. Therefore, the current recommendation process places too much value on standardized test scores and work ethic. Finally, the students in Physical Science College Prep can be successful in a Physical Science Advanced class if they have more time. Currently, a similar situation happens in math, where some students take Algebra I for an entire year and not just one semester. If some students could enroll in Physical Science Advanced for the entire year, this would provide the time necessary for them to be successful; therefore, gaining a better opportunity to seek higher education both in high school and in college.

Observation #9: The researcher was encouraged by both building and district administration to continue teaching the Physical Science Advanced material and using the Physical Science Advanced methods after the completion of Unit Two. The students continued to demonstrate success at the advanced level and 80% met the school requirements to be recommended for Biology Advanced for the 2017-2018 school year. However, the final unit the students completed was Unit 11, on Energy. The researcher worked with the students over a ten-day period (a typical honors class would spend six days) and the students completed the honors unit with a 72 average grade. The students showed proficiency in knowledge of kinetic energy, potential energy, work, and power. They were able to illustrate their understanding, not only to some of the eleventh-grade physics standards, but also in describing the detailed relationship between the kinetic energy and potential energy of a rollercoaster. Throughout the honors unit and on the unit test, the students demonstrated high-level algebraic skills and exhibited a strong control of academic English.

Question #8**:** Table 4.29 shows that there was a statistically significant, positive relationship between students’ perceptions of their teacher’s beliefs after Unit One, and overall scores on the Unit One math test. There was a similar relationship between Unit One (math portion) test scores, and Unit One average test scores. There was also a similar relationship between students’ belief that their teacher knew they could be successful in Unit Two, and students who took an advanced math course. No other statistically significant relationships existed between Item 8 questions (after Units One and Two) and other student outcomes.

Table 4.29: Correlations Between Item 8 question (*Do you believe your teacher knew you could be successful in this unit?;* Units One and Two) and Student Outcomes (*n* = 14)

Student Outcome	**Pearson Correlation, *p*-value**	
	Unit One	Unit Two
Lunch_Num	$r = -.493$, $p = .073$	$r = -.244$, $p = .400$
Math_Course_Num	$r = -.067$, $p = .821$	$r = .556^{*}$, $p = .039$
English_Course_Num	$r = .339$, $p = .235$	$r = -.189$, $p = .519$
Sex_Num	$r = -.089$, $p = .761$	$r = .149$, $p = .611$
Aspire8_Overall	$r = .016$, $p = .957$	$r = .033$, $p = .912$
Aspire8_EnglishSS	$r = -.290$, $p = .314$	$r = -.332$, $p = .246$
Aspire8_EnglishGE	$r = -.271$, $p = .348$	$r = -.339$, $p = .236$
Aspire8_MathSS	$r = .315$, $p = .272$	$r = .195$, $p = .504$
Aspire8_MathGE	$r = .307$, $p = .286$	$r = .235$, $p = .418$
Aspire8_ReadingSS	$r = .093$, $p = .753$	$r = .252$, $p = .385$
Aspire8_ReadingGE	$r = .150$, $p = .609$	$r = .267$, $p = .356$
Aspire8_ScienceSS	$r = .189$, $p = .517$	$r = .248$, $p = .393$
Aspire8_ScienceGE	$r = .147$, $p = .616$	$r = .128$, $p = .663$
Aspire8_WritingSS	$r = .336$, $p = .240$	$r = .148$, $p = .613$
Quiz_Unit1_Math_Conversion	$r = .333$, $p = .245$	$r = .444$, $p = .112$
Quiz_Unit2_Math_Density	$r = .437$, $p = .118$	$r = .411$, $p = .144$
Unittest_Unit1_Math_Overall	$r = .589$, $p = .027$	$r = .098$, $p = .739$
Unittest_Unit1_Math_MathPortion	$r = .688$, $p = .009$	$r = .180$, $p = .556$

Unittest_Unit2_Math_Overall	*r* = .256, *p* = .376	*r* = -.123, *p* = .676
Unittest_Unit2_Math_ShtAnsEssay	*r* = .312, *p* = .278	*r* = -.041, *p* = .890
Unittest_Unit2_Math_Thought	*r* = .045, *p* = .879	*r* = -.273, *p* = .346
Unittest_Unit2_Math_MathPortion	*r* = .248, *p* = .392	*r* = -.093, *p* = .753
AVG_Unit1_MinorGrades	*r* = .368, *p* = .196	*r* = .176, *p* = .548
AVG_Unit1_Test	*r* = .589, *p* = .027	*r* = .098, *p* = .739
AVG_Unit1_Overall	*r* = .413, *p* = .142	*r* = .181, *p* = .535
AVG_Unit1_GPA	*r* = .274, *p* = .343	*r* = .100, *p* = .734
AVG_Unit2_MinorGrades	*r* = .326, *p* = .255	*r* = .480, *p* = .082
AVG_Unit2_Test	*r* = .256, *p* = .376	*r* = -.123, *p* = .676
AVG_Unit2_Overall	*r* = .347, *p* = .225	r = .452, *p* = .105
AVG_Unit2_GPA	*r* = .345, *p* = .227	*r* = .461, *p* = .097
Class_Absence	*r* = .266, *p* = .358	*r* = .266, *p* = .358
Extra_Help_Unit1	*r* = .141, *p* = .630	*r* = .141, *p* = .630
Extra_Help_Unit2	*r* = .032, *p* = .913	*r* = -.205, *p* = .481

Table 4.30 shows that statistically significant relationships exist between students' Unit Two overall average scores and other student outcomes. Specifically, students with higher Unit Two overall average scores had higher rates of enrollment in Advanced English, Unit Two math quiz (Density) scores, Unit Two unit math test (short answer and essay), average Unit One minor grades, average Unit One overall scores, average Unit One GPAs, average Unit Two minor grades, average Unit Two GPAs, and sought extra help on Unit One.

TABLE 4.30: Correlations Between Students' Unit Two Overall Average Scores and other Student Outcomes (*n* = 14)

Student Outcome	Pearson Correlation, *p*-value
Lunch_Num	*r* = -.108, *p* = .713
Math_Course_Num	*r* = .474, *p* = .087
English_Course_Num	*r* = .585*, *p* = .028
Sex_Num	*r* = .513, *p* = .061
Aspire8_Overall	*r* = .317, *p* = .270
Aspire8_EnglishSS	*r* = .024, *p* = .936
Aspire8_EnglishGE	*r* = .048, *p* = .870
Aspire8_MathSS	*r* = .136, *p* = .642
Aspire8_MathGE	*r* = .152, *p* = .603

Aspire8_ReadingSS	$r = .394$, $p = .164$
Aspire8_ReadingGE	$r = .440$, $p = .116$
Aspire8_ScienceSS	$r = .416$, $p = .139$
Aspire8_ScienceGE	$r = .327$, $p = .253$
Aspire8_WritingSS	$r = .427$, $p = .128$
Quiz_Unit1_Math_Conversion	$r = .414$, $p = .141$
Quiz_Unit2_Math_Density	. $r = 704^{*}$, $p = .005$
Unittest_Unit1_Math_Overall	$r = .285$, $p = .324$
Unittest_Unit1_Math_MathPortion	$r = .340$, $p = .255$
Unittest_Unit2_Math_Overall	$r = .302$, $p = .295$
Unittest_Unit2_Math_ShtAnsEssay	. $r = 590^{*}$, $p = .026$
Unittest_Unit2_Math_Thought	$r = .264$, $p = .361$
Unittest_Unit2_Math_MathPortion	$r = -.018$, $p = .952$
AVG_Unit1_MinorGrades	$r = .654^{*}$, $p = .011$
AVG_Unit1_Test	$r = .285$, $p = .324$
AVG_Unit1_Overall	r = $.667^{*}$, $p = .009$
AVG_Unit1_GPA	$r = .631^{*}$, $p = .016$
AVG_Unit2_MinorGrades	$r = .993^{*}$, $p = .000$
AVG_Unit2_Test	$r = .302$, $p = .295$
AVG_Unit2_GPA	$r = .999^{*}$, $p = .000$
Class_Absence	$r = .116$, $p = .693$
Extra_Help_Unit1	$r = .579^{*}$, $p = .030$
Extra_Help_Unit2	$r = .494$, $p = .072$
A1: Do you believe your teacher knew you could be successful in this unit?	$r = .347$, $p = .225$
A2: Do you believe your teacher knew you could be successful in this unit?	$r = .452$, $p = .105$

Teacher Efficacy

Before Unit 1, the results of Teacher Efficacy Long Form revealed the researcher had relatively high teacher efficacy in the three categories of student engagement, instructional strategies, and classroom management. Reported scores in these categories were 6.5, 7.86, and 8.13, respectively (Table 4.31). After the completion of Unit One, the researcher had increased teacher efficacy scores in all three categories, of 7.38, 8.14, and 8.25, respectively. Results indicated that student engagement increased by 13.5 from before Unit One to after Unit One. After the completion of Unit Two, the researcher's teacher efficacy scores increased in two categories. The student engagement score increased to 8.38 and the instructional strategies score increased to 8.29. Meanwhile, the classroom management score remained the same. The student engagement score once again increased by 13.55 from after Unit One to after Unit Two. Overall, teacher efficacy in student engagement increased by 28.92%, instructional strategies increased 5.47%, and classroom management increased by 1.48%.

Table 4.31: Teacher Efficacy Scores

Category	Before Unit One	After Unit One	After Unit Two
Efficacy in Student Engagement	6.50	7.38	8.38
Efficacy in Instructional Strategies	7.86	8.14	8.29
Efficacy in Classroom Management	8.13	8.25	8.25

Conclusion

This action research study examined the impact of detracking high school physical science courses in a ninth-grade classroom in upstate South Carolina. The results indicated that when there was an increase in academic rigor, an increase in the demand for academic maturity, an increase in time outside of class, and high teacher efficacy, the students enrolled in Physical Science College Prep could attain academic success in Physical Science Advanced classes. The small sample size (*n* = 14) proved difficult, as it was difficult to obtain statistically significant results. However, the small sample size was a necessity due to the limits of the action research in the researcher's first block class. A much larger sample size would allow for more statistical power. Even though the tests failed to demonstrate a statistically significant relationship between teacher efficacy and student achievement, students did achieve a B-grade average for Unit 2. The lack of statistical significance does not allow inference of a relationship between student performance at the Advanced level and teacher efficacy, but the presence of practical significance does warrant additional analysis. Even though the students were reading at a third grade level, science was taught on a first grade level, math was taught on a fourth grade level, and English was taught on a fifth grade level, the students completed Unit Two with a B-grade average for the Physical Science Advanced material and methods. Additionally, Table 4.32 shows that no statistically significant relationship exists between ACT Aspire English, reading, and math scores, and Physical Science Unit Two outcomes.

Table 4.32: Correlations Between ACT Aspire English, Reading, and Math scores, and Physical Science Outcomes (*n* = 14)

	Pearson Correlation, *p*-value		
	Aspire8_ EnglishSS	Aspire8_ ReadingSS	Aspire8_ MathSS
AVG_Unit2_MinorGrades	$r = .028$, $p = .925$	$r = .371$, $p = .191$	$r = .108$, $p = .713$
AVG_Unit2_Test	$r = -.026$, $p = .930$	$r = .281$, $p = .331$	$r = .269$, $p = .352$
AVG_Unit2_Overall	$r = 0.024$, $p = .936$	$r = .394$, $p = .164$	$r = .136$, $p = .642$
AVG_Unit2_GPA	$r = .030$, $p = .918$	$r = .396$, $p = .161$	$r = .14$, $p = .634$

Race

Concerning race, Table 4.33 shows there were statistically significant, positive relationships existing between two variables: Math Course and Average for Unit Two minor grades.

Table 4.33: Correlations between Race and other Significant Factors ($n = 14$)

Student Outcome	Pearson Correlation, *p*-value
Math_Course_Num	$r = -.548^{*}$, $p = .043$
English_Course_Num	$r = -.42$, $p = .135$
Aspire8_Overall	$r = -.073$, $p = .803$
Aspire8_EnglishSS	$r = -.113$, $p = .701$
Aspire8_MathSS	$r = .208$, $p = .475$
Aspire8_ReadingSS	$r = -.17$, $p = .562$
Aspire8_ScienceSS	$r = -.039$, $p = .894$
Aspire8_WritingSS	$r = -.111$, $p = .704$
Quiz_Unit1_Math_Conversion	$r = -.038$, $p = .897$
Quiz_Unit2_Math_Density	$r = -.423$, $p = .132$
Unittest_Unit1_Math_Overall	$r = .164$, $p = .575$
Unittest_Unit1_Math_MathPortion	$r = -.063$, $p = .838$
Unittest_Unit2_Math_Overall	$r = .062$, $p = .834$
Unittest_Unit2_Math_ShtAnsEssay	$r = -.34$, $p = .234$
Unittest_Unit2_Math_Thought	$r = .034$, $p = .907$
Unittest_Unit2_Math_MathPortion	$r = .279$, $p = .334$
AVG_Unit1_MinorGrades	$r = -.452$, $p = .104$
AVG_Unit1_Test	$r = .164$, $p = .575$
AVG_Unit1_Overall	$r = -.43$, $p = .125$
AVG_Unit1_GPA	$r = -.461$, $p = .097$
AVG_Unit2_MinorGrades	$r = -.549^{*}$, $p = .042$
AVG_Unit2_Test	$r = .062$, $p = .834$
AVG_Unit2_Overall	$r = -.526$, $p = .053$
AVG_Unit2_GPA	$r = -.508$, $p = .064$
Class_Absence	$r = .013$, $p = .963$
Extra_Help_Unit1	$r = -.42$, $p = .135$
Extra_Help_Unit2	$r = -.189$, $p = .517$

A1: Do you believe your teacher knew you could be successful in this unit?	*r* = .164, *p* = .575
A2: Do you believe your teacher knew you could be successful in this unit?	*r* = -.091, *p* = .756

The following chapter discusses the final two phases of the action research cycle: *developing* and *reflecting*. With the results presented in Chapter Four, the researcher will develop an action plan to reduce the number of tracks available to Physical Science students, reflect on the study methodology, and examine the overall study for improvements to future studies that evaluate the academic and social impacts that tracking has on minority and low socioeconomic status groups

CHAPTER 5: SUMMARY & DISCUSSION

Introduction

This chapter will discuss the final two facets of the action research methodologies: the development of the investigation and a reflection on the results. It will also provide an overview of the study, address the major points, and consider the strategies needed to facilitate educational change at the research site. The chapter will culminate in a discussion of the action plan, as guided by the results of the study, to inform future inquiry.

Problem of Practice

The "problem of practice" at the study school is that the current curriculum for the Physical Science College Prep course does not adequately prepare students for future enrollment in higher education courses. The effects are greater for minorities, those of low socioeconomic status, and the lowest-achieving students. How can these students achieve at the levels required for college acceptance? Oakes (1990) addressed these very issues and cited students in the lower achieving tracks as having limited access to a science curriculum that is less extensive and far less demanding. These limitations strongly diminish the opportunities for the prerequisite courses needed for higher education courses. She also went on to write, "Students in low-track classes (disproportionately high percentages of whom are low-income and minority students) are far less likely than other students to be taking courses that emphasize traditional academic science and mathematics content" (Oakes, 1990). Tracking causes polarization in student achievement due to resistance in school demands, labeling, peer groups that develop due to restrictive class choices, and differing expectations (Gamoran, 1992). Oakes (1990) did recognize there is a relationship with students' circumstances before they entered high school, which do not prepare students for the rigorous courses needed as college prerequisites. Finally, the less-rigorous courses do not expose the students to critical thinking skills and basic science concepts.

Study Rationale

For over 40 years, research has repeatedly exhibited the negative academic and social effects of tracking on high school students. There is a conflict between the views of academia and what some teachers and administrators call the "reality" of high school. At the research site, middle school teachers and school practices track minority and low socioeconomic status students into Physical Science College Prep courses at greater rates than students who are not of color and not on free/reduced lunch. This study's significance lies in its demonstration that students who were enrolled in Physical Science College Prep could successfully complete a Physical Science Advanced Unit, which was achieved through increased teacher efficacy.

Purpose Statement

The purpose of this study was to determine whether students who were enrolled in Physical Science College Prep could achieve academic success with the Physical Science Advanced curriculum. High teacher efficacy, accompanied with success at the Advanced level, gives students a greater opportunity to enroll in high-level high school classes such as advanced placement or dual enrollment courses. The concept of teacher efficacy was established through the research literature and in the numerous interventions proposed in this dissertation. Teacher efficacy can alleviate the "problem of practice" and facilitate greater student achievement for College Prep students.

Research Question

What would be the short-term effect of class work, laboratory work, and test scores on in-house, teacher-prepared assessments of student achievement of an organized program of teacher efficacy and student expectations for students in the Physical Science College Preparatory program?

Summary of the Study

This mixed-method action research study collected data over two units with freshman Physical Science College Prep students. Currently at the research site, Physical Science is taught at three levels: College Prep, Advanced, and Honors. The study took place at a suburban high school in upstate South Carolina with participants taking part in the study in the spring of

2017. In cooperation with Equal Opportunity Schools, a plethora of information was gathered concerning students' and teachers' perspectives on student capabilities in higher-level classes. Study participants consisted of Physical Science College Prep students from the researcher's first block class. During Unit One, the students were taught using Physical Science College Prep materials and methods, but in Unit Two, the students were taught using Physical Science Advanced materials and methods.

School XYZ and the Equal Opportunity School initiative set a benchmark of 30% enrollment in advanced placement or dual enrollment courses. The researcher analyzed the correlation of student race to socioeconomic status and currently, only one category was not underrepresented: medium- to high-income white/Asian students. Every other category, including low-income white/Asian, medium- to high-income Hispanic, low-income Hispanic, medium- to high-income African-American, low-income African-American, medium- to high-income "other races", and low-income "other races" were below the benchmark of 30% enrollment.

Unit One was an introduction to science and included the following topics of study: lab safety, scientific method, standards of measurement, conversion of units (math), and organization of data. It took thirteen days, including the review day and the test day. The students had 90 minutes to complete the unit test consisting of 50 multiple-choice questions, the last ten of which evaluated students' understanding of density. The Unit Two subject matter included the classification of matter, matter and energy, states of matter, the kinetic theory of matter, and state changes of matter. The class took fourteen days to complete Unit Two and this included the review and test days. The students had 90 minutes to complete the Unit Two test consisting of 30 multiple choice questions, five density math questions (students had to demonstrate all five parts: the formula, replacing variables with real numbers, solving for a variable, using the correct units, and obtaining the correct answer), three short answer questions, two thought questions, and one essay. Data was gathered over these two units, including daily grades, quiz grades, laboratory experiments, and unit tests.

The student's' overall average scores showed a slight increase from Unit One to Unit 2, from 87.67 to 87.8 (SD = 7.42, 7.45). Even though the test average dropped three points from Unit One to Unit Two (from 79 to 76), the student's minor grades increased from 87 to 88. The students also showed an improvement in the math quizzes and math portion of the tests. Regarding the Unit Two test, the students struggled with the writing portion (scoring an average of 69) but did considerably worse with the thought portion (averaging 42). Despite an increase in academic rigor, academic maturity, and the amount of time spent outside of class, the students were able to complete successfully Unit 2 with a GPA of 3.72.

Discussion of Major Points of the Study

Several key questions emerged from the study:

1. How can the school de-track Physical Science courses so that only Physical Science Advanced and Physical Science Honors are taught?

2. What changes can be made to the study to support further analysis of the relationship between detracking and teacher efficacy?
3. What instructional changes need to occur at the middle school level and within the science department to promote an environment for academic success for all students enrolled in Physical Science Advanced?
4. What role can teacher efficacy play in the academic success of students, and how can professional development increase teacher efficacy?
5. How can the school and district look to de-track other subject areas, including math and English?
6. Would extended class time allow students who have not completed Algebra I, and are enrolled in Physical Science Advanced, gain the necessary skills to complete the course with a B average?

These six questions will guide the collaboration of teachers and administrators and the advancement of this action plan.

Action Plan: Implications of the Findings

Participatory Action Plan: The third phase of action research is the *developing stage*. This can only occur after an analysis of the data has been completed. The researcher developed an appropriate plan for academic change at the research site after the results were taken into consideration. The results informed the development of an action plan (Table 5.1) with additional input from stakeholders, including building-level administration (the principal and assistant principal), guidance counselors, middle school science teachers, the research site's science department, and district-level administration (the science coordinator and assistant superintendent for instruction). Each of these stakeholders scrutinized three aspects of the Physical Science Advanced course: the curriculum, the methodologies, and expectations.

Table 5.1: Action plan				
Elements of the Plan	Staff Responsible for Implementation	Timeframe	Required Resources	Measurement of Data
Creation of district community of practice	District Science Coordinator, Science Department Heads from each middle school, Science Department Head from research site	6 x 2-hour meetings after school	Meeting space at district office, document sharing technology, learning management system	Qualitative measurements
Middle school science departments professional development	District Science Coordinator, middle school science teachers	8 x 2-hour meetings after school	Meeting space at district office, document sharing technology, learning management system	Qualitative measurements
Science department professional development	District Science Coordinator, research site science teachers	1 Semester	Meeting space at district office, document sharing technology, learning management system	
Committed focus on	Researcher	Ongoing	Technology to conduct	Quantitative measurements

equality component			research	

The first component of the action plan includes the creation of a "community of practice", including the district science coordinator, all middle school department heads, and the science department head at the research site. In the researcher's district, each of these individuals are considered experts in their respective positions, and possess the leadership qualities required to communicate the results of the initial meetings to the corresponding constituents. This community of practice will look to develop an appropriate curriculum, methodology, and expectations for the Physical Science Advanced course. The development of these items will necessitate six meetings.

Nearly the entire curriculum is established through the required state standards, but additional items need to be added to prepare the students for the chemistry and physics courses taken in grades ten through twelve. A few additional items to include are electronic configuration, thermal energy, and the use of Avogadro's constant. This community of practice should look into how to implement these additional items to students who are well below grade level through a variety of teaching styles that would best fit the academic needs of the students, including, but not limited to, problem-based learning, project-based learning, and appropriate, correlated, laboratory experiments.

The second component of the action plan is professional development for middle school and high school science teachers. This professional development will look to implement the new curriculum components, methodologies, and expectations for the Physical Science Course through teacher training. Previous research has shown that through proper training, there is an increase in teacher confidence, which leads to an increase in teacher efficacy. This component will consist of eight two-hour meetings.

The third component of the action plan is a committed focus on ensuring the continuation of equality for all students, not only in physical science, but in other classes as well. Part of the action research process is the continuation of the research, and this component will allow the researcher to sustain the investigation of detracking physical science, to see whether detracking benefits minority and low socioeconomic status students. Several years ago at the research site, a precedent was established when the school implemented only two tracks in the social studies department. Using the social studies department as an example and the positive results gained within the science department, the other classes (including math and English) should follow suit.

Facilitating Educational Change. Several elements that have slowed the immediate implementation of detracking physical science at the research site include insufficient research, time, and teacher willingness. The data that was collected and analyzed was from one class of approximately fifteen classes, and fifteen students from the more than 300 that were enrolled in Physical Science College Prep (4%). Also, the school schedule included four blocks per day, with each block having characteristics that are unique to that time of day. For example, students entering into third block after lunch do not have the same energy and alertness as those students who enter during first block. The research was only conducted during first block.

Tracking in physical science is ingrained into the school and social environment of the district. Detracking physical science will take some time, as there must be proper training, registration, and implementation of the proper materials and methods. It is late spring of the 2017 school year, and the registration process has already occurred for the 2017—2018 school year for all 876 incoming freshmen. To reschedule about one-third of the freshman would not be practical at this point, because training would need to take place first. This training would take place during the 2017—2018 school year for both the middle school science teachers and the science teachers at the research site. The training would take place over the 2017—2018 school year for full implementation in the 2018—2019 school year.

Both insufficient research and available time have led to teacher reluctance. With data gathered from one teacher and only during first block, the research does not take into account teaching styles, time of day, and teacher abilities. Teacher efficacy requires teacher confidence, and if teachers do not give credence to the data that helped the administration decide to de-track, then they may not have the confidence to teach a successful Physical Science Advanced class. Sufficient data and proper training could lead to greater teacher efficacy and, therefore, increased academic performance for lower-achieving students in Physical Science Advanced classes.

Suggestions for Future Research

The final phase of the action research process is reflection, which requires evaluations of 1) the effectiveness of the methodology chosen to answer the research question, 2) the significance of the study's data, and 3) the new insights that provide specific guidelines for future research concerning detracking physical science at the research site. Collaborating with the science department, the school principal, and district administration will return meaningful insights for essential alterations.

One of the changes that would prove to be most beneficial would be to change the methodology of the new Physical Science Advanced course. Specifically, the amount of time allotted to it. In this action research, time proved to be a valuable asset, as the students required more time to learn how to complete the math sections and how to write in a scientific manner. Further researchers could possibly develop a yearlong Physical Science Advanced course. The traditional Physical Science Advanced course at the research site covered more material than the Physical Science College Prep course in the same amount of time. However, if educators want the results to be the same, which is for each student to have a challenging curriculum in preparation for higher education, then could an extended course duration give students the opportunity to achieve the desired result?

The study produced some statistically significant results, although the study still could use additional data because the sample size (n = 14) limited the statistical power of the analyses. A study with identical conditions and a much larger and more diverse sample (e.g., all freshmen enrolled at the research site in both first and second semester) would increase statistical power. However, the greater significance lies beyond the numbers calculated from the data. The most important element is not a data point but the educational opportunities afforded to every student, especially to minorities and those of low socioeconomic status. There is a need for further research to track the fourteen students studied in the present thesis and observe their high school course selection, measure the impact of the Physical Science Advanced curriculum via a survey, and to record their higher educational pursuits.

Conclusions

This mixed-methods action research study investigated the effects of detracking a high school Physical Science course. The research was motivated by studies that suggest there are negative impacts of tracking on minority and low socioeconomic status students. Removing the lowest level of Physical Science (College Prep) and only offering Physical Science Advanced and Physical Science Honors to students would increase academic rigor and expectations for lower-achieving students. At the research site, students in the lowest-level Physical Science class were placed there due to lack of effort, low standardized tests scores, or misbehavior that had negative academic consequences.

The study occurred during the spring of 2017 at a suburban high school in the upstate of South Carolina, USA. The sample consisted of freshmen enrolled in a Physical Science College Prep class. The students in the researcher's first block class were taught the first unit using materials and methods consistent with the College Prep track, including laboratory experiments, daily work, multiple choice quizzes, a math portion (conversion), and a 50-question multiple choice test. The time requirement outside of class was minimal. The second unit included laboratory experiments, daily work, full work quizzes, a math portion (density), and a 45-question multi-faceted test (multiple choice, short answer, math, thought, and an essay). The students should have spent about thirty minutes per day outside of class completing assignments and reviewing the material.

Fourteen students in the first block class were able to complete the Physical Science Advanced Unit for the action research despite the class average ACT Aspire scores being well below grade-level in English, math, reading, science, and writing subjects. Only 33% of the students met the college, bench readiness mark in English, and none of the students met the college, bench readiness mark in math, reading, science, and writing. Survey results indicated that students spent very little time outside of the classroom completing assignments. Students thought that math was going to be the most difficult part of the units, and less than 20% saw themselves as being motivated to complete assignments. The correlational analyses determined a few relationships: 1) female students had higher overall ACT Aspire scores, 2) females sought extra help, and 3) students in English Advanced courses scored higher on Unit Two tests. According to the Teacher Sense Efficacy Scale (long form), teacher efficacy increased from Unit One to Unit to Two in all categories: student engagement, instructional strategies, and classroom management. The student data from Unit One and Unit Two indicated a two point decline in the math quiz average, a one point increase in the minor grade average, a three point decrease in the overall test average, and a less than one point increase in the final averages after each unit. These preliminary results indicate that the low-level achieving students are capable of successfully completing Physical Science Advanced with at least a C-grade average.

The action plan for detracking the study high school's Physical Science course is a meticulous, systematic process. There is a need to overhaul the curriculum, methodologies, and teacher expectations. This reconstruction will need to start from the district office with an endorsement from the superintendent, the curriculum directors, and the science coordinator. Once this movement has total support (including financial) from the leaders of the district, only then will detracking of the Physical Science course have the greatest chance of success at the high school level. Finally, research needs to continue even once the new classes are established to ensure that the needs of all students are being met.

Previous studies have demonstrated that operating under the *status quo* of tracking in high school is detrimental to the future educational opportunities of the students in lower-achieving tracks. Notably, minority and low socioeconomic status students suffer the greatest hindrances due to tracking. Detracking the high school Physical Science course will not only create academic difficulties in the classroom, but will create considerable political pressure as well. Even with the challenges of detracking the Physical Science course and only offering the more challenging Physical Science Advanced and Physical Science Honors courses, the potential benefits for every student are momentous, and will better prepare them for a tertiary education.

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